

INDIAN COTTON COMMITTEE

MINUTES OF EVIDENCE

TAKEN BEFORE THE

INDIAN COTTON COMMITTEE

VOLUME I

AGRICULTURAL

PART I

MINUTES OF EVIDENCE FROM UNITED PROVINCES, CENTRAL PROVINCES
BURMA, NORTH-WEST FRONTIER PROVINCE, PUNJAB AND SIND



10

CALCUTTA
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1920

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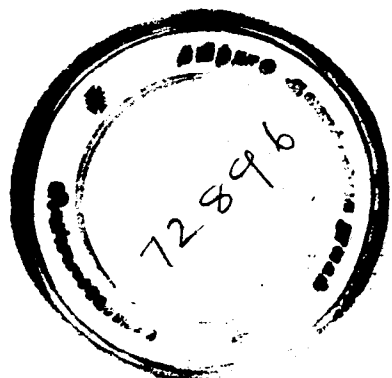
NOTE.

It is regretted that it has been impossible to publish the evidence given before the Indian Cotton Committee earlier owing to the transfer of the Secretary to other duties in August, 1918. For convenience of reference, the evidence has been classified under the three heads, Agricultural, Irrigation and Commercial. Volumes I and II contain the Agricultural Evidence, Volume III the Irrigation Evidence and Volumes IV and V the Commercial Evidence. The evidence of a witness will, therefore, be found in one or other of these volumes according to its predominating character. The references in black type in the written statements are to the questions issued by the Committee which are printed at the commencement of each volume. Thus "(30) Local trade customs" shows that the paragraph is a reply to question 30. A glossary of the more common vernacular terms used in the evidence is appended.

F. NOYCE,
Secretary,
Indian Cotton Committee.

BOMBAY;
October 1st, 1919.

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Glossary of the more common vernacular terms used in the evidence.

Amin	.	.	.	.	.	Subordinate official of the Irrigation Department.
Arat	.	.	.	.	.	Commission.
Aratya	.	.	.	.	.	Commission agent.
Arhar	.	.	.	.	.	Pigeon pea (<i>Cajanus indicus</i>).
Bajra	.	.	.	.	.	Bulrush millet (<i>Pennisetum typhoideum</i>).
Bania	.	.	.	.	.	Village shop-keeper and money-lender.
Barani	.	.	.	.	.	Land dependent on rainfall.
Bhata	.	.	.	.	.	Lateritic soil in the Central Provinces.
Bhindi	.	.	.	.	.	Lady's finger (<i>Hibiscus esculentus</i>), a vegetable.
Bhusa	.	.	.	.	.	Crushed straw.
Bigha	.	.	.	.	.	A land measure, usually about three-eighths of an acre.
Bora	.	.	.	.	.	Bag of unpressed cotton of varying weight, generally five maunds.
Chari	.	.	.	.	.	Great millet (<i>Sorghum vulgare</i>) grown as a fodder crop.
Chaudhri	.	.	.	.	.	A headman.
Dalal	.	.	.	.	.	Broker.
Deshi	.	.	.	.	.	Indigenous.
Docra	.	.	.	.	.	Bag of unpressed cotton of varying weight, generally five maunds.
Ghats	.	.	.	.	.	Hills.
Gwar, gwara	.	.	.	.	.	Field vetch (<i>Cyamopsis psoralioides</i>), a fodder crop.
Hari	.	.	.	.	.	Cultivating tenant in Sind.
Inam	.	.	.	.	.	Land held on favourable terms or free of land revenue.
Juar	.	.	.	.	.	Great millet (<i>Sorghum vulgare</i>).
Kamdar	.	.	.	.	.	Fieldman : subordinate in the Agricultural Department.
Kan	.	.	.	.	.	Weight of lint obtained from unit weight of unginned cotton.
Kanungo	.	.	.	.	.	Subordinate revenue official in charge of a group of villages, known as Revenue Inspector in Madras and Circle Inspector in Bombay.
Kapas	.	.	.	.	.	Unginned cotton.
Karbi	.	.	.	.	.	Dry <i>juar</i> fodder.
Karnam	.	.	.	.	.	Village accountant.
Kharif	.	.	.	.	.	The autumn harvest.
Khurpa	.	.	.	.	.	Hand hoe similar in shape to a trowel.
Killa	.	.	.	.	.	Square of land usually equal to 1½ acre in area.
Kodo, kodon	.	.	.	.	.	A millet (<i>Paspalum scrobiculatum</i>).
Kumbu	.	.	.	.	.	Bulrush millet (<i>Pennisetum typhoideum</i>).
Kunbi	.	.	.	.	.	A cultivator.
Kutki	.	.	.	.	.	A pulse (<i>Dolichos biflorus</i>).
Lakh	.	.	.	.	.	One hundred thousand.
Mahajan	.	.	.	.	.	Money lender.
Makki	.	.	.	.	.	Maize (<i>Zea mays</i>).
Malguzar	.	.	.	.	.	Landholder in the Central Provinces.
Mandi	.	.	.	.	.	Market.
Methi	.	.	.	.	.	Fenugreek (<i>Trigonella foenum-græcum</i>).
Moth	.	.	.	.	.	A pulse (<i>Phaseolus aconitifolius</i>).
Mukhtiarkar	.	.	.	.	.	Revenue officer in charge of a <i>taluka</i> (q.v.) in Sind.
Mung	.	.	.	.	.	A pulse (<i>Phaseolus mungo</i>).
Patel	.	.	.	.	.	Village headman.
Patwari	.	.	.	.	.	Village accountant.
Phutties	.	.	.	.	.	Unginned cotton : <i>Kapas</i> .
Rabi	.	.	.	.	.	The spring harvest.
Rui	.	.	.	.	.	Lint.
Sahukar	.	.	.	.	.	Money-lender.
Sailab, Sailabi	.	.	.	.	.	Land irrigated by floods or percolation from a river.
Sen	.	.	.	.	.	Hemp (<i>Crotalaria juncea</i>).
Senji	.	.	.	.	.	A fodder crop (<i>Melilotus parviflora</i>).
Shaftal	.	.	.	.	.	A fodder crop (<i>Trifolium resupinatum</i>).
Tahsil	.	.	.	.	.	Revenue sub-division of a district

Tahsildar	Officer in charge of a <i>tahsil</i> , <i>taluk</i> or <i>taluka</i> (q.v.).
Taluk, taluka	Revenue sub-division of a district.
Til	Sesamum (<i>Sesamum indicum</i>).
Toria	An oil seed (<i>Brassica campestris</i>).
Tur	Pigeon pea (<i>Cajanus indicus</i>).
Urad	A pulse (<i>Phaseolus mungo</i>).
Varagu	Bulrush millet (<i>Pennisetum typhoideum</i>).
Zaildar	A rural notable appointed by Government. The head of a Zail or Circle of villages.
Zamindar	A landowner; in the provinces visited by the Cotton Committee generally a peasant proprietor.

VOLUME I.

Agricultural.

PART I.

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INDIAN COTTON COMMITTEE

MINUTES OF EVIDENCE

TAKEN BEFORE THE

INDIAN COTTON COMMITTEE

VOLUME I—Agricultural.

PART I.

Questions issued by the Committee.

I.—AGRICULTURAL EXPERIENCE.

(a) “*Deshi*” short-staple cotton.

1. In what cotton growing districts have you been stationed and for what period in each? Have you been in actual touch with cotton cultivators?
2. What varieties of *deshi* short staple cotton are grown in the districts with which you are acquainted?
3. What is the average size of holdings in which cotton is grown and what proportion of the holding is under cotton?
4. What are the average yields and profits per acre?
5. What rotations are followed and what manures, if any, are applied?
6. How does the return to the cultivator of the different varieties of *deshi* short staple cotton compare with the return from (a) *deshi* long staple cotton, (b) other *deshi* crops, (c) exotic cottons?
7. Does the area under *deshi* short staple cotton fluctuate at all largely in the districts with which you are acquainted, and if so, is there any special reason for this? Is there any possibility of an increase under *deshi* short staple cotton and, if so, what are the factors which would limit that increase?
8. To what uses is the seed put? Is any seed selection practised and, if so, on what principles? Is seed selected for sowing specially hand ginned?
9. Please add any remarks you consider may be helpful to the Committee on the general economic state of the cotton growing districts with which you are acquainted.

N.B.—Please see note at end of Section (c) below.

(b) “*Deshi*” long staple cotton.

10. In what cotton growing districts have you been stationed and for what period in each? Have you been in actual touch with cotton cultivators?
11. What varieties of *deshi* long staple cotton are grown in the districts with which you are acquainted?
12. What is the average size of holdings in which cotton is grown and what proportion of the holding is under cotton?
13. What are the average yields and profits per acre of different varieties of *deshi* long staple cotton of which you have had experience? How do these compare with those of (a) *deshi* short staple cotton, (b) other *deshi* crops, (c) exotic cottons?
14. What rotations are followed and what manures, if any, are applied?
15. What, in your opinion, are the special conditions which would affect any increase in the area under *deshi* long staple cotton in the districts with which you are acquainted, e.g., length of ginning season, irrigation available, climatic considerations, competition with food crops, limitation owing to necessity of observing rotations, labour supply, etc.?
16. Do you consider that, in the cotton growing tracts with which you are acquainted, the right varieties of *deshi* long staple cotton are being pushed in the right districts or whether still superior types could be introduced?
17. What measures would you recommend to prevent the mixing of *deshi* long staple cotton with (i) *deshi* short staple cotton, (ii) exotic cotton (a) in the field, (b) in the factory?
18. To what uses is the seed put? Is any seed selection practised and, if so, on what principles? Is seed selected for sowing specially hand ginned?
19. Please add any remarks you consider may be helpful to the Committee on the economic state of the cotton growing districts with which you are acquainted.

N.B.—Please see note at end of Section (c) below.

(c) *Exotic* cotton.

20. In what cotton growing districts have you been stationed and for what period in each? Have you been in actual touch with cotton cultivators?
21. What varieties of exotic cotton are grown in the districts with which you are acquainted?
22. What is the average size of holdings in which cotton is grown and what proportion of the holding is under cotton?

Continued.]

QUESTIONS ISSUED BY THE COMMITTEE.

23. What are the average yields and profits per acre of the different varieties of exotic cotton of which you have experience? How do these compare with those of (a) *deshi* short staple cotton, and (b) *deshi* long staple cotton, (c) other *deshi* crops?

24. What rotations are followed and what manures, if any, are applied?

25. What, in your opinion, are the special conditions which would affect any increase in the area under exotic cotton in the districts with which you are acquainted, e.g., length of ginning season, irrigation available, climatic considerations, competition with food crops, limitation owing to necessity of observing rotations, labour supply, etc.?

26. Do you consider that, in the cotton growing tracts with which you are acquainted, the right varieties of exotic cotton are being pushed in the right districts or whether still superior types could be introduced?

27. What measures would you recommend to prevent the mixing of exotic cotton with (i) *deshi* short staple cotton, (ii) *deshi* long staple cotton (a) in the field, (b) in the factory?

28. What is your opinion as to the desirability of importing seed direct from America or Egypt as required as against relying on selected seed grown in India?

29. Please add any remarks you consider may be helpful to the Committee on the economic state of the cotton growing districts with which you are acquainted?

N.B.—The Committee would be obliged if you would give them your views as to the best organization for handling cotton in your province. Under this head you might consider research in connexion with improvement of the plant, establishment of seed farms for the production of improved seeds, district staff necessary and the regulation of buying agencies and ginning factories.

II.—COMMERCIAL ASPECT.

30. Give, as fully as possible, an account of local trade customs with which you are acquainted in regard to the marketing of the cotton crop, in particular as regards any systems of agency, advances, future buying or contracts.

31. What are the commercial names of the various grades of cotton with which you are acquainted and from what areas do they come? Do you regard them as suitable and, if not, what alterations would you suggest? Can you suggest any means by which the commercial names could be standardized, i.e., of securing that the same name should be used for the same cotton from whatever locality it comes?

32. What do you consider is the best form of buying agency?

III.—STATISTICAL.

33. Do you consider that the cotton forecast, as at present published, is sufficiently accurate as far as your province is concerned? If not, can you suggest any way in which it could be improved?

34. Can you suggest any methods by which the statistical information published by Government in regard to cotton other than the forecasts, e.g., the cotton press return, could be made of greater use to the cotton trade?

35. What are your views in regard to the daily publication of Liverpool and Bombay cotton prices at up-country markets?

IV.—MANUFACTURE.

(a) Ginning and Pressing.

36. What class of gins and presses do you use and how many have you in your factory?

37. What is the size of the bale produced by your factory?

38. What is your opinion as to the relative merits of saw and roller gins?

39. Have saw gins been successful with Indian cottons and, if not, what is the objection to them?

40. Have you experienced any difficulty in obtaining factory labour?

41. Do you find the condition in which raw cotton reaches your factory in any way objectionable and, if so, what remedies would you suggest?

42. Assuming that it were found possible to replace any large quantity of short staple cotton by long staple cotton, would any substantial alteration in your machinery be necessary?

N.B.—The Committee would be obliged by any information you can give them in regard to the general question of long versus short staple cotton and also in regard to any experience you have had in handling any new staple cotton.

(b) Spinning and Weaving.

43. What counts are spun in your factory and what is your principal market?

44. Do you find the condition in which cotton reaches your factory in any way objectionable and, if so, what remedies you suggest?

45. What, in your opinion, would be the effect on the cotton market generally if any large proportion of the short staple cotton at present grown in India were replaced by long staple cotton?

N.B.—The Committee would be obliged by any information you can give them in regard to the general question of long versus short staple cotton and also in regard to any experience you have had in handling new staple cotton.

V.—GENERAL.

46. Does your experience indicate that buyers in the past have been prepared to encourage the growth of improved cottons by offering a premium for them?

47. Do you consider that the water rates charged have any effect on the cultivator's preference for a particular crop?

48. Do you consider that any changes are called for in the schedule of water rates at present in force?

49. Do you consider that the tenure on which land is held in the tracts of which you have experience in any way affects the extension of cultivation of cotton?

VI.—IRRIGATION.

(For Punjab witnesses only.)

50. Please state what experience you have had of irrigation in general and in particular of irrigation under canals? Have you any experience of canal irrigation assessment work?

QUESTIONS ISSUED BY THE COMMITTEE.

[Continued.]

51. Has it been your experience that cultivators prefer wheat to cotton as an irrigated crop? If so, what is the reason for the preference?

52. (a) What is the critical period in regard to the water-supply in the canals of which you have experience? How would this be affected if there were an increase in the irrigated area under cotton between April and October?

(b) When is cotton watered and what is the volume of water required per acre at each watering?

(c) Please furnish statistics for the channels of which you have had experience showing—

(i) the average flow of the channels month by month throughout the year.

(ii) the average monthly area of each crop irrigated under the channels. It will be sufficient if the average for the last three years is given.

The maximum carrying capacity of the channels should also be stated.

53. (a) Are there any periods during which the supply in the rivers would be sufficient for a large expansion of the area under cotton to utilize which the canals could properly be enlarged with due regard to financial considerations? If so, please give figures for the canals of which you have experience?

(b) How would such an enlargement of the canals affect the area under wheat?

54. (a) To what extent could the duty of water on the canals of which you have experience be improved by equalising the distribution of the supply between the upper and lower outlets on the distributaries?

N.B.—In the Punjab this process is technically known as the "remodelling of outlets."

(b) To what extent could modules be used to effect this purpose?

(c) If the distribution were equalized, what additional irrigated area would accrue? What crops would be grown on this additional area?

55. Does the supply in the rivers increase gradually in spring and decrease gradually in autumn or are both the increase and decrease sudden? In either case what is the effect on the cultivator's preference for a particular crop? Please furnish, if possible, a diagram with statistics illustrating your reply for the canals of which you have experience.

56. (a) In cases in which canals carry a supply for irrigation during the summer months only, would it be possible for the sowings and final waterings of cotton to be carried out by irrigation from wells? Do you know any tracts in which such a combination of irrigation from wells and canals would be feasible in the case of American cotton?

N.B.—American cotton requires watering as follows:—

(i) First watering between March 25th and May 5th.

(ii) Three waterings between the time when the flowers begin to appear which is between July 20th and August 10th and (the end of September.

(iii) A fifth and final watering in October.

(b) To what extent do wells exist in the areas commanded by the canals of which you have experience and what steps are required to extend the irrigation under them in those areas?

(c) Have you any experience of tube-wells and do you consider that their use would be valuable in this connexion?

(d) Do you consider that it would be possible sufficiently to improve the canal system by the construction of weirs or in other ways so as to obviate the use of wells?

(e) Can you give an idea of the cost of such an improvement in the canals and the time it would take to carry out as compared with the cost of the construction of the requisite number of wells and time it would take?

57. In case it were found possible to increase the size of canals and consequently the irrigated area under cotton, what addition to gross revenue at present rates for water would you expect? Please illustrate your reply from the statistics furnished in answer to other questions.

58. Can you give a rough estimate of the average area of each crop grown on a holding of 100 acres? How are these areas affected by the water supply and by the necessity for growing a fodder crop and of preserving suitable rotations of crop? Would any proposal you have put forward bring about an alteration in these areas?

59. Have you any experience in regard to the lining of canals? Do you consider it a practicable measure?

60. Can you give a rough estimate of the probable cost of lining canals in terms of acreage irrigated? How does this compare with the acreage rates of cost of the canals in their present condition?

61. If it should prove desirable to enlarge a canal, could this be carried out in conjunction with lining? How would you propose to provide for the existing irrigation whilst the work of enlargement and lining was being carried out?

62. What effect would the lining of canals have on seepage problems and the rise in the subsoil water table? To what extent would the expenditure involved be justified on these grounds?

63. To what extent would the lining of canals improve the supply (a) in the summer months, (b) in the winter months? Would the expenditure involved be justified by the improvement, if any, effected under this head?

64. Do you consider that the water rates charged have any effect on the cultivator's preference for a particular crop? Do you consider that any changes are called for in the schedule of water rates?

VI.—IRRIGATION.

(For witnesses from Provinces other than the Punjab and North-West Frontier Province.)

65. Please state what experience you have had of irrigation in general and in particular of irrigation under canals. Have you any experience of canal irrigation assessment work?

66. When is cotton watered and what is the volume of water required per acre at each watering?

67. Has it been your experience that cultivators prefer wheat to cotton as an irrigated crop? If so, what is the reason for the preference?

68. Does the supply in the rivers increase gradually in spring and decrease gradually in autumn or are both the increase and the decrease sudden? In either case what is the effect on the cultivator's preference for a particular crop? Please furnish, if possible, a diagram with statistics illustrating your reply from the canals of which you have experience?

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69. (a) To what extent do wells exist in the areas commanded by the canals of which you have experience and what steps are required to extend the irrigation under them in those areas?

(b) Have you any experience of tube wells and do you consider that their use would be valuable in this connexion?

70. Do you consider the existing water rates charged for cotton suitable? If you can give statistics to explain your answer, please do so.

71. Can you give a rough estimate of the average area of each crop grown on a holding of 100 acres? How are these areas affected by the water supply, the necessity for growing a fodder crop and of preserving suitable rotations of crops. Would any proposals you have put forward bring about an alteration in these areas?

72. Do you consider that sufficient water is available for a considerable increase in the area of cotton and, if so, why is a larger area not irrigated?

73. Is it your experience that cultivators prefer *deshi* cotton to American cotton? If so, can you explain their reasons for the preference?

74. Is it your experience that the canal regulations create any difficulties in regard to the irrigation of American cotton?

I.—United Provinces.

The Hon'ble Mr. H. R. C. HAILEY, C.I.E., I.C.S., Director of Land Records and Agriculture, United Provinces.

EXAMINED AT CAWNPORE, NOVEMBER 1ST, 1917.

Written statement.

1. (General.) The cotton growing area of the provinces is practically limited to the western districts that is, to the tract lying between the Jumna and Ganges, the Ganges and the Ramganga with Bundelkhand, comprising the Meerut, Agra, Allahabad and Jhansi divisions with parts of Rohilkhand. It is true that a certain amount of cotton is grown in the border districts such as Unao and Hardoi, but the total area in Oudh is small and the submontane and eastern districts are generally unsuitable for cotton growing. The normal cultivated area of the cotton growing western districts is 16,516,000 acres; that of the submontane and eastern 18,390,000. The water level in the latter is for the most part near the surface, and the rainfall is heavier in these than in the western districts; though attempts have been made to grow cotton in these parts of the provinces, they have for the most part ended in failure, owing to the ground readily becoming waterlogged. It is unlikely in any case that cotton would supersede rice and sugarcane.

(2) The largest area on record under cotton was that of 1913-14 when 15½ lakhs of acres were under this crop. Prices had been high in the previous year, the season was a dry one and the conditions generally were favourable for a large area under cotton. This area is only likely to be much improved upon by a large increase in cotton growing in Bundelkhand where, provided water for early sowing were available, there might be a considerable increase in the lighter soils. In the heavier or black soils, no appreciable increase is to be looked for. The area under cotton is largely determined by two factors (1) current prices, and (2) the character of the season. In these provinces, the cultivator has a wide variety of crops to choose from and a drop in the prices of cotton will tempt him to put down another crop. In 1915-16, after the heavy fall of prices in the previous year, the area dropped to eight lakhs of acres. In the following year, namely 1916-17, prices improved, but indigo had come into competition and this crop was sown on a considerable scale in fields that had hitherto been devoted to cotton. In what is known as the Upper Doab cotton competes with sugarcane and a rise in the price of *gur* will lead to a decline in the area under cotton. The Middle Doab is unsuitable for cane and, under normal conditions, cotton will remain the favourite *kharij* crop in this tract. There have been heavy fluctuations in the area under cotton in Bundelkhand and at one time it became unpopular owing to series of bad years, but, prior to the war, cultivation was showing a somewhat marked improvement. Perhaps, however, the main factor influencing the area under cotton is the character of the rains. If the rains are late, the cultivator will prefer to sow a food grain crop such as *bajra*, as it is improbable that cotton will mature before the cold weather sets in. This is shown by the drop in area in 1911-12. Prices were good in the previous year but there was a drop in cultivation from 13½ lakhs of acres to nine lakhs owing to the lateness of the monsoon. This is the factor that very largely affects the area in districts which either have no canal irrigation or where, as in B undelkhand, water cannot be regularly provided for hot weather cultivation.

(3) Of recent years, every effort has been made to induce the cultivators to sow their cotton early with the aid of canal irrigation in order to render the crop independent of the rainfall. The irrigated area under cotton varies considerably; the largest of which there is any record was in 1913-14, when 6½ lakhs were sown with the aid of irrigation. In the year 1916-17, the area had fallen as low as two lakhs since the cultivators, being uncertain of prices, did not consider it worth while to pay irrigation rates, and trusted to sowing on the monsoon. On an average about a third of the crop is sown with canal irrigation, but in dry years when the monsoon is late, as in 1911-12, the proportion is considerably higher and in that year was 45 per cent. This point of considerable importance, since the long staple cotton which has hitherto been grown in the provinces, namely Cawnpore American, must be sown early with the aid of irrigation. It must also be pointed out that in these provinces there are no large tracts wholly commanded by canal irrigation. It is the exception rather than the rule for the whole of the village to be commanded by the canal and consequently, unless a long staple cotton is introduced that can be sown on the rains, it may happen that short staple and long staple cotton are grown in the same village with the attendant inconveniences and dangers of mixing of seed.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

2. (2) **Varieties.**—The short staple *deshi* grown in these provinces is that known to the trade as Bengals. The length of the staple may be said to range from ½ to ¾ths of an inch. Certain areas within the provinces

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have a reputation for a better class of cotton, as, for instance, the cotton grown round Chandausi in the Moradabad district which usually fetches a higher price than ordinary *deshi*, and that grown round Kashipore in the Naini Tal district has a sufficiently good reputation to attract imports from other localities in order to secure the price that is being fetched for the locally grown cotton. These differences seem due to local conditions. Various selections have been made from these mixed cottons of which the most popular is that known as Aligarh White Flowered, originally put out at Aligarh. Its main feature is its ginning percentage which averages about 39 per cent., while special selections since made have given an even higher percentage. It has become very popular and the area is now probably well over a lakh of acres. It continues to command a premium on account of its ginning percentage, though not so large a one as when first put out. The average may be taken from eight annas to Re. 1 per maund of *kapas*. In the eastern districts, there is a small area under a somewhat different kind of plant called *radya* which does not bear cotton until the hot weather months instead of the end of the rains. The area under this variety is small and though its seed fetches rather higher price than that of ordinary *deshi*, its staple is no better and it is a very poor yielder.

3. (3) **Size of holdings.**—The average size of the holdings in the western districts is ordinarily put down at three to four acres. It is extremely difficult to say what proportion of this is under cotton because so much of the cotton is grown as a mixed crop with *arhar*. It is improbable, however, that a cultivator with a three acre holding will not in any case put down more than one acre under cotton.

4. (4) **Yields and profits.**—The accepted normal outturn for cotton per acre is 230 lbs. in irrigated tracts and 130 lbs. in unirrigated. The latter figure is only that of the outturn of a series of years in some of which the crop was a practical failure. In years of normal rainfall the outturn of unirrigated *kapas* may be quite as good as that of irrigated and in some cases it is better, as in recent years it has occasionally happened that the earlier sown cotton has been caught by heavy rain and stripped of its flowers and bolls. As to the profits, it is almost impossible to give any exact figures. Taking the figures of the past five years the price of lint per imperial maund in Cawnpore was Rs. 23 in 1912, Rs. 21 in 1913, Rs. 10-8-0 in 1914, while it went up to Rs. 32-8-0 in 1916. The average of these figures would be about Rs. 22 per imperial maund. Assuming the ginning percentage is about 33 per cent. the cultivator will thus be getting between Rs. 7 and Rs. 8 per maund of *kapas*. Taking his average outturn as ranging between six to eight maunds, his gross profits may be put somewhere about Rs. 50 per acre. The following estimate has been made of his expenses. It must be taken for what it is worth.

	List.	Rs.	A.	P.
Ploughing	.	4	0	0
Clod Crushing	.	0	8	0
Seed	.	0	6	0
Sowing	.	0	13	0
Weeding twice	.	4	0	0
Picking	.	5	0	0
Rent	.	10	0	0
Irrigation rate, if irrigated	.	2	0	0
	TOTAL	26	11	0

It must, however, be pointed out that some of these operations such as ploughing, picking, etc., are carried out by the cultivator with his family and entail no extra cost. Further, as cotton is generally grown as a mixed crop, part of this expense will have to be debited to the crop with which it is grown.

5. (5) **Rotations and manures.**—Cotton for the most part in these provinces rotates with wheat or barley. The cultivator, if he has any manure, usually prefers to apply it to the wheat. Manuring of cotton is believed to be followed by an excessive vegetative growth.

6. (6) **Comparative returns.**—As regards the return from *deshi* long staple cotton, there is none grown in these provinces. As regard the returns from exotic cottons, the cultivator has always been guaranteed Re. 1 per maund of *kapas* for his American over *deshi* and in some years, the premium has amounted to between Re. 1 and Rs. 2. As regards the return from other *deshi* crops, I should not like to undertake to make any comparison. To begin with, the outturns from *deshi* cotton vary very greatly. In dry years, such as 1913-14, many of the cultivators were getting 13 maunds of *kapas* per acre or more. For the last two years, it is probable that the average has been nearer four or five owing to the wet seasons. Generally speaking, however, cotton is regarded as one of the most paying crops, or rather was so regarded before the recent cycle of wet years set in. There is an element of gambling about it which appeals to the cultivator since with high prices such as he was getting before 1914 and good crops, profits were large. Taking the competing crops, it seems probable that sugarcane, with the outturn the cultivator ordinarily gets, yields less net profit, owing to the higher ratio of expenses. On the other hand, the returns from wheat are much better assured and as the cultivator is now getting high prices for the secondary produce, namely, *bhusa*, it is probable that, on the whole, wheat is the more profitable crop. The outturn from wheat is ordinarily reckoned at ten to eleven maunds per acre. The price of wheat has ranged on an average of Rs. 4 per maund for the last two years and *bhusa* has been as high as Re. 1 per maund. The expenses of wheat growing are higher than those of cotton.

7. (7) **Conditions affecting increase in area.**—I have already alluded to the great fluctuations in the area under *deshi* short staple cotton and pointed out that they are connected with (1) fluctuations in prices, (2) the course of the monsoon. It is improbable, in these provinces, that, looking to the demand for food crops, there could be any very great increase in the area under *deshi* short staple cotton within the part of the provinces suitable for cotton growing. The necessity for growing a fodder crop for his oxen during the *kharij* will always compel the cultivator to put down some part of his holding under a crop such as maize, *juar* or *bajra*, which will provide food for his cattle until the *rabi* crop is harvested; in addition to that there will be the area which was under cotton last year and is reserved for wheat in the ensuing *rabi*. Stability of cultivation, which is greatly desired by the manufacturers, can only be insured by the introduction of a large area of early cotton with the aid of canal irrigation. Our canals, however, at the present moment are utilised to their utmost and it is highly improbable that, unless fresh sources of supplies are opened up, more water will be available. Of recent years, there has been a movement in favour of raising water by

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mechanical power in the well irrigated tracts. The exact area of cotton irrigated by this means is not known, but every agricultural officer has had instances before him of cotton crops raised by this means; though cotton is occasionally sown from wells dependent on bullock lift, the strain is too much for the cattle and the amount of water required for preliminary watering in the hot weather is very great.

8. (8) **Uses of seed.**—The seed of these provinces, owing to the ravages of the pink boll-worm, has a bad reputation and I am assured by Messrs. Ralli Brothers that not a great deal of it is exported to England. It is only necessary to look at the seed in any ginning factory to see the damage done by this pest. For the most part, the seed is fed to cattle or exported to the Punjab. Taking the figures of the year ending March 1914, the total export from these provinces amounted to 19½ lakhs of maunds of which eighteen went to Punjab and 1½ to Central India. Only 5,000 maunds went to Bombay, 1,000 to Karachi and the same amount to Calcutta. This fully bears out the statement made as to the unpopularity of the seed produced in these provinces for export. I think it may be attributed largely to the boll-worm damage though possibly the seed was not so rich in oil as that grown in Bombay Presidency. There is too the further question of railway freight.

9. (9) **General economic conditions.**—I will only remark under this head that in the canal districts the cultivators follow cotton, wherever possible, with a catch crop, usually peas, or peas and barley mixed. They therefore greatly prefer an early cotton, the pickings from which may be finished in time to enable them to sow the *rabi* crop. The earlier it is off the ground, the better the class of crop which can be sown. This is an impediment to the spread of a cotton of the American type which goes on yielding until the frost sets in. As regards cotton growing generally, I think it might be useful for the Committee if I append some figures* showing the rainfall in the Aligarh and Cawnpore districts from June to September in the years 1914-15 and 1915-16. It will be seen that for the last two years, namely 1915 and 1916, the rainfall in August and September has been extremely heavy, and I may add that the rainfall in September in this year was the heaviest of which there seems to be any record. Under these circumstances, it will be understood how excessively precarious cotton growing in these provinces must be. The three years, 1915, 1916 and 1917, have been extremely poor for cotton growing and there is little doubt that, if indigo shows any signs of becoming a permanency in these provinces, many cultivators would take to it in preference to cotton simply because of the assured return. These figures have another bearing, namely, that the crop being subject to such extreme fluctuations, the cultivator, who is usually without capital, will always prefer the hardiest type known to him and one most likely to stand the extreme vicissitudes of the climatic conditions to which it is exposed. It can hardly be expected that a good quality cotton can be found to be quite so hardy in character and resistant to extremities of great heat and heavy rain as that which has become popular in the western districts, viz., the Aligarh White Flowered, the staple of which is short and the lint harsh. This cotton of course has suffered with other cottons during the last three years, but, at the same time, its popularity is undoubted and this may be attributed not merely to its high ginning percentage but also to the belief of the cultivators that they get a better yield from it in bad seasons than from a better quality cotton. The extreme vicissitudes, to which these provinces are exposed, do not mark them out as an ideal cotton growing tract and the cultivators' apprehensions of the future of his crop do, to my mind, largely explain the reluctance to embark on growing a cotton possessing a longer staple. Price is, of course, a consideration and this weighs particularly in any comparison between the respective advantages to the grower of American cotton and Aligarh White Flowered which has always commanded a premium. But as between ordinary *deshi* and American, the advantage has, owing to the arrangements made by the Department, been in favour of the latter, and its comparatively slow expansion is due mainly to a succession of bad seasons and the unwillingness of the cultivator to try a new kind of cotton which he believes is likely to suffer more severely from climatic conditions than the indigenous variety.

(b) "*Deshi*" long staple cotton.

10. (11) **Varieties.**—The only *deshi* long staple cotton is the hybrid which Mr. Leake had produced and of which he will give a description.

(c) *Exotic cotton.*

11. (Historical.) Mr. Burt will give details regarding the present state of growing of American cotton round Cawnpore, but it would be as well if I gave the short history of the introduction of long staple cotton into these provinces, particularly with a view to making it clear why the present locality which is perhaps not the best suited for a long staple cotton came to be selected.

(2) After a variety of experiments dating from 1881 at the Cawnpore farm, a long staple cotton of mixed American origin known as Cawnpore American was put in the Aligarh district in 1906. In order to overcome the difficulties of marketing small quantities, and to secure a pure supply of seed, the *kapas* was bought back from the cultivators at Rs. 2 per maund over the price of *deshi kapas*. At the time the price of *deshi* was as low as Rs. 6 per maund of *kapas*. The lint was ginned by the Department and sold by public auction, the price realised being sufficient to cover the expenses. This arrangement continued for the three seasons, 1906, 1907 and 1908. In the latter year, the area had increased considerably and an advance of Rs. 45,000 was required to finance the crop. The Accountant-General objected to the large amount of this advance without previous sanction of the Government of India. In reply, the Government of India expressed the hope that arrangements would be made to discontinue the intervention of the Department as soon as possible. It is understood that this action was taken in accordance with orders issued by the Secretary of State on the subject of interference with private trading. By some mistake, these orders were not communicated in time to Dr. Parr, the Deputy Director. The cotton was brought in as before by the cultivators who expected the same premium. This Dr. Parr was not authorised to give and as the cultivators could not wait they took it off to the bazaar where they actually got lower prices than *deshi*—since, in the bazaar, *kapas* is sold on the basis of its ginning percentage. Eventually some arrangements were made to clear off the balance, but not at the price that was understood would be given and after much had been sold privately. The cultivators were aggrieved and next year there was a very heavy drop in the area of cultivation. When it was decided to start growing long staple cotton again, it was thought better to open operations in the Lower Doab where there had been no difficulties in the marketing and where no prejudice against it existed. This is the main area in which American cotton is grown though a smaller area is still grown in the Upper Doab. A further reason for the growing of long staple cotton round Cawnpore was that some of the Cawnpore cotton

* Vide Annexure, page 9.

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mills were willing to purchase the cotton and pay a premium. In the first year, the Elgin Mills financed the whole transaction. In the following years, a variety of arrangements have been made, either with the Elgin or the Muir Mills, all of which however have assured the cultivators at least a bonus of Re. 1 over *deshi kapas*. In the recent years, the price of *deshi* remained high till 1914 when there was a heavy drop. The following are the figures of the bonus paid over *deshi* for the last few years :—

		Rs.	A.	P.		Rs.	A.	P.
1913	.	.	.	.	.	1	8	0
1914	.	.	.	.	.	1	4	0
1915	.	.	.	.	.	1	12	0
1916	.	.	.	.	.	1	0	0

In the latter year, the price of *deshi* was very high. Through all these years, the Department has made arrangements for the ginning of American cotton and keeping the *kapas* entirely separate from *deshi* and so securing a supply of seed which is made over again to the cultivators for sowing. It has always been regarded by the Department as absolutely essential to retain a control over the seed, at any rate in early years, in order to prevent any admixture with *deshi* which would lower the value of the lint. It will be seen that, so far as these provinces are concerned, the American long staple cotton—since growing was started round Cawnpore—always secured a premium over *deshi* and further that the arrangements made have secured purity of the type and prevented any mixture with *deshi*. If there was to be any large expansion of cultivation, the system could probably be extended by arrangements with owners of ginning factories. The difficulties are really greater so long as the crop is a small one.

12. (25) **Conditions affecting increase in area.**—It has already been pointed out that American cotton can only be grown with the aid of canal irrigation, unless there is a great spread of irrigation by means of tube wells of direct pumping from existing wells. The main difficulty in the United Provinces as regards canal irrigation is that it rarely extends over the whole of the village and therefore only a portion of the land can be put under long staple cotton. It is thus difficult to get compact areas under this one variety of cotton. Further, the irrigation facilities from canals in these provinces are strictly limited and it is extremely doubtful whether any further extensions of the system would be possible. Arrangements have recently been made with the canal department for giving special facilities for American cotton but if the growing of this cotton is to be extended it will only be possible provided there is ample assurance that water will be forthcoming in the sowing season. As regards climatic considerations, it has been proved that, in normal seasons, Cawnpore American is at least as heavy a yielder as *deshi* and potentially a higher yielder with proper cultivation. Whether or not it really does—as the cultivators seem to think—suffer more in wet years than *deshi* it is impossible to say, but it is somewhat more expensive to grow, as it always requires canal irrigation and somewhat better cultivation, and, looking to the precariousness of the crop in these provinces, there is justification for the preference often shown for the cheaper *deshi*. There is a further disadvantage in American that it is longer on the ground than *deshi* and therefore prevents the cultivator from getting in his catch crop as early as with *deshi*. If the cultivator can get his cotton off the ground in October, he can sow a mixed barley and pea crop, and this point undoubtedly weighs materially in favour of *deshi*, the pickings of which are over earlier. In good years, such as 1913, the yield from American was very high and the cultivator was amply compensated for any loss he may have sustained in the lateness of sowing his second crop; but such yields cannot be counted on and if both are going to yield only a poor crop the cultivator would perhaps do better by sowing *deshi* and following it by a catch crop.

13. (27) **Prevention of mixing of different varieties.**—As the long staple *deshi* seed has always been given direct to cultivators, the difficulty of mixing with *deshi* has not arisen. If the marketing of American cotton were entirely uncontrolled by the Department, such difficulties would inevitably arise. On the other hand, ginners have expressed their willingness to gin the American cotton separately and, in point of fact, these arrangements have been made with one of the ginners in the western circle. Provided the cotton were grown in a fairly compact area on a large scale, there does not seem to be any reason why the difficulty should not be overcome. There is of course a likelihood of seed getting mixed on the floor of a ginning factory, but provided it were ginned in sufficiently large quantities, it would be easy to find ginners who would be prepared to take the necessary precautions. Most of the difficulties regarding the mixing of seed really arise in the early stages before it is worth while for the ginner to take trouble and keep the *kapas* separately. As regards marketing, the provincial dealers buy mainly on the basis of the ginning percentage. If thrown on the market, American cotton would actually fetch less than Aligarh White Flowered. Until therefore the basis of buying is radically altered, the Agricultural Department will have to make some arrangements for the sale of long staple cotton—and this would apply equally to K.22 or any other cotton put out by Mr. Leake. Such being the case it is really simpler for the Department to make special arrangements for ginning, trying so far as possible to keep growing within fairly compact areas and allowing a gradual expansion round certain centres.

II.—COMMERCIAL ASPECT.

14. (30) **Local trade customs.**—A few remarks may be made on this subject, on which there appears to be some misconception. In these provinces, it has already been remarked that the cultivator is a small man with a small area under cotton, and, as he frequently grows cotton as a mixed crop, the amount that he could take to the market would be small. The actual grower accordingly usually sells his cotton to a middleman, who may be a local dealer, or a *zamindar*, or an occupancy tenant who buys in other cultivators' cotton and sells it with his own. Consequently the cultivator himself is largely unaffected by the actual customs of the market. It has been clearly proved, in a recent enquiry held on the subject, that though he benefits by a rise in prices, he does not get the full benefit of any such rise as took place this year. In some instances that came to my notice, the cultivator received only Rs. 9 per maund of *kapas* when cotton was selling for Rs. 12 in the neighbouring market. This will answer the question whether there is any advantage in the publication of Bombay prices in upcountry markets. Such publication is unlikely to benefit the cultivator who will only secure the full benefit of the market rate when some joint system of selling is introduced or he could sell the medium of the co-operative societies to which he belongs. As regards the local trade customs they do not differ greatly in these Provinces from those in other parts of India. The dealer who brings in cotton from

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the adjoining villages conducts his operations through the medium of the *aratya*. The latter, in theory, secures him the best price available in the market, taking a fixed commission and making certain charges for weighing and generally also a small charge for what is known as *rambila*. The market price for the day which is known as "*mir*" is fixed by the big dealers who are in communication with Bombay. In the actual bargaining, a number of considerations such as the amount of discoloured cotton, the ginning percentage, amount of dirt, brightness of colour and fraudulent practices, such as watering, have to be taken into account. The Bombay prices which are for lint only can at best form a very general guide in buying and selling *kapas*. In conducting these transactions the much abused *aratya* does perform some useful services to the seller. He is the medium of communication with the larger buyers who do not want to deal in small lots and further he pays the money down on the spot. The dealer himself is by no means without experience nor he is so much at the mercy of the *aratya* as is sometimes represented. He has a very good notion of what local prices should be and of the value of his cotton and probably generally manages to secure a fair price. In these Provinces, cotton forms only one of a great variety of other crops and there are no regular cotton markets. The *aratya* has his shop and frequently the shops of others may be close together for convenience. In the absence of any regular market it is an advantage to the dealer to go straight to one of these *aratya's* shops. It would certainly be to the benefit of dealers generally, if regular cotton markets were established but, except in a few centres, it is doubtful whether the importance of this crop would warrant it. Our cotton season is a short one and for the last two years it may be doubted whether the total yield has been as much as three *lakhs* of bales. The advantage of the cultivator can be better secured by some method of joint sale than by any alteration in the actual customs in vogue in the market.

III.—STATISTICAL.

15. (33) **Improvement of cotton forecast.**—Since the system of returns from baling presses has been established, it has been possible to make a further test of the accuracy or otherwise of the cotton forecast. The following figures compare the results of the last two years.

List.

	Estimated outturn in Bales.	Ginned amount in Bales.
1915	* 261,873	† 235,845
1916	* 308,805	† 245,130

* Includes outturn for the Rampur State.

† These figures are for the year from 1st September to 31st August.

It is believed that the returns are received from practically all the baling presses at work and, in the principal centres, they are visited by a member of Agricultural Department who enquires whether the returns have been submitted. A certain quantity of the cotton grown is kept for domestic use and the better class of cultivators themselves gin enough for seed purposes. The forecast is therefore necessarily in excess of the figures received from ginning presses and some of the mills take in loose cotton which has not been baled. The published returns give rise to some misapprehension as they contain a column showing number of baling presses in the United Provinces and another column for the returns that have been received. This has misled some of the manufacturers into thinking that the returns are received only for a small proportion of those that work, whereas, in point of fact, at the larger centres the presses are formed into pools and in years in which the season has been unfavourable only a limited number will be working. Considering the difficulty of framing the forecast, I consider that a reasonable amount of accuracy has been secured. It would however greatly assist matters if baling presses were compelled by legislation to submit their returns. At present we are entirely dependent on their good will which is a very unsatisfactory system. There does not appear to be any reason why presses should not be compelled by law to state their fortnightly outturns on the condition that the figures of individual presses were not published.

VI.—IRRIGATION.

16. (General.) As regards head VI, it may be understood that the existing water rates for cotton, viz., Rs. 2 are relatively low considering the profits obtainable in good years in the crop. There is no doubt that these low rates have greatly encouraged the sowing of early cotton. So far as these Provinces are concerned, I have only to remark that it would be a great advantage if adequate arrangements could be made for providing water for early sowing of cotton in Bundelkhand. As regards long staple cotton, the future of the cotton in these Provinces largely depends on the canals being able to ensure a supply of water regularly to the grower. There is very little doubt that the Irrigation Department have not enough water for any considerable extension of the cotton area; but more important than this is the necessity for giving an absolute assurance to the grower that he will get water in time for sowing the American cotton and will receive water for a second watering provided the rains are unusually late. As regards other forms of irrigation it must be pointed out that the tube wells can never supply water as cheaply as canals; even when water is pumped direct from existing wells, the cost will always be higher than that of irrigation from canals. I do not therefore look to any great expansion of the cotton growing area from the use of any mechanical power, though undoubtedly when plant is again available a much larger number of engines will be put down and there may be some expansion of cotton area resulting from it. An experience gained this year may be of some value in connection with this. The cultivators round the tube well were offered water at the bare cost of running if they would sow cotton in the hot weather. They almost unanimously preferred to wait till the rains rather than take the rate which was about double the canal rate.

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[Continued.]

ANNEXURE.

Statement showing the rainfall in the Aligarh and Cawnpore districts from June to September in the years 1914, 1915 and 1916.

MONTHS.	1914				1915				1916				REMARKS.
	CAWNPORE.		ALIGARH.		CAWNPORE.		ALIGARH.		CAWNPORE.		ALIGARH.		
	Actual.	Normal.	Actual.	Normal.	Actual.	Normal.	Actual.	Normal.	Actual.	Normal.	Actual.	Normal.	
June	1.32	3.56	2.14	2.43	2.45	3.56	0.94	2.43	9.68	3.55	2.90	2.43	
July	10.65	9.98	7.17	8.12	8.11	9.98	3.00	8.12	11.35	10.01	9.11	8.12	
August	8.27	10.29	8.23	7.81	15.21	10.20	4.10	7.81	13.26	10.14	9.50	7.81	
September	5.51	5.21	7.90	3.99	12.53	5.21	2.43	3.99	6.39	5.21	6.27	3.99	
TOTAL	25.85	28.95	25.44	22.35	38.30	28.95	11.37	22.35	40.98	28.91	27.78	22.35	

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[Continued.]

The Hon'ble Mr. H. R. C. HAILEY, C.I.E., I.C.S. called and examined.

17. (Mr. Henderson.) The principal recommendation of Aligarh White Flowered is that it has a high ginning percentage, namely from about 39 to 42. As to yield, it is very difficult to say anything about the average yield of the cotton crop in these provinces where conditions are so variable. All that can be said is that it has a reputation of being a heavy yielder and in this respect is possibly superior to ordinary *deshi*. It at present extends over an area of from a *lakh* to a *lakh* and a half of acres. The premium in its favour was originally Re. 1 per maund of *kapas*, but now it is not more than eight annas. There is no difference in the price of its lint and that of *deshi*. The spinners object to this cotton but buyers who buy *kapas* mainly on ginning percentage do not discriminate against it on account of its poor spinning quality. It is quite possible, however, that the spinners may object to it as they are already complaining about the difficulty of spinning it. When it was taken for the Continent or Japan, I believe it was largely used for unions or for mixing with waste.

18. It would be correct to say that there are four main classes of cotton in these provinces, viz., Aligarh White Flowered, ordinary *deshi*, staple *deshi* and Cawnpore American. It is very hard to work out any correlation between prices of *deshi* and American cotton. The price of *deshi* sometimes goes up out of all proportion to that of American. The price of the American cotton quoted in Liverpool naturally affects the price of the American cotton grown here but if *deshi* happens to be a short crop, then its price goes up out of proportion to American because it has an entirely separate market. The cultivator prefers growing *deshi* cotton because it is easier to grow.

19. I have not seen 4 F. and have no experience of the methods adopted in the Punjab. I consider it absolutely essential that the Agricultural Department in the United Provinces should control the ginning and distribution of seed of its recommended types of cotton. I think it would be advisable to introduce auctions of lint. If the *kapas* were auctioned, it would be impossible to maintain the purity in seed which would get mixed at once. At present the Agricultural Department hires a ginning factory. It would be possible to hold auctions of lint, if the Agricultural Department collected the *kapas* and sold the cotton by auction. Even if the crop greatly increased, this could still be carried out provided we had sufficient staff because we could always hire additional ginning factories. Under present conditions, I do regard it as most essential that the Agricultural Department should control ginning of American cotton. The expansion of this cotton in United Provinces is limited to the irrigated area. This amounts in all to some 6½ *laks* of acres, that is to say, this is the maximum area that has been under irrigated cotton in these provinces.

20. K. 22 was only issued two years ago, and both of these were very wet years. It is not possible to say anything definite about it. At the Aligarh farm, it did not give as good a yield as White Flowered. There is not the same objection to it as to American on the score of lateness. The mills are willing to pay a premium over *deshi* for it. All that can be said is that at present it is in an experimental stage and that another cotton of Mr. Leake's viz. K. 28, may prove a considerable improvement on it. It would grow on the unirrigated tracts whereas American would not.

21. It is difficult to get the cultivator's view regarding American cotton. 1913-14 was a good year for cotton and the cultivator got heavy profits from his American cotton crop. It looked as though it was going ahead very fast. Bad years followed and it has gone back. Its yield is higher than that of *deshi* by general agreement. The cultivator prefers a cotton of the *deshi* type because he can sow a catch crop afterwards in the *rabi*. If, however, a really heavy premium were obtainable for the American, this objection to it would disappear. I think that if we got one really good year and a substantial premium, the crop would go ahead fast and the cultivator would not bother very much about the catch crop. He can in any case sow peas after it. Sowing in lines is not very common in these provinces, but cotton is grown very much as a mixed crop.

22. (Mr. Roberts.) With regard to the premium given for the Cawnpore American, our object has been to see that the cultivator got at least Re. 1 per maund of *kapas*. This is not the market rate but a rate entered into with the Cawnpore mills in order to insure at least some premium. It would be difficult to guarantee a premium based on the difference between the rates for *deshi* cotton and the rates for American cotton in Bombay. The guarantee has to be given at sowing time and the cultivator wants something definite. I agree that the present arrangement is not altogether satisfactory but the area under American is so far small and it is more desirable to get a definite fixed advantage over *deshi* than the full possible difference in price at harvesting. This year advances have been received from Government to enable me to pay Re. 1 premium and then institute auctions in Cawnpore. If Cawnpore will not take the cotton or all of it, then Bombay will be tried. The cotton will be sold after ginning at our factory.

23. According to figures of yield, the yield of cotton is higher in these provinces than in the Punjab. These figures of outturn are based on experimental crop cuttings and experiments at the farms. The figure is steadily rising. They are low for anything like a good year. In case of cotton, there is a good deal to go on because our forecasts can be compared with the figures of imports and exports and also with the returns from ginning factories. On the whole, our accepted figures would appear to be low rather than high.

24. The United Provinces cannot be said to be an ideal tract for cotton owing to the extraordinary variations of climate. The two best districts are possibly Aligarh and Muttra. These are in the Western Circle, which was under Dr. Parr. He was keener on *huri* than Cawnpore American because the ginning percentage of the former was somewhat higher. Some of the mills too seemed to prefer *huri* to Cawnpore American. Different policies have been adopted in these provinces in the matter of cotton growing. After the failure of Cawnpore American in his circle, the reasons for which are explained in my written statement. Dr. Parr believed that the ginning percentage of *huri* was higher than that of *deshi* and it might compete favourably. American cottons are not more subject to disease than *deshi* but suffer more from the leaf-roller. This is worse on the smooth than the rough leaf. The ordinary middleman will not buy American except on the same basis as he buys *deshi*, that is, the ginning percentage. He will give nothing more for staple.

25. (President.) A small cultivator does not take his cotton as a rule to the market. He sells it in the village to a middleman who takes it to the larger markets. Most of the cultivators are probably indebted to middlemen or their landlords. The latter sometimes deal in various crops. The occupancy tenants are more free from debt and are often large enough men to sell direct. As a whole, however, it may be said that the grower does not receive the full market rate for his cotton and the only solution appears to lie in the formation of co-operative societies which would combine to sell their cotton in the market. It would be necessary, of course, for the societies to appoint an agent to do the selling and the growers would have to trust him to get the best price possible. Possibly a competent Secretary would be able to do the selling. Joint sales are a high phase of co-operation and will take time to bring about.

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[Continued.]

26. All the cottons grown in the United Provinces are known as Bengals. Some, such as that grown at Chandausi, may rank as fine Bengals. The forecasting of cotton is an extremely difficult matter in an area like these provinces where yields vary so greatly with the season. I am not prepared to state how it could be improved. In a year like the present, Aligarh White Flowered gave only two to three maunds of *kapas* on our farms, whereas in a favourable year twelve or thirteen maunds may be counted on. I do not think the publication of Bombay prices in the village *mandis* will greatly benefit the cultivator and I do not see any reason for going out of our way to assist the middlemen. I do not therefore consider that the publication of prices would do much to ensure the grower getting a better price for his cotton. I consider that the submission of ginning and baling returns should be made compulsory. At present it is extremely difficult to get these returns submitted and we have to send men round the factories and press them to submit their returns. If ginning factories are licensed, this should be made a condition.

27. The Imperial Cotton Specialist is, so far as I am aware, of no assistance to the United Provinces. It is possible that a botanist with a big reputation might be of assistance in co-ordinating the cotton policy but I do not think that the appointment of a specialist is the best way to bring this about. It would be quite impossible for any one specialist to have a better knowledge of the cottons of the provinces than the local botanists who spend their time working on them. In my opinion, the botanist ought to have a farm of his own to try his improved types on a field scale and afterwards to maintain the purity of type. When their value has been established they could be made over to the Deputy Directors for distribution. The latter deals directly with the tenants and the decision as to whether the cotton will prove popular must rest ultimately with the Deputy Director. He will not go in for cotton, if he finds that for particular reasons it is not popular with the growers. If possible, the botanist's farm should be near the head-quarters but this is not easy to arrange. Seed farms should be in the hands of the Deputy Directors and the distribution of seed must rest with them. This does not exclude the Economic Botanist from maintaining a farm to keep up the purity of the type. These provinces are endeavouring to increase the number of their seed farms. It is not altogether a matter of finance, as this form of farm should pay for itself with a competent staff. If K. 22 should spread, great care will have to be taken in maintaining the purity of seed and seed farms will probably be necessary in every district. I am not in favour of a special cotton department for these provinces which seems to me quite uncalled for, as it would only be a half time business. K. 22 does not necessarily conflict with Cawnpore American because it can be grown on unirrigated land. The variety it would displace would be Aligarh White Flowered. An Entomologist is badly needed in these provinces as the ravages by boll-worm are serious and a recommendation to this effect by the Committee would be very welcome.

28. (Mr. Wadia.) The price of *deshi* fluctuates greatly and only averages over the season can be given. The figure I quoted differs from that given by Rai Ganga Prasad which has possibly worked out on different data. The price of *huri* cotton is much the same as Cawnpore American. The habit of Cawnpore American is better than that of *huri* and so far as my experience goes, it yields better and is not so late.

29. The cultivator is in the habit of watering his cotton and so does the middleman when bringing it into the market. The brokers, however, are fully alive to this custom and discount it. I do not think that the watering of cotton in the baling presses is common in these provinces. Mixing of cotton is, however, rampant. Cotton for instance is brought into Chandausi in order to get the price of fine Bengals because Chandausi is a good mark and realises higher prices in Bombay. Licensing of gineries would not prevent ginning of *kapas* brought from forty or fifty miles away. I fail to see how it is possible to prevent cotton being brought in by rail or cart from, say, Aligarh to Chandausi and it would be difficult to characterise the mixing of two qualities of Bengal cotton as adulteration. This would not apply, however, to mixing of *deshi* with, say, K. 22 which is a definitely superior staple. This will have to be put down on selected areas and arrangements may be made for ginning it separately. If it subsequently become mixed with *deshi*, it would be difficult to provide a remedy but a constant supply of pure seed could be given out from the seed farms. Ginning in these provinces is largely done on commission. Legislation in regard to adulteration of cotton presents greater difficulties than in the case of an article of food such as *ghee*. Different staples would have to be specified beforehand and any mixing of these declared to be illegal. It would require an expert in each case to say what mixing has taken place. As ginning in these provinces is done on commission, there would be difficulties in dealing with the ginner who gins cotton that is sent to him mixed already and to fine him for ginning such a cotton would be a drastic step. At the same time, I should like to see gins licensed in order that we may be able to keep control over the seed. The licensing would ensure submission of proper returns and would prevent seed infested with bollworm being sold to cultivators. Fumigation, as in Egypt, should be insisted upon.

30. The pool system is in force in the United Provinces. It saves labour and coal and undoubtedly results in economic working. There is no question but that ginning factories are erected in some instances simply to compel other factories to pay owners not to work them or to share in the profits of a pool. I would not say that the profit in both cases comes out of the growers' pocket. The exporter and manufacturer certainly have to pay their share. In bad years, like the present, there is competition among ginners for cotton and the middleman who brings the cotton to the market gets a full price for it. The primary object of a pool is not to keep down prices but to ensure some economy of working. If there is a big crop, there may be enough cotton to go round all the gins, but ordinarily there is not enough cotton and it is therefore cheaper to work a few gins and so save in staff and coal. I doubt whether it would be legally possible to refuse licences to gins which are not working. They could probably bring evidence to show that they have worked in previous years when the crop was bigger. I understand that the Industrial Commission are considering the question of issuing licenses to sugar factories but only in the case of factories to be erected in future and not in the case of those already in existence. If the factory has once been built, I do not think you could rule it out of existence but there is no reason why a rule should not be made for keeping *rui* and *kapas* separately and for enforcing structural alterations. The conditions of licensing, in my opinion, should cover only methods of proper treatment of seed, submission of returns, etc., and should not extend to mixing of various kinds of cotton which should be left for the trade to deal with. We should not find difficulty in getting a sufficient number of ginning factories to gin American cotton separately if the crop should be increased. A syndicate might help for marketing, though so far there has been no difficulty in disposing of the crop.

31. (President.) There are, I believe, clauses in the pool agreement ruling out the erection of new gineries or their financing by members of the pool. It would be only reasonable to refuse licenses for new factories in places where a sufficient number exist already. I do not think you could compel a man to remove

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[Continued.]

his factory which was not working to some other place. He was perfectly within his rights in erecting it in the first instance and special legislation to this effect would be unfair as it would have a retrospective effect. It would certainly be to the advantage of ginners as a body if licenses were to be refused when there are already a sufficient number of gins and this would be some compensation for the control which would be exercised over them in any system of licensing.

32. (Mr. Ashton.) Water for sowing American cotton was last year concentrated on selected channels. No difficulties arose in regard to zamindars on other canals asking for similar treatment. What the Irrigation Department did was definitely to ensure growers of cotton an adequate supply of water. As it turned out, there was not much demand. Water supply in the canals in these provinces is not adequate to the demand and there are proposals for sending the Sarda water across to the Ganges and for additional storage in Bundelkhand. When the permanent barrage is built over the Ganges, the water supply will be better assured. At present we have only a temporary one on the Upper Ganges. What we are aiming at is a compact area of American cotton both for ginning purposes and seed selection and therefore it is very desirable that water should be concentrated on certain channels. Up to this time, the Irrigation Department have not seen their way to meet my request and this is the first year they have undertaken to do so. The Agricultural Department is not in favour of providing water for catch crops and we think that, because the crop is cheap, there is no reason why it should get cheap water. We would prefer that adequate water was given for the main crops, such as wheat, and for this reason I should like to see rates for catch crops raised. Among other things this will encourage the growing of more wheat which at the present time is very necessary.

33. As regards oil engines, their employment is not increasing at present. The price of oil is high and little plant is obtainable. I think the tube wells will go ahead in parts of the provinces where ordinary wells cannot be constructed, or give very little water. If Government were to undertake to construct a large number of tube wells and maintain them, a big mechanical staff would be required. It is preferable, therefore, that assistance should be given to zamindars in constructing them and running them, but their management should be left to zamindars themselves. If private firms were to take up the business, so much the better.

34. In those tracts in which water is concentrated for the sowing of American cotton, there is no restriction on sowing *deshi*. The object is not to prevent *deshi* being sown but merely to ensure an adequate supply for American without which it will not be sown. At present the water rate for cotton is Rs. 2. I should prefer to see it raised if an adequate supply can be assured. I see no reason why some slight preference should not be given to American in its early stages, that is to say, to encourage it, the rate should be Re. 1 less than *deshi*, provided that the rate for cotton generally is raised. I do not think that the Irrigation Department care for differentiation of rates. The Agricultural Department naturally, however, wish to encourage particular crops when they are somewhat new to the cultivators and their merit is not fully established. The Irrigation Department assess the rates. It is possible that differentiation of rates, etc., as suggested would not be popular. In the long run, however, I think it will be to the advantage of the Irrigation Department to make such differentiation because, in case American cotton became firmly established, they could always count on a large area under this crop annually. *Deshi* cotton need not necessarily be sown with irrigation and cultivators often prefer to wait till the rains. American cotton must be sown early with irrigation and to encourage it seems a sound business proposition. Cotton is not irrigated to any large extent from wells. The percolation level is deep throughout most of the western districts and irrigation from wells would impose a very severe stress on the cattle.

35. (President.) Government issues a good many loans for sinking wells. The co-operative societies do, I believe, include the sinking of wells among the objects for which grants are made. If the area commanded by the tube wells were to increase this would necessarily mean that a larger amount of American cotton could be sown.

36. As regards the question of an Imperial cotton expert, there would be difficulties in having one man for the whole of the country and I prefer something in the way of a Committee. If there were one man only, he would probably be a botanist and thus clash with the provincial experts. The Committee would include trade representatives. I think the control of one expert over another is apt to be resented and, in any case, it is extremely difficult for one man to try to control others far more intimately acquainted with local conditions than he is.

37. There is some considerable difference in my figures as to the average holding in these provinces and those of Rai Ganga Prasad. Mine are from three to four acres; his are from eight to ten. His figures seem to be vitiated by the exclusion of subtenants. The number of recorded tenants last year was 25½ millions and the area in their holding 38 million acres, which gives a very low acreage, but many of these probably hold jointly. My figures were taken from settlement reports which give an area of three to four acres. The main point is that our cultivators are small men and I am afraid it is only a very few that hold large holdings of eight or ten acres. The result is, therefore, that they prefer to go in for the hardiest crop such as Aligarh White Flowered and indeed many of them prefer to grow a mixed crop as an insurance crop. The improvement of cotton in the United Provinces, therefore, involves economic as well as climatic considerations and, apart from the uncertainty of the cotton crop generally, the small cultivator always prefers quantity to quality.

Supplementary written statement submitted by the Hon'ble Mr. H. R. C. Hailey, C.I.E., I.C.S.

Legislation to prevent the damping and adulteration of cotton.

38. Mr. Wadia at the meeting of the Cotton Committee asked me to put up a note on the question of legislation to prevent the adulteration of cotton. I have since had the advantage of reading the note prepared by Mr. Noyce for the use of the Committee on the subject of previous legislation on the subject. One interesting point is that the Cotton Frauds Act does not seem to have been an entire failure but had a certain, if not very great, deterrent effect and its repeal was followed by an immediate revival of adulteration in a very severe form. The second is that in the Punjab—and possibly this applies to other parts of India—the principal purchasers of cotton are the ginners and they are averse to letting out their factories to a Government Department whereas, in the United Provinces, no difficulty is experienced in hiring factories for ginning special classes of cotton.

39. The action suggested to me took two forms, (1) proceedings against the ginners by means of licensing, (2) against the dealers by some Act similar to the Cotton Frauds Act. It is possible that in other parts of India the terms are practically synonymous and therefore it would be difficult to touch one party without touching the other. This is not the case in the United Provinces. Some ginners work entirely on commission; others work partly on commission and buy themselves at the same time. Where the ginner works

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[Continued.]

on commission, it would only be possible to touch him if he mixed for a client and this could be very easily got over by the client mixing beforehand. Licensing alone, therefore, would not have the desired effect. The dealer who mixes an inferior with a better class cotton can fairly be made amenable to criminal legislation on the ground that his action not only amounts to a fraud against the purchaser but is opposed to the national interest, inasmuch as he is lowering the reputation of Indian cottons and ultimately hurting the grower. But previous history shows that any legislation against such practices is extremely hard to carry into effect and further that it met with great opposition from various branches of the trade, not from any sympathy with the practices it was proposed to put a stop to but because merchants were very doubtful of the value of the particular piece of legislation. If cottons of one variety were confined to particular districts, it would be comparatively simple to pass legislation to the effect that any one importing cotton from another area or selling cotton grown in one area mixed with cotton grown in another as pure cotton was guilty of an offence. But looking to the great mixture which has already taken place in the principal growing tracts, this obviously will not meet the case. In fact it might have the opposite effect to that intended. It might encourage individuals to grow a short staple cotton in a good cotton tract, such as Broach, to enable them to mix without fear of prosecution. It must be remembered that the characteristics of the short staple cottons is that they have a high ginning percentage and this, provided any sort of price can be obtained for them, makes them profitable to grow. This is the characteristic alike of Aligarh white flower, *roseum* and *goghari* in Broach. To take an instance which affects us more closely, if K-22 or any other hybrid were to spread widely in the United Provinces, it would not be confined to a particular area. To make legislation effectual therefore, it would be necessary to append to the Act careful definitions of each important class of cotton and declare that any mixing of one with the other would be an offence against the Act. This would be most difficult to work because one grade of cotton shades off into another, and it is probable, for instance, that there is very little difference between fine Bengals and poor *Oomras* and it would, in many cases, be extremely difficult for the court to decide whether an intentional mixing had taken place. Secondly, it does not necessarily follow that, because the cotton is mixed, the dealer has mixed it. It may be due to the mixing of seed and where, as in the case of Cawnpore American and *deshi*, both are sown side by side in the same village, this is sometimes very difficult to prevent. Again what appears to be a lower grade of cotton may really be due to crossing with an inferior type of cotton. This would accentuate the difficulties of definitions under the Act. Under these circumstances what can be done? If you once admit the ginner's plea that he did not mix the cotton but ginned it as bought from the grower, it seems to me that licensing will become wholly inoperative. It would be necessary, before a conviction could be obtained to bring proof that actual mixing took place and no one with any experience of the country would imagine this would be possible. If legislation goes to the logical conclusion of prohibiting the ginning of any mixed cotton, the cultivator will be driven to growing an inferior species simply because he is sure of some sort of market. It comes back to this that, under the prevailing conditions, all that the dealer can guarantee would be a certain degree of purity and it is on this basis that I think action should be taken.

40. In these provinces, our cottons in the shape of Bengals being on the lowest grade, we need not fear adulteration from outside. Such frauds as are practised consist in moving by rail or by road cotton from one area into another, the cotton of which has a somewhat better reputation. The differences in prices between the cottons of various localities are not however very great and there is thus a practical limitation on the distance from which it pays to bring outside cotton. Further, variations in the character of the season will effect the quality of the crop in different localities and tend to equalise prices. As it would not appear that the cultivators in districts such as Moradabad, where the Chandausi cotton generally fetches a rather better price than the cotton of the Doab, get any better prices and as they certainly make no effort to maintain purity of their local types, the practice alluded to above hardly seems to call for legislative interference. If however we get a better class of cotton grown on a fairly large scale, our problem will perhaps be more difficult than that of other provinces, as the better stapled cotton will be grown in the same villages as ordinary *deshi*.

41. The remedy, however, does not seem to me to lie in legislation against the ginner or against the dealer but in persuading the principal consumers of our potential cotton to combine to keep it pure. This does not appear to me at all impracticable. Assuming that Cawnpore American or K-22 spreads widely and the Department is compelled to surrender the direct control over marketing, I should think that it would be feasible to get the local consumers to undertake to buy only on a guarantee of purity. I do not think it at all improbable that the spinners of these provinces would find dealers who will be prepared to give them this guarantee. They would, of course, have to pay somewhat more highly for guaranteed cotton and this will enable the dealers to pay the cultivator a fair price for keeping his cotton pure. The fact that they are prepared to pay full market rates for unadulterated cotton will keep up the price of this class of cotton as against the fraudulent dealer who wishes to export mixed cotton to other parts of India. It may turn out extremely difficult to prevent mixing of seed and growing of mixed cottons in the fields but this seems to me a very strong argument for not undertaking criminal legislation because the dealers might be afraid to touch it at all if mixed and this might drive the grower back to *deshi*. If absolutely pure cotton of the better varieties were unobtainable, spinners could arrange with dealers to pay according to purity. It seems to me better to get spinners to combine against adulteration, and the cultivator, if he finds that the market is going against mixed cotton, will probably of his own accord take steps to keep it unmixed; or at any rate to keep it as far as possible pure. Of the two alternative courses, *viz.*, prosecution and the attendant difficulties of carrying it out and bringing about some sort of combination among the consumers, the latter seems to me preferable. So far as we are concerned, the question is rather hypothetical but an opinion is asked and as it is a matter that may concern us in the future, I am of the opinion that the disadvantages of criminal legislation strongly outweigh any possible advantages. A small number of dealers might be deterred from fraudulent practices by the fear that they may be brought into court, but when a few prosecutions have been initiated and failed, as I believe they would, the Act would become wholly inoperative and a start would have to be made afresh in another direction.

ANNEXURE I.

Note by Mr. B. C. Burt, Deputy Director of Agriculture, United Provinces.

Prevention of Adulteration of cotton.

As pointed out in Mr. Hailey's note, this question does not concern this province intimately at present as the chief cotton we produce is classed as Bengals. A limited quantity is classed as fine Bengals and there if

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The Hon'ble Mr. H. R. C. HAILEY, C.I.E., I.C.S.

[Continued.]

little risk of deterioration by mixing. But we are at present engaged in the introduction of a stapled cotton, viz.: Cawnpore American, and hope to have shortly a hybrid cotton of improved staple to introduce. The problem may therefore be a serious one at an early date. The risks appear to be false packing, mixing of unginned cotton (*kapas*) before ginning either at the gins or by the mixing of *kapas* by cultivators or village dealers, the growing of mixed crops, and deterioration by hybridisation.

False packing is common cheating and would appear to be capable of being dealt with as such or under the Merchandise Marks Act. In any case, it is the least important of all as it only affects the particular consignment concerned. The mixing of unginned *kapas* of inferior quality with the *kapas* of a staple cotton is more important as it may lead, and has apparently done so in the case of Broach, to the loss of reputation of an important class of cotton to the loss of both the cultivator and trade. By the sowing of mixed seed and subsequent hybridisation, a variety of Indian long stapled cotton may be entirely lost in a few years. It is suggested that this could be remedied by the licensing of ginning factories and by making mixing a penal offence. The difficulties that would be encountered in this province in working an Act of this kind are numerous. Some ginners work only on commission for cotton merchants and, in such cases, terms vary widely. A gin (with or without a press) may be entirely reserved for one merchant or, more commonly, will work so many days per week for various customers. A ginning factory may be buying *kapas* for themselves and also ginning on contract for other buyers or in rare cases may do their own buying entirely. The ginner is not necessarily a good judge of cotton and, even in the case of mixing cotton in the opener, it would not be easy to hold him responsible for mixing done under the instruction of the owner of the cotton. Even if mixing in the ginning factory were stopped, there would still be nothing to prevent the dealer from mixing *kapas* before sending it to the ginning factory. There is also no small risk of the cultivator himself (or the village dealer) mixing *kapas* of various classes and not necessarily with intent to defraud but merely through carelessness or because the quantities dealt with are small. This is no small difficulty in the case of Cawnpore American. Since that variety can only be grown with irrigation, it is inevitable that some *deshi* cotton should be grown in the same villages as American or at any rate villages served by the same market would be growing both varieties. It is clear therefore that a dealer may be in possession of mixed *kapas* honestly acquired.

Legislation therefore appears to be extremely difficult to work. The only means of preventing mixing appears to be (i) the organisation of buying agencies for cotton of improved staple which can give premiums which will make it worth while the grower's keeping his *kapas* pure and which will be in sufficiently close touch with the larger interests of the cotton trade to ensure fraudulent mixing being made unremunerative, (ii) adequate provision of seed farms to ensure supplies of pure seed so that, even if mixing occurs in any one season, mixed seed is not sown again. In introducing a hybrid cotton, an attempt would naturally be made to concentrate attention on limited areas but even so adequate arrangement for the supply of pure seed would be essential.

ANNEXURE II.

Note by Mr. H. M. Leake, Economic Botanist, United Provinces.

In putting forward my views as to the practical remedies for the adulteration of cotton, I do so with some diffidence as I have no practical experience of the trade. I am not therefore in a position to do more than outline what, in my opinion, are the essential facts which must be taken into consideration if effective legislation is to be undertaken and what the bearing of the facts must be on any scheme of legislation.

The essential fact is that the consumer desires to purchase his requirements in uniform consignments of the quality of which he can be reasonably sure. Unless he possesses full confidence as to quality, he will not pay the full intrinsic value of the grade he contracts for as he will have to allow a margin for the risk run. Taking the word adulteration in its widest sense to mean a lack of uniformity, it is first necessary to trace its origin. The first source lies in the field. By the growth of mixed types a mixed produce is obtained, and it is clear the dealer will not be in a position to handle pure produce of uniform quality if it is not raised in a pure condition.

The second source is the district; each individual field may be pure but, if different types are grown in the various fields, the produce may be kept pure but the process requires a degree of skill which it is perhaps impossible to expect all dealers to possess and which will only be evolved if it pays the dealer to exercise that skill. At present there appears to be no such incentive; adulteration is, in the first case, unavoidable and its avoidance, in the second, unremunerative. In neither case can it be called wilful.

The third source is the deliberate admixture of low, in order to obtain the price of high grades, in its worst form involving the railing of inferior cotton to a place which bears a name for quality. This is wilful adulteration and in principle should be punishable. Under the present conditions of cotton cultivation and of the trade, however, it is doubtful if the three classes of adulteration can, in the result (the bale), be distinguished and herein lies the difficulty of restrictive legislation.

Legislation can, however take two forms; a negative form, in which honesty is a consequence of the deterrent effect of punishment inflicted and a positive form, developing conditions which render honesty the best policy. The former, purely restrictive legislation can, to my mind, never be a real success; it involves the creation of complex machinery to carry it into effect and it diverts ingenuity to evolving methods of evasion. It is doubly undesirable in cases, like that under discussion, in which the difficulty in establishing wilful action must be great. From a perusal of Mr. Noyce's note, it appears that legislation hitherto enacted is of this nature and, before recourse is had to similar efforts, it is at least profitable to consider whether it is not possible to attain the desired end by the latter form of legislation.

I think something in this direction is possible, though, as I have said, I speak with some reservation. We can suppose a system of licensing presses and of marks which enforces the stamping of all bales with the name or mark not only of the press but of the dealer. Such a rule appears to me capable of cheap enforcement and to form no restriction on legitimate trade. The effect, however, will be considerable in that the consumer, who opens the bale, will be in a position to trace the dealer who was originally responsible for pressing the bale, even though the bale has passed through the hands of a number of middle men. The result would be that cotton, instead of passing under the general trade name of say "*Ujjain*" would pass as "*Ujjain mark*," say "*Ram Pershad*." It introduces a personal responsibility of the dealer which would at the time have a certain market value. Dealers would find it pay to study and try to maintain quality and a premium would be placed upon honesty.

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The effect however would go further; the dealer who buys from the cultivators would be in a position to pay for quality and purity and the incentive would extend to the cultivator, stimulating the growth of pure types of superior quality.

From Mr. Noyce's note, it appears that presses were licensed and a system of marks introduced under Act IX of 1863 (Bombay). That system might be effective where the presses are owned by the dealers but it ceases to be effective where, as is so common, the gins and presses are worked on contract. It appears to me impossible to make one person responsible for the quality of another person's goods when he is handling them only during one operation. Such legislation is purely repressive and further fixes responsibility on a subsidiary and minor interest. By the enforcement of stamping the dealer's mark on the bale the press incurs no responsibility as to the quality and that responsibility is laid on the interested party. Such legislation appears to me of the purely positive type. No vast machinery is required to enforce it, no complex prosecutions, involving expert trade evidence, can arise, while it will enable the trade to develop, by a system of contracts, in a way hitherto impossible. This development can, I think, be safely left for the trade and private enterprise to evolve.

Mr. B. C. BURT, Deputy Director of Agriculture, Central Circle, United Provinces.

EXAMINED AT CAWNPORE, NOVEMBER 1ST, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "*Deshi*," short staple cotton.

42. (1) **Experience.**—I have been stationed at Cawnpore for some 10 years; my circle includes three distinct cotton growing tracts:—

- (1) The lower middle and lower *doab* (districts Etawah, Mainpuri, Farrukhabad, Cawnpore and Fatehpur).
- (2) Part of the Lucknow division (Unao, Hardoi and Sitapur).
- (3) The Jhansi division (Bundelkhand).

I am in actual touch with cultivators.

43. (2) **Varieties.**—The cotton commonly grown in these areas is classed as "*Bengals*." The best of the cotton from the Jhansi division is classed as "*Fine Bengals*." It will be convenient to discuss these three tracts separately.

(2) In the *doab*, cotton is largely but not entirely grown with irrigation. The area in these five districts in 1914 was 318,000 acres of which 176,000 acres were sown with irrigation. The total area in this tract is not subject to very great fluctuations (except as induced by change of prices) since these districts enjoy considerable canal facilities. The irrigated area varies more than the total.

(3) In the Lucknow division, on the other hand, sowings are entirely dependent on early rainfall and the area sown is liable to considerable fluctuation.

(4) In the Jhansi division, cotton is sown both with and without irrigation: the area sown is largely governed by the date at which the monsoon commences and the character of the monsoon in the early periods. The canals are storage canals and the amount of water available for cotton sowing is practically limited to the supplies from the previous *rabi* season which on the Betwa canal, in particular, is often practically nil.

44. (3) **Size of holdings.**—The average size of holdings varies enormously as also the percentage under cotton. Settlement reports give practically no information on the subject. In Etawah, which may be considered the best cotton district in my circle, information obtained during the recent settlement showed indirectly that, in the case of ordinary tenants, the holding rarely exceeded eight acres and a large number of holdings clearly averaged three or four acres. From my own experience, I know that the total area under cotton sown by a single tenant is commonly from half to 1½ acres.

(2) But there are a number of cultivating proprietors and large occupancy tenants in this and adjoining districts whose holdings are much larger, not infrequently being twenty to thirty acres. Such proprietors are an important factor in our agriculture but any attempt to obtain statistical information is made the more difficult by the fact that the same proprietor may cultivate one part of his own land and let another portion and also cultivate other land as a tenant.

(3) In the season 1914, the percentage of the cultivated area under cotton in certain districts of my circle was as follows: these are not average figures but refer to a favourable year:—

Doab	Etawah	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14
	Mainpuri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11½
	Farrukhabad	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
	Cawnpore	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12
Lucknow division.	Fatehpur	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
	Hardoi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4½
	Unao	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Bundelkhand.	Jhansi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3½
	Banda	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Jalaun	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5½
	Hamirpur	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5½

(4) In Cawnpore, Etawah and Mainpuri, owing to the fact that there are considerable areas that are unsuitable for cotton growing, the proportion of the cultivated area in the cotton tract rises to close on twenty per cent. which is probably as high as sound rotations permit.

(5) In Hardoi and Unao, there is no canal irrigation. The introduction of canal or tube well irrigation would doubtless lead to important increases in area as well as in yield and certainty.

(6) In Bundelkhand, much of the soil is totally unsuitable for cotton. Additional canal facilities would

(7) In all discussions as to the possibility of increasing the cotton area, it is important to bear in mind that cotton is essentially a precarious crop in this part of the United Provinces. In non-canal districts, it is sometimes almost impossible to sow it when the monsoon starts late. This is shown at once by large fluctuations in area. Apart from this, the average year is too wet for cotton and damage by excessive and untimely rain in September and October is frequent. There is thus very great uncertainty as to the yields. The crop is one requiring considerable expenditure on labour for weeding and picking and there are many years when it barely pays expenses.

45. (4) **Yields and profits.**—The average yield of ginned cotton per acre sown with irrigation is about 220 lbs. per acre and without irrigation 110 to 120 lbs. Profits are extremely variable but are probably on a normal crop with normal prices about Rs. 15 per acre without irrigation and Rs. 25 to Rs. 30 with irrigation.

46. (5) **Rotations and manures.**—Cotton commonly follows wheat. In canal irrigated tracts, it is followed commonly by a catch crop of peas but, in non-canal districts, no other crop can be sown within twelve months after sowing cotton. Rotations in this province are inclined to be opportunist and ill-defined but the principal other crops grown in rotation with cotton are wheat, barley, *juar* and other millets, *arhar* and other pulses and gram. Cotton probably rarely occupies the same land more frequently than one year in three or four nor is it desirable that it should do so. Cotton is rarely manured direct, as direct manuring of cotton in average years not only does not pay but frequently leads to an undesirable growth of wood. On the other hand, the preceding wheat crop is generally manured to some extent and experiment has shown this to be the most economical way of maintaining fertility for cotton. Experiments with artificial manures on cotton do not indicate that any improvement can be expected in this direction. On light poor soils, particularly in dry years, cotton sometimes responds to general organic manures but I am not prepared to recommend any general change of practice in this direction. On the other hand, there is ample margin for better tillage, a point which will be referred to later.

47. (6) **Comparative returns.**—With present market conditions, the most profitable variety of short staple *deshi* cotton is one with high yield and a high ginning percentage. Long staple *deshi* cottons such as are grown in other parts of India cannot be grown here as the season is too short. Long stapled hybrids received from Mr. Leake are being experimentally grown in my circle on a limited scale but it is as yet too early to state the relative profits to the grower.

(2) Cawnpore American cotton, an acclimatised exotic, yields on an average as well as short staple *deshi*, is potentially a higher yielder but requires somewhat better cultivation. On normal yields and average prices, it yields the cultivator about Rs. 8 per acre more than irrigated short staple *deshi*. It cannot be grown without canal irrigation as it must be sown well before the rains.

48. (7) **Conditions affecting increase in area.**—This question has been partially answered above. The area of short staple *deshi* could be materially increased and made much more stable by improved irrigation facilities making the crop less dependent on the early monsoon. Apart from this, the area is governed by the relative prices of cotton and food grains, the cultivator being more influenced by the prices of the previous season than by future prospects.

49. (8) **Uses of seed and seed selection.**—Cotton seed is largely used for cattle food and there is a limited amount crushed locally for the manufacture of oil. There is a considerable export both to Europe and to other provinces.

(2) Seed selection is not practised to any considerable extent except in so far as good cultivators keep a certain quantity of seed for their own use. As usually understood, the selection of seed is unknown nor is it likely that anything of importance could be done by cultivators in this direction. In many districts hand ginned seed is preferred and a premium is paid for it not so much because of gin damage as because cultivators realise the value of seed of known origin. A large proportion of seed sown is however purchased from the market and eventually has come from the ginning factories.

50. **Improvement of *deshi* cotton in Bundelkhand.**—A brief reference should also be made to an attempt to improve the *deshi* cotton grown in Bundelkhand. The cotton grown in the north of Jalaun district and neighbourhood is known to the trade as "Kalpi" and is usually classed as "Fine Bengals." There is often a shortage of seed in this district following bad seasons and importation of seed from outside leads to a coarser cotton being grown. Selections have been made from local cottons and a pure race isolated with staple valued by the mills as fully equal to the best "Kalpi," and with a high ginning percentage and yield. This cotton is now being multiplied for distribution. The recent opening of a farm of 100 acres in one of the large estates in the tract will be of material assistance.

(c) *Exotic cotton.*

51. (20) and (21) **Experience and varieties.**—My experience of exotic cottons has been limited to an attempt to establish American cotton cultivation in the canal irrigated parts of the circle. A certain measure of success has been obtained in the introduction of Cawnpore American cotton, which was Upland Georgian in origin and was apparently originally introduced at the time of the Cotton Commission and has therefore been continuously grown in the province for a quarter of a century. This cotton is of about one inch staple and is bought on the basis of "midling American" and has met a ready sale at, on the whole, satisfactory prices. But for a series of bad seasons, there would probably have been a large area of this cotton under cultivation but its introduction has received a series of checks. In 1914, the general slump in cotton prices greatly disheartened growers and this and the subsequent competition of indigo caused a marked set back. The following years, 1915-16, were phenomenally wet years and crops were poor. In the current year, conditions were satisfactory at the start but the latter part of the monsoon was far from favourable.

(2) This cotton can only be grown on a limited area for the reason that it can only be sown with canal irrigation and must be sown in time to be well established at the commencement of the monsoon. The canal supplies are at their lowest at the beginning of May as a rule but increase towards the end of the month and in early June, with the rising of the Ganges as the snow melts. *Deshi* cotton therefore has this advantage over American that it can be sown either with or without irrigation and need not be sown so early. A scheme has been tried this year for the first time of concentrating American cotton growing on certain channels to which the canal department guaranteed water supplies. It is as yet too early to judge results but it is clear that if American cotton is to be established some scheme of this kind must be worked out.

(3) **Experimental work** has been largely devoted to the isolation of the best races from the Cawnpore American for reproduction and distribution. A detailed examination of the crop showed that there was considerable variation in agricultural characters, in lint and ginning percentage. A number of

pure races have now been isolated and tested and the best are being multiplied. Valuations of the lint have been obtained in each of the last two years which show that, as regards spinning value, these selections are satisfactory. An attempt has been made to select an earlier maturing variety to permit of later sowing but although types have been obtained which are no longer in vegetative period than the local *deshi* cotton these do not do well when sown late. The reason for this appears to lie in a difference in the root system.

52. (28) **Importation of seed.**—A number of trials have also been made with imported American cottons, both obtained direct and through the courtesy of the Deputy Director of Agriculture, Sind. None of these have done well even after several years' acclimatisation nor has it been possible to isolate high-yielding types from them. In very dry years, e.g., 1913, they yielded extremely well and good crops were obtained from a number of well-known American varieties but in wet and average years they failed entirely. One reason for this appears to be that all modern American varieties have a smooth leaf and are very susceptible to damage by aphids. The Cawnpore-American has a rough leaf and, provided that it is sown at the right time, is no more damaged by unfavourable weather than short-stapled *deshi* cotton. It follows from the above that any attempt to introduce American seed in bulk would be foredoomed to failure. The introduction of the best types of the acclimatised Cawnpore-American offers the best prospects of success. If a better cotton is required, it must be obtained by hybridisation. Extended trials were also given to Dharwar-American at Cawnpore but it was eventually discarded as unsuitable.

II.—COMMERCIAL ASPECT.

53. **Market organization.**—Any effort to establish a superior cotton, whether it be improved *deshi* cotton, a hybrid long-staple *deshi* cotton or an acclimatised exotic is obviously handicapped by the present organization of the cotton trade. This is not in any sense because the consumer is unwilling to pay a fair price. Once cotton is ginned and baled, it commands even in Cawnpore its full market price provided that it can be offered in minimum commercial quantities and even smaller quantities can often be satisfactorily disposed of. But there is an unmistakable gap between the spinner or big dealer and the grower. Unginned seed cotton (*kapas*) is bought without reference to quality except in so far as purchasing ginner pays attention to colour, cleanliness and often to probable ginning percentage. Not only are the growers small men who frequently do not bring their own *kapas* into the big markets, but they are frequently in need of money and accept comparatively low prices from peripatetic buyers. A perfect army of middlemen has thus sprung up between the ginner and the grower. It is difficult to suggest an organization to deal with this. In the introduction of American cotton, it has been necessary for the Agricultural Department to act as middleman and arrange for the purchase of the *kapas* at a reasonable premium and put the ginned cotton on the market. Even in the early stages, this is a big strain on the department's staff which is limited and it is clear that some form of buying agency is required as soon as the crop reaches any important dimensions. Unless a market can be guaranteed, the grower will not be bothered to grow long-staple cotton unless it pays him on yield alone. This seems a matter for the cotton trade to deal with. The Agricultural Department has as much as it can do to deal effectively with the introduction of new crops, the supply of seed and demonstration of the correct methods of cultivation. In some parts of India, *kapas* auctions have been organised to meet this difficulty. I gather that they have been only a partial success but in any case they are inadequate for this province as the individual growers are mostly small men. Co-operative cotton purchase societies have been suggested and in certain areas may do very useful work. But it is clear that such societies are only likely to be a success where the general conditions for successful co-operative societies exist and these conditions are absent in many of our cotton-growing districts. Without buying organizations, the department is deprived of an effective weapon, viz., the enhanced price in the early stages of introduction of an improved cotton. The spinner fails to get the new staple since it is absorbed in the much larger *deshi* cotton market and in addition the seed is mixed. It is clear therefore that some form of commercial buying agency for stapled *kapas* is required which will organize the purchase of small quantities of *kapas* from the grower and arrange ginning and marketing. With such an organization, the Agricultural Department could co-operate with great advantage to both.

V.—GENERAL.

54. (1) **General organization for cotton improvement.**—As regards research and investigation, the existing organization appears to be on right lines. It has been suggested on more than one occasion that a special staff is required to deal with cotton improvement but this suggestion has been made without knowledge of the agricultural conditions of the province or the organization of the Agricultural Department. Even where research officers are concerned, it is clear that, as there are two distinct seasons in only one of which cotton is grown, a research officer can with advantage take up the study of more than one crop. In the case of the Deputy Directors and the district staff of the department, the reasons are stronger. Improvement of cotton cultivation is indissociable from general agricultural improvement. The areas to be covered are very large and local knowledge and experience and intimate association with cultivators essential.

(2) A separate organization for cotton would be looked on with suspicion by growers and much of the influence which we have at present gained by contact with cultivators on various matters would be lost. As to the needs of staff for research purposes, the Committee will already have received Mr. Leake's views and I would merely add here that there is an obvious need for an entomologist to study cotton pests in Northern India. The damage caused at present by bollworms is very great indeed and in some years as much as 25 per cent. of the crop is either lost or seriously reduced in value. It is not unlikely that either legislation or general administrative action would be needed to deal effectively with the matter, but neither is justified until the problem has been much more carefully studied on the spot. Apart from special research staff, the general strengthening of the staff of the Agricultural Department is essential. Deputy Directors' circles are much too large for efficient working. The area of cultivation in my circle is ten million acres and it includes three distinct tracts of very different character.

55. **Organization of seed supply.**—Apart from the question of staff the main need of the province in this connection is larger areas for Government seed farms. It must be assumed in introducing any improved *deshi* cotton (whether long-staple or short) that the bulk of the seed produced by cultivators in the early stages will be unfit for issue for sowing purposes owing to probable impurity due to natural cross-fertilization. While much can be done by concentrating attention on limited areas, with the object of completely replacing the inferior cotton at the earliest possible date, it is obvious that, in the early stages, the department must be in a position to send out large quantities of pure seed.

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(2) In an average year, one acre of cotton will produce seed for not more than forty acres for the succeeding year, so that to establish a new crop, and subsequently to provide a centre of purity for its maintenance, a considerable area is required even when full use is made of unofficial seed farms. With the aid of the money placed at the disposal of the department recently by the Government of India, it is possible to make a considerable step forward. Were a buying agency organized, it would be possible by co-operation between this agency and the department materially to lighten the burden of organizing the seed-supply.

56. (46) **Attitude of buyers to improved cottons.** Provided that the cotton is ginned, I have found spinners ready to offer fair terms to encourage new cottons. But with one exception, they are not prepared to deal with *kapas*. The present effort to introduce Cawnpore American cotton was made possible by the Elgin Mills coming forward to guarantee growers in the first year a premium of Re. 1-4-0 per cotton maund for American cotton in the form of *kapas*. The *kapas* was actually bought in by the Agricultural Department and ginned but on the Elgin Mills' account, and they took all financial risks. A previous attempt to introduce the same cotton was shut down just when it was meeting with some measure of success owing to the refusal of the Government of India to sanction an advance to enable the department to organize the purchase of *kapas* from growers. Not only did this delay matters for some years but it made it impossible to attempt American cotton-growing again in certain districts.

57. (47) **Effect of water rates.** I consider that present water rates for cotton are sufficiently favourable.

58. (49) **Effect of tenure of land.**—The present scattered nature of holdings is undoubtedly an obstacle to improvement in cotton-growing as well as in the case of other crops. Under the present system proper drainage is impossible, in many cases a matter of no small importance where cotton-growing is concerned. The same difficulty arises in any attempt to introduce better tillage. Small and irregular fields cannot be cultivated to advantage and implements for interculture to replace more expensive and less effective hand-weeding are impracticable on many holdings. As this subject is being discussed fully at the next Board of Agriculture, it is perhaps unnecessary to deal further with it here. It must be emphasised, however, that the present scattered nature of holdings makes the improvement of crops for quality much more difficult. It adds enormously to the difficulties of the plant-breeder, if in addition to the production of a plant combining the necessary qualities of staple and ginning percentage with the various characters necessary to secure high yields in our short growing season, he has to also include the somewhat indefinite characters constituting hardness and ability to stand ill-treatment such as are possessed by certain types of short-staple *deshi*. Further the quality of cotton lint is adversely affected by bad cultivation particularly by inefficient drainage.

VI.—IRRIGATION.

59. (65) **Experience.**—I have had experience of cotton-growing in two irrigation circles.

60. (66) **Watering of cotton.**—Except in famine years, cotton is only watered for sowing. The best practice is to irrigate the land as soon as possible after the removal of the preceding wheat crop and to plough and subsequently to irrigate a second time for ploughing and sowing. Frequently, however, only one watering is given and after this cotton is sown after a hurried ploughing. In either case the total volume of water used is about the same, *viz.*, about 100,000 to 120,000 gallons per acre.

61. (67) **Cotton versus wheat.**—Wheat and cotton do not in any way compete.

62. (68) **Fluctuations in river supplies and their effects.**—The supply in the Ganges steadily declines from October until April. A gradual rise takes place in May and June as the snows melt, but the date of this is variable and the volume of water available for cotton-sowing and for the sowing of other *khari* crops is variable. When the rise is late, the cotton area is apt to be affected and sowings delayed. This is of more importance to American cotton than to *deshi*, as already explained.

63. (69) **Wells and tube wells.**—In my circles, wells are of great importance as regards wheat irrigation since wheat is, in normal years, sown on natural moisture and the wells are only used for subsequent irrigation. This is true both of canal and non-canal tracts, though well-irrigation naturally declines with the introduction of canal-irrigation. Wells giving sufficient discharge to enable them to be used for flooding land for ploughing and cotton-sowing are rare and for practical purposes, existing wells can be ignored so far as cotton irrigation is concerned.

(2) I have had some experience with tube wells. A Brownlie tube well is at present being worked by the department as a demonstration and experiment in the Hardoi district in a village where no irrigation facilities existed before. Our object in this experiment is to ascertain the costs of working and it is intended to hand the well over to a co-operative society for management in due course. At present, it can be stated that the well can irrigate 100 acres per season and that the cost of pumping and management is not too high to admit of a rate being charged which would permit of cotton being profitably grown on tube well irrigation. A number of such wells are being installed for *zamindars* and some are at work. This work is in the hands of the Agricultural Engineer and I understand that progress is chiefly limited by the difficulty in obtaining the necessary plant and material. There are large areas of the province outside the canal tracts where tube wells can be successfully constructed and development in this direction could undoubtedly materially improve the cotton crop as well as the wheat and sugarcane crop.

64. (74) **Effect of canal regulations.**—I have already mentioned a scheme which is under tentative trial for the concentration of water on selected channels for the irrigation of American cotton at sowing time. The ordinary system of canal regulation is not suited to the growing of American cotton since supplies in many villages are certain to be inadequate in a number of years. Our canal system is organized more on protective lines than for the securing of the maximum return in the form of commercial crops. If Cawnpore American cotton is to be established, it will be necessary to modify this policy and to concentrate the available water at a certain period of the year on certain selected areas. It may be pointed out that this does not involve any hardship to the other areas as since cotton rarely requires irrigation once sown, water can in turn be concentrated on the other areas for the sowing of *deshi* cotton and other crops which can be sown somewhat later.

65 **Conclusion.** The Agricultural Department would be greatly assisted if the cotton trade as a whole would state its matured opinion as to what it requires. At present we are faced with two contradictory statements from authoritative sources. We have it on the authority of the International Federation of Master Spinners that every bale of additional short-staple cotton produced in India releases a bale of American for finer spinning. On the other hand, the Chairman of the British Cotton Growing Association states that an additional production of 100,000 bales of cotton of staple of not less than one inch is more important than

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a million bales of cotton of shorter staple. The requirements of Indian spinners are fairly well defined, *viz.*, (1) an increased production of *deshi* cotton and an improvement in its quality and (2) the production of as much cotton as possible of a staple equal to *Oomras* such as Mr. Leake's K-22. They would also welcome the additional production of a limited quantity of cotton of longer staple but do not attach great importance to it. Nor does the history of cotton prices, either in Bombay or Liverpool, afford much guide. While it is true that the price of all cottons are largely governed by the price of middling American, the relationship between the price of middling American and *deshi* is very vague. The margin between them is often far less than one would expect from their relative spinning values. It is clear that the ultimate test must be which cotton is the more profitable to the grower over a series of years. A clear statement of the trade's requirements would be of the utmost value.

Mr. B. C. BURT called and examined.

66. (Mr. Roberts.) As to the system under which Cawnpore American cotton is marketed during the experimental stage, the Agricultural Department has guaranteed to the grower a minimum premium of Re. 1 per maund over the price of *deshi* cotton for the day. Our own staff receive the cotton at certain centres and get it ginned at a small ginning factory at Mandana which we hired for the purpose, other cotton being excluded. The accounts are made up at the end of the season and if they show any surplus over and above the premium already paid, it is distributed to the cultivators as a bonus. The price varies daily. At Mandana, the premium paid is Re. 1 above the price of cotton in Cawnpore for that day. At village markets the premium is Re. 1 per maund above the local price. The maund in this case is the standard maund. The local cotton maund is $1\frac{1}{2}$ standard maunds, *i.e.*, about 103½ lbs. The lint is sold in bulk in quantities of 50 bales or lower. In previous years, arrangements were made in advance with Cawnpore mills to take the lint. This year, the Government has sanctioned the Agricultural Department buying in all the *kapas* and offering the ginned and baled cotton on the open market. In the first year, the Elgin Mills bought the *kapas* and agreed to pay Re. 1 premium and take all risks. We arranged and supervised the ginning on their account and took over the seed. The following year, they bought the lint on the basis of a half penny a pound below the price of Middling American. In 1914, the arrangement with the mills based on Liverpool prices broke down owing to the closing of the Liverpool Cotton Exchange and it was arranged that a fixed price should be paid over the whole season. In 1915, the cotton was sold at the spot price of Middling American for the day at Liverpool. That was the best arrangement ever made. As American cotton should with normal freight be about 1½ per lb. dearer in Cawnpore than in Liverpool, the method of selling cotton amounted to dividing the profits between the cultivators and the mill owners. It is not a satisfactory arrangement to go to the mills beforehand and to ask them to guarantee to buy cotton, the quantity of which can not be guaranteed. It is much more satisfactory to buy *kapas*, get it ginned and offer it in commercial quantities in the market. We are just getting in the *kapas*. We are absolutely free to sell the cotton where the best price can be got for it. In 1916 we had to ask the mills to revise their terms as these had included a maximum price. Cotton prices rose so rapidly that under the original arrangement we could not have bought in any *kapas*. The price was revised and a premium of Re. 1-4 was given to the cultivators. The cultivators have never got less than the minimum of Re. 1. They always got more because we had profits to distribute after selling the cotton. One year they got Re. 1-12, another year Re. 1-8 and another year Re. 1-10. There is no parity between the price of American and *deshi*. The price of *deshi* is often much higher than one would expect it to be compared with American. If you take the Bombay prices, there is practically no correlation between the price of Broach and that of fine Bengals considering how different they were or between the price of Broach and that of Middling American. The difference between the prices of Cambodia and Broach and Middling American and that of *deshi* has not been consistently high. The *deshi* crop of this province is the first portion of the Bengal cotton crop that comes into the market and therefore it commands a better price than the cotton of the Central Provinces which comes in later. This is particularly the case if there has been a short crop in the previous year. A premium of Rs. 2-8 or Rs. 3 per maund would make all the difference to the spread of Cawnpore American.

67. The ginning percentage enters largely into the question of price. The ginning percentage of Cawnpore American is between 30 and 31, that of the ordinary *deshi* of the province is 33 but some of it goes up to 35 or 36 in a good year. The ginning percentage of Aligarh white flower goes up to 40. The lower ginning percentage of Cawnpore American reduces the premium which it is possible to pay for the *kapas*. The cultivator's first consideration is yield and the second the price he gets for his *kapas*. The yield of Cawnpore American over a number of years is equal to that of *deshi*: in a good year the yield of Cawnpore American is greater than that of *deshi*. In a bad year it may be greater or less, last year it was less, this year greater. On an average, the yield is practically the same. I am speaking of irrigated *deshi* only; the yield of unirrigated is less.

68. No selected Cawnpore American has yet been put out; I hope to get better results in yield from selected types. The selected cotton is not much better in staple; it is more uniform and has a better ginning percentage. It will be a better cotton all round. The whole crop for the first years was grown from seed selected by mass selection. It was subjected to roguing but nothing else was done. Thirty acres were grown at Kalyanpur and undesirable plants were rogued out. Since then the cultivators have been given seed from the *kapas* purchased by the Department. For seed purposes, only the first two pickings were taken; the last pickings were not taken as they were damaged by insects. The seed from the farm was given to the best cultivators whose *kapas* was specially earmarked for seed purposes. The same price was paid to them for the seed taken back from them as for *deshi* seed although in the open market the price of American seed was less than that of *deshi*, as owing to its fuzzy character, there was a prejudice against it. The cotton seed was sold chiefly to oil mills in order to ensure the cotton seed being used for oil and not given out. This may have meant a lower price. The possible area that could be grown under Cawnpore American instead of *deshi* is about sixty thousand acres in my circle. The total area of irrigated cotton is about 186,000 acres. About one third of that could go under American but it would not be safe to go above this figure. In the scheme mentioned in my written evidence for concentrating water on certain channels, there is not water for more than this area in time.

69. American cotton does not require more water than *deshi* but it requires it earlier. The supply of water in the Ganges Canal system is at its lowest about April. The Upper Ganges Canal passes on water to the Lower Ganges Canal but has a heavy demand for sugarcane to meet. The supply passed on to the Lower Ganges Canal in early May is liable to be short as also the supply from the river direct. The main factor is the

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rise in the river owing to the melting of the snows which takes place in late April or May but the time is variable. We began trying to give out cotton in villages which were normally expected to get a good supply of water but this was unsatisfactory. We therefore decided to concentrate work in certain channels and arranged with the Irrigation Department to guarantee a supply at certain periods. There were no complaints this year but further experience of this arrangement is required. In cases in which American cotton is grown in the same village with *deshi*, there may be difficulty in getting the American pure. There is bound to be some mixture. The area under cotton in the Cawnpore district is 97,000 acres of which 54,000 is irrigated. In distributing an improved *deshi* cotton, there is the additional difficulty of deterioration by hybridization which can only be got over by complete replacement of *deshi* by the new variety. For this reason I should be loth to put out an improved *deshi* cotton unless it could be sown equally well with irrigation or without.

70. Cotton follows wheat as a rule and is sown as soon as wheat thrashing is over. The best cultivators plough their fields as early as possible with previous irrigation, irrigate again later and then sow. The usual practice is to irrigate once and then plough and sow. Cultivation in lines is not making much progress. Where *deshi* cotton is sown with the rain, it is of doubtful advantage. Two or three hand weedings are given in July and early August. In very wet year weeding cannot be properly done. The objection to using implements drawn by bullocks is that the fields are too small. There are few men with single fields of cotton above half an acre in extent. Many fields are exceedingly small. The sub-division of holdings imposes a limit on the improvement of cotton cultivation. Neither proper cultivation nor drainage can be carried out. *Arhar* is sown with cotton. I cannot explain why the average outturn in the United Provinces should be higher than in the Punjab. Cotton forecasts err, if anything, on the side of being too low. There is enormous variation in yield from four maunds of *kapas* to twelve. Sowing on ridges has been tried at the experimental farms with Cawnpore American cotton. At first this method seemed promising but on the whole the germination was not satisfactory and the cost of making the ridges was considerable. Sowing in lines can be done with an ordinary country plough, sowing on ridges necessitates dibbling the seed by hand and also the use of a special ridging plough which few of our cultivators can afford. Sowing in lines and subsequent intercultivation with the bullock hoe, on the other hand, is quite feasible and is profitable and this practice we are gradually introducing. A ridge and cultivator would have to be used. The use of co-operative implements might be possible. Sowing in lines is more important with American cotton than with *deshi*. *Deshi* will stand sowing at fifteen inches, American requires 2-6 feet. American sown by cultivators is not often sown in lines but it is thinned out afterwards: probably three quarters of the American cotton is sown broadcast and the rest in lines. We have men who go round to show cultivators how to cultivate American.

71. It is largely a matter of chance, if American suffers more than *deshi* on account of rain. It depends when heavy rain fall occurs in relation to the flowering time and the boll setting. It is not possible to lay down any rule about it. Last year, damage was done by continuous rain early in the year causing stunted plants. *Deshi* cotton is not so dependent on the number of bolls per plant for its yield and therefore did not suffer so much as American. This year it is the other way: the American cotton was well in boll and the *deshi* was just setting and therefore the American suffered less than the *deshi*. American has a better chance of recovery than *deshi*, as it goes on flowering longer. American suffers more from bad cultivation than *deshi* and is not so tolerant of waterlogging. Waterlogging in the early stages causes general stuntedness. American cotton sown too late never grows properly. If sown at the right time, there is no difference. As to damage at flowering time, the American flowers more gradually and therefore is not so liable to damage by storms owing to mechanical knocking off of the bolls. Waterlogging would affect both alike. Our heaviest rainfall is usually in August with one break and in September in ordinary years with marked breaks.

72. (Mr. Henderson.) The seed of our cotton is distributed with the greatest ease. The distribution of Aligarh White Flowered seed is not sound beyond a certain stage. Although the cultivators get a considerable profit, the mills do not want it and an unlimited supply could not be absorbed. I refused to give it out in Cawnpore. In my circle, it is only being given out in two districts where there is no canal irrigation and where a hardy cotton is absolutely essential. It is spreading rapidly in Aligarh. Once a cotton is given out, one must be prepared to go on with it. The organisation for spreading Aligarh White Flower may be useful when there is something else to give out. The reputation of some of cotton tracts is past spoiling and therefore there is no danger in this respect.

73. The staple of Cawnpore American No. 7 and No. 9 is just over an inch. I have had no reports on these selections from Manchester but have had regular valuations from Bombay. Ordinary Cawnpore American has been valued in Manchester. In one year, the price of *deshi* cotton was Rs. 30 for 100 lbs. and American Rs. 44 to Rs. 44-8 per 100 lbs. of *rui*. That year we paid a premium of Re. 1-12 for American over *deshi*. There was really also a concealed premium as the cultivator was getting the full Cawnpore bazaar price and paid no deduction for weight or trade deductions and sold his cotton at convenient places. I started selection work on Cawnpore American cotton in 1912. C. A. 7 and C. A. 9 are both good yielders and were valued as best as regards lint last year. It is the limitation on irrigation which prevents the spread of Cawnpore American. We could work up to 60,000 acres with improved Cawnpore American types. That would allow for one-third of the total irrigated area under cotton being Cawnpore American, provided there were no difficulties in regard to irrigation. We can only establish a large area of American cotton if Government will accept the policy of making special irrigation provision for it. Our canals are organised on a protective basis and to establish any large area of American cotton, which can only be grown with irrigation, the present arrangements for running channels need modification, i.e., we must have a limited number of channels on full supply and running longer than the ordinary rotation.

74. The ideal improved *deshi* cotton would be better than American as it could be sown either with or without irrigation. The prevention of deterioration by hybridization is largely a matter of seed farm organisation. Farm seed should be supplied to a village until entire replacement of *deshi* has been effected. As to the feasibility of introducing a *deshi* cotton which will have a longer staple or the same as that of Cawnpore American No. 9, I see no reason why it can not be done but we have no such cotton yet. Mr. Leake's work is directed to that end. The damage due to boll worm is equal for Cawnpore American and *deshi*. Actual countings of damaged bolls have shown that the number of worms is rather less in Cawnpore American than in *deshi*. For practical purposes the damage is the same.

75. (President.) Under the system on which cotton is sold in these provinces, there is very large number of intermediaries. It is impossible to say how many middlemen there are. Holdings are small and therefore there is a large number of individuals concerned. The man who goes round with a cart gives a better price than the *bania* does but he is a great nuisance. He introduces a tremendous danger of mixing the crop. In certain tracts in order to get American cotton brought in, arrangements had to be made with respectable

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lanias. Some such arrangement will have to be kept up until there is some trade organisation which will take things over. There may be a future for co-operative cotton buying associations but it is of no use starting them where co-operation does not thrive. The *zamindars* in some of the best cotton growing districts, e.g., Etawah, lend money to their tenants and therefore there are no co-operative credit societies there. I would keep to co-operative marketing. I do not recommend co-operative ginning (except possibly for seed purposes only) as I have no belief in amateur ginning. It is better to get cotton ginned in well managed, fair sized ginning factories.

76. That portion of the cotton trade which wants long staple cotton, should meet the Agricultural Department half way. At the stage in which the control of the Agricultural Department becomes difficult, the trade should come in and arrange for the purchase of the *kapas* and for ginning it. It would be easy to arrange for ginning as factories in this province work on commission. I cannot say what the minimum annual production must be before special arrangements for marketing could be withdrawn. It is difficult to resist the impression that the trade wants everything done for it. It should be willing to take some risk or even to put up with a little loss. There would be no need to put up ginneries as there are plenty of ginneries in existence already. Long staple cotton is not the main interest of the local cotton spinners. If the local cotton trade wanted Cawnpore American badly, they would very soon arrange to overcome the difficulties about buying it but they are not really interested in Cawnpore American although they always buy it readily. I have discussed the question of Government auctions with the *zamindar*: but they are not in favour of it as the individual cultivator is too small a man and cannot afford to wait for his money. The local market is held once or twice a week. He expects to take his cotton there and dispose of it in small quantities. He gets paid for it on the spot and does his marketing for the week at the same time. It would be no use posting up Liverpool or Bombay prices in the village *mandi* as the cultivator would not understand them.

77. Mr. Leake has done no work on Cawnpore American except to give any help for which he was asked. K-22 is a type issued by him. I have made district trials of K-22 from seed issued by him and these are being continued. I am not prepared to lay down any line at which the functions of the Economic Botanist should cease. Everything must depend on the relations between the Economic Botanist and the Deputy Director. I consider that distribution should be left to the Deputy Director; the latter would decide whether the crop was sound for his circle or not. Cotton pests are sufficiently serious to justify the appointment of an entomologist in the province. Little is known about them except their names. Egyptian experience cannot be utilised straight away. I believe in the multiplication of seed farms. We cannot have too many.

78. As to the best organisation for co-ordinating the work of long staple cotton, the Imperial Cotton Specialist is of no use to the United Provinces. He has rendered assistance in regard to valuations which could be obtained direct from firms. One man can only work on cotton for a particular tract. The objection to a standing Cotton Committee, consisting say of two Deputy Directors, a botanist working on cotton and two representatives of the trade meeting quarterly, would be that the members would be taken off their work at the most important time. I do not see what such a body could do. Every province should stand on its own legs.

79. (Mr. Wadia.) There is very little deliberate damping of *kapas*. Though there is no intentional damping, the cultivators bring it in as wet as possible. There are certain ginning factories which are ideally situated for mixing fine Bengals with coarse Bengals. The only person who could stop all damping is the purchaser. It is not very important here as the big buyers discourage it. Watering of lint has been much exaggerated as far as these provinces are concerned. I have no information to show how far it goes on. As regards mixing, the only way to stop it is by stopping the premium on the cotton sold. When *deshi kapas* comes in mixed with American, it is very easy to detect it when it comes to the gin. Nobody wants mixed cotton. Spinners will not pay for mixture. Mixing may be done by the ginner or by the man who gets his cotton ginned and the only way to stop this is to show that it does not pay. The cultivator will soon learn if he loses his premium. A system of licensing might be a feasible way of stopping it but not in the case of two grades of *deshi* cotton. In this province, many of the largest ginneries do not own the *kapas* they gin and done buying. There will be difficulty in proving the case against the ginneries. They will say that they bought their *kapas* as it came in and had nothing to do with mixing it. The remedy lies in the consumer buying cotton somewhere else next time. Certain ginneries in Cawnpore buy *kapas* and supply lint to the mills and are very particular for fear of losing their customers. If mixed seed were found in the gin, it could be ordered to be used for purposes other than sowing; it could for instance be sold to an oil crusher. One-twentieth to one-fortieth of the seed only is required for sowing and the rest is sold for cattle food. I do not see how a system of licensing could be worked in the United Provinces. One or two ginneries should be sufficient to deal with the produce of 60,000 acres of American cotton and therefore the question of licensing gins will not arise in that case. When the stage arrived at which large areas were under such a cotton as K-22, some form of buying agency would prevent mixing.

80. Press and ginning pools exist owing to the fact that there are more presses and gins than are required in an ordinary year. In an year of short crop, there is not enough work to go round. The result is cut throat rates on account of which pools come into existence. It is impossible to say to what extent pool profits come out of the pockets of the cultivators or out of those of the consumer. They must largely come out of the pockets of the producer. The larger the intermediate charges, the less the producer gets. The present ginning charges are 7½ annas to eight annas per maund of *kapas*, i.e., Re. 1-8 per maund of lint. Pools in course of time always get broken up and therefore legislation to limit profits is unnecessary. Some of the biggest ginning factories have cleared out of the pools. There is nothing to show that pools put up the price of ginning above the rates that give ordinary reasonable profit. Small ginneries used by the Agricultural Department charged eight annas per maund of *kapas* when the price in Cawnpore was six annas to 6½ annas per maund. I am not opposed to the licensing of gins and presses. My opinion is that under existing conditions in the province the result would be small for the reasons stated above.

81. (Mr. Ashlon.) A system of concentrating water on certain channels is a good one provided the area on which the water is concentrated is not too large. The position is this, that our main irrigated *khari* crops are cotton, including American and *deshi* sugarcane, early maize and early rice. Water was concentrated for three weeks on certain channels for early sowings and then those channels were closed and water was given elsewhere. The *zamindars* on other channels having learnt about this might claim a similar treatment but it could not be given. The present water supply will not go round all the channels. There is no

objection to the cultivator of *deshi* cotton being penalised by a heavy water rate with the idea of securing the cultivation of American cotton in well defined tracts where special facilities are being given for the irrigation of American cotton. If an improved *deshi* cotton proved as good as American, then I would stop American but that stage has not been reached. I would charge an extra water rate for *deshi* cotton sown in the well defined tracts I have suggested or else give a more favourable water rate for American. The water rate for cotton in this province is already low. The cultivation of *deshi* cotton under rain could not of course be stopped. American cotton does not cross fertilise with *deshi* and therefore when the two are mixed, it must be intentional. I would induce cultivators to grow American cotton by giving sufficient water. Agreements were taken from the cultivators only to use certain temporary outlets for sowing American cotton.

82. Extension of tube wells will have to be taken up by Government if any large tract is to be irrigated by this means. In Sitapur and Hardoi districts there are about three million acres of which two million acres are under cultivation which are mostly dependent on poor wells and therefore there are great possibilities for tube wells in these districts. The establishment for pushing tube wells will have to be a separate organisation. The possibilities in regard to tube wells are being investigated at present. Probably the work would eventually have to come under the Irrigation Department but a special circle would have to be made of it.

Mr. R. W. D. WILLOUGHBY, I.C.S., Registrar, Co-operative Societies, United Provinces.

EXAMINED AT CAWNPORE NOVEMBER 2ND, 1917

Written statement.

83. *Preamble.* My knowledge of the technical side of cotton growing and the special economies of the trade is both superficial and second-hand, and my views on these subjects would not, I think, have any value for the Committee. The only two matters in which I can contribute matter relevant to the enquiry would appear to be (1) the part hitherto played by co-operative societies in this province in the introduction of improved cotton strains and, in particular, long-stapled strains, (2) the part which co-operative societies may be expected to play, not only in the introduction of improved cotton, but in the direction of collective sale, if not collective production.

84. *Part played by co-operative societies in the United Provinces in the introduction of improved cotton strains.* In all the western and central districts of the province in which there is a developed co-operative organization, something has been done towards the introduction of improved cotton, though the operations are as yet on quite a small scale. So far what has been done has been mainly in connection with the short-stapled Aligarh White Flowered variety, though efforts have been made to popularize Cawnpore American long staple in some central districts, and some *buri* has been given out in the north. As a sample both of the methods and scale of seed distribution, I will instance the Hardoi district. This district has two fairly substantial central societies, at Hardoi and Sandila. These banks sell for cash to cultivators in their better societies Aligarh White Flowered seed obtained from the Agricultural Department. In the last year they bought in about forty maunds of this cotton seed, previously passed by the department, paying the selected cultivators to whom the seed is distributed a substantial bonus over market prices. The department arranges for the sale of lint and ginning under supervision. This sample represents the most systematic work that has been done. Introduction elsewhere has been more sporadic and on a smaller scale though seed-distribution on similar lines has been undertaken in Jazirana (Mainpuri), Bulandshahr, Moradabad, and Bareilly and attempts have been made in Budaun, Unao, and other districts. We have sought to impress on the societies the necessity for concentrating on compact areas in order to avoid cross-fertilization and mixture of seed. That more rapid progress has not been made in the popularization of improved cottons is largely due to the fact that two successive cotton crops have failed under heavy rain and in a large tract of the cotton area, these failures were preceded by drought. The improved varieties have thus had small opportunity of demonstrating to the grower their superiority as paying propositions. Very much greater progress has been made with the introduction of Pusa wheat. Co-operation appears to have so far done very little towards the introduction of long-stapled cotton. This is mainly because in the districts for which the Agricultural department recommend Cawnpore American, *viz.*, canal-irrigated areas in Mainpuri, Etawah, Cawnpore, Farrukhabad, and Fatehpur, there is as yet little co-operative organization, except in Mainpuri and Fatehpur. Mainpuri has just started an agricultural supply association with a good building for storing seed and a respectable capital, and efforts will be made to utilize both this and the Fatehpur District Bank for the introduction of Cawnpore American. It is also probable that there is a fine opening for long-stapled cotton in the Muttra district with its short rainfall and canal-irrigation, though the latter has reached its limit and well-irrigation is difficult. Co-operative organization in Muttra is recent but fairly vigorous and something can be done to utilize it for pushing long-staple cotton.

(2) I have lately been moving the co-operative central institutions to assume responsibility for their seed operations, relieving the Agricultural Department of their commitment. The possibilities of loss are small where decent administration can be secured and where a small separate fund can be earmarked to guarantee the main credit organization against loss. I am afraid that for the next few years the development of the societies on the agricultural side is likely to be seriously retarded. Most of the larger and older banks have to grapple with a very serious problem in the shape of a mass of deteriorated societies which they dare not finance and either will not or cannot close. The mechanism of liquidation at present functions very slowly and very ineffectively, and the time of their staff is absorbed in tinkering with these societies to little purpose and to the detriment of development generally. The extent to which we can, in this province, look to the co-operative society as an agency for agricultural propaganda and improvement must necessarily depend largely on its co-operative quality and in the event of the Committee desiring further information on this point I venture to refer them to my annual report, a copy of which will be available in a few days.

85. *Part co-operative societies may be expected to play.* It is obvious that an extension of the cultivation of improved cotton can only be secured if it can be demonstrated to the peasant that it will pay him better to put down cotton than other crops and that it will pay him better to put down improved cotton than *deshi* cotton. The Government recently instituted enquiries in this province as to the possibility of obtaining for the actual grower a better return for his cotton by the improvement of the conditions of marketing. These conditions were examined by Mr. Hailey in a report (which is probably before the Committee) and

the conclusion which emerged was that the only way in which the ordinary grower could get a closer approximation to the market price was by organizing himself into sale unions or co-operative societies and himself selling through the *aralya*. Both Mr. Hailey and Mr. Silver thought that the grower, taking into account the services performed for him by the dealer or *bania* did, on the whole, receive something like a fair price for his produce in relation to its market value. I was asked to consider the possibilities of organizing sale for the grower co-operatively. My general impression was that, at the present stage of the development of co-operation in this province, it was not easy to see how cotton sale societies could be called into existence in the immediate future. There are neither separate cotton markets nor does the cotton-grower as such form a distinct class. He generally grows cotton as an incident, often as a somewhat subsidiary incident, of his cultivation. Even in the main cotton tracts, though cotton is largely relied on to pay the rent, the cultivator's interests are not concentrated on cotton to the exclusion of other staples. It will not be easy to find compact bodies of cultivators who specialize so exclusively on cotton, as to make them ready to form co-operative societies solely with a view to improving the conditions under which they market cotton. If the dealer gives the cultivator anything like fair value for his cotton, as my own enquiries as well as those of Mr. Hailey would seem to show, the grower is not likely to undertake the trouble involved by organizing himself for sale. Unless he can be convinced of the possibility of thus commanding a much larger profit, he will not embark on a difficult operation which calls for combination and considerable mental effort. Such combination only occurs under strong and felt economic pressure. I saw little prospect of the establishment of cotton sale societies *ad hoc* until such time as our societies begin to reach the stage of combination for co-operative sale of their produce *in general*. When this stage is reached, they may be able to improve their economic position in the general market and get better terms for their cotton as for their other produce, particularly if the co-operative spirit is successful in inducing them to maintain the quality of their produce against adulteration, deterioration by admixture, watering, etc. Again, the societies are as a whole not strong enough co-operatively for this kind of combination, which calls for a high degree of integrity and mutual trust. They cannot usually yet be trusted not to monopolize loans and in the collection and disposal of the joint produce there would be very strong temptation to abuse their position. I made enquiries in societies throughout the cotton tracts and without exception the members were against it. The *panchayats* were unwilling to undertake the organization for sale and the members were unwilling to trust them with such an operation. My staff reported that there was no possibility of success with such unions for some years to come. I am however going to make an attempt to organize an experimental society in some specially favourable locality.

(2) An interesting article on cotton sale societies appeared in the *Bombay Co-operative Quarterly* of last June written by Mr. Keatinge, I.C.S., and dealing with conditions in the Southern Maratha country. It may be illuminative to compare the conditions there stated with ours. The most obvious differences would seem to be that in the tracts he describes "the cotton trade is the trade *par excellence* and dominates all others in the estimation of the people" whereas with us cotton-cultivation is an incident. Mr. Keatinge divides the growers into four classes: (1) the poorest who sell their cotton standing in the field before it is ripe; (2) those who have little cotton and no means of transport and sell the gathered cotton loose to a small dealer; (3) the big men who take their cotton, sometimes getting it ginned, to the market and deal direct with the buyers; (4) the great majority who make loose seed-cotton up into bundles and take it to the market, where they sell through their *datal*. Mr. Keatinge would only apply organization for collective sale to the last class. The third needs no such help and the first two mainly need a little financing which the ordinary credit society can supply. Now the fourth class does not in any way represent the typical grower in this province. He is more like what Mr. Keatinge describes under (2) and what he primarily needs is finance. Cultivators do not here bring their cotton to the market for sale. The grower is usually a small man and sometimes (like the first class above) wants money at once and cannot wait till each picking is finished before he sells. He often grows cotton mixed with other crops and he almost always sells to a dealer, who may be a *bania*, a small *zamindar* or a larger cultivator who grows cotton himself and purchases from smaller growers. The dealer can always take care of himself, but the small man is not, I think, organizable for sale till he has assimilated the rudiments of organization through his credit society. It would seem in any case not possible thus to organize him for sale till he is released from the clutches of the *bania* to whom he is tied and has to sell his cotton. Moreover co-operation is not a substitute for efficiency and the associated peasant will have to learn, both collectively and individually, as much about the trade as the dealer knows before he can compete in the market with success.

Mr. R. W. D. WILLOUGHBY, I.C.S., called and examined.

86. (President) Cotton is, in this province, only a subsidiary section of cropping and there are no separate cotton markets. Consequently collective sale of cotton is a difficult proposition until societies have reached the stage of selling collectively their general produce. We have not, as, on the Bombay side, compact areas of cotton where the establishment of special cotton sale societies would be comparatively easy. The formation of co-operative sale societies is not possible until the peasant can be made to see that he stands to gain very considerably by undertaking the trouble and risking the mutual trust which such organisation requires. For the reasons given in my written evidence, it is not easy to demonstrate to him that he stands to gain so considerably as to counterbalance the effort required. My inquiries showed that the credit societies in the cotton districts did not in any way welcome the idea of co-operative sale. Attempts will be made to establish one or two experimental societies but the momentum will have to come from outside and success is doubtful, specially at present, when a considerable number of credit societies are in an unsatisfactory condition. More elaborate developments in the direction of sale societies are not probable until the general condition of the credit societies is more vigorous. At present the only really successful branch of co-operation is agricultural credit. The small urban societies for the benefit of petty traders and artisans have generally been a failure owing to lack of cohesion and mutual knowledge and to recent disturbed conditions of trade and industry, and difficulties regarding raw material, dyes, etc. We have had considerable success with the utilisation of credit societies to push the cultivation of Pusa wheat. If Mr. Burt could establish a successful strain of American cotton, there should be no insuperable difficulties about pushing such a strain through the medium of co-operative societies. Muttra, Mainpuri and Fatehpur might be fairly promising fields. In these matters the Co-operative Department works in close touch with the Agricultural Department. The Aligarh White Flower cotton is being pushed in Hardoi and other districts on Mr. Burt's recommendation and with his active and local assistance.

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87. (Mr. Wadia.) The establishment of an agricultural bank on the Egyptian model and on the lines described by Sir D. Wacha's article, would, in my opinion, simply mean *takavi* on a large scale. I would refer the Committee to an article by Mr. Chatterjee in the Allahabad Economic Journal. The only staff available to such a bank for distribution and collection would be the same or a similar staff to that employed in the distribution and collection of *takavi* and there is no reason to think that the money would reach the actual cultivator at any lower rate of effective interest than that at which *takavi* reaches him. This rate, my inquiries show, to be certainly not less than fifteen per cent. on the average. It is usual for the cultivator to have to pass ten per cent. on the loan before he gets it and he often has to pay five per cent. or more when the *takavi* staff has to collect. A State agency would have to be created and would cost both the Government and the borrower a very considerable amount. In my opinion such a bank would not be nearly as successful in organising cheap credit as co-operative societies. The agricultural bank in Egypt has not worked well and latter reports show, I think, that the preferability of co-operative methods was coming to be realised.

Rai Sahib GANGA PRASAD, Officiating Deputy Director of Agriculture, Western Circle, United Provinces.

EXAMINED AT CAWNPORE, NOVEMBER 2ND, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

88. (1) Experience.—I have served in the Agricultural Department of the United Provinces of Agra and Oudh for the last twenty years, working in the Western Circle (headquarters Aligarh) for the last twelve years. I have been in actual touch with cotton cultivators, particularly in Aligarh, Etah, Muttra, Agra and Bulandshahr.

89. (2) Varieties.—Country white-flowered cotton, generally known in the educated world now as the "Aligarh White Flowered cotton"—

Length of staple $\frac{7}{16}$ to $\frac{11}{16}$ ths inch.

Average $\frac{9}{16}$ ths inch.

Percentage of lint—Maximum 41, average 38.

It is found either pure or mixed with the yellow-flowered *deshi* cotton. Where found alone, it has been introduced by the Agricultural Department.

90. (3) Size of holdings.—This varies considerably in different districts. About eight to twelve acres per pair of bullocks or a plough may be taken as a fair size of the holding. The proportion under cotton further varies considerably, depending on trade, irrigation and the nature of the rains. In the irrigated tracts, it may be taken as two to four acres per plough and nearly two acres in the tracts depending on the rains. This distribution of area is from my personal knowledge and is not based on any statistics. Other witnesses may throw further light on the point.

91. (4) Yields and profits.—The yield of the crop sown early with irrigation is about ten maunds, from that sown late with the rains about seven to eight maunds of seed cotton per acre. Sometimes with the bad distribution of the rains, the early sown cotton gets spoiled and the late sown takes its place in outturn. The profits are to be calculated on the basis of the yield per acre and the market rate. The calculated maximum cost of cultivation on irrigated crop comes to about Rs. 32* per acre, but, on the crop sown with the rains, it decreases by about Rs. 6, viz., the cost of irrigation. Supposing Rs. 8 to be the market rate of *kapas*, the profit on ten maunds yield comes to Rs. 48, and on eight maunds to Rs. 40 per acre. These will increase or decrease according to the yield per acre and the price obtained in the market.

	Rs. a. p.
* Two ploughings and sowing	2 8 0
Seed	1 0 0
Irrigation charges and wages	6 0 0
Three weedings	4 8 0
Rent and manure	18 0 0
TOTAL	32 0 0

92. (5) Rotations and manures.—The usual rotation is cotton after wheat or sugarcane. Generally, the previous crop of wheat or sugarcane is manured with the *ghoo a.†* The same manure, viz., the *ghoor* is applied to cotton where it is sown on land having had an unmanured previous crop.

93. (6) Comparative returns.—On account of its good outturn per acre and high percentage of lint and good colour Aligarh White Flowered cotton has been found to bring the cultivator more money than the mixture of white and yellow-flowered cotton commonly known as the ordinary *deshi* cotton.

But in comparison with the American cotton introduced and purchased by the Department at an increased rate in the favourable year, the return was slightly less. They may be compared as below:—

Name of <i>kapas</i> .	Outturn per acre.	Market rate.	Value.
Aligarh White Flowered	Mds. 10	Rs. 8	Rs. 80
<i>Deshi</i> or the mixture of white and yellow flower	8	7	56
American	10	9	90

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[Continued.]

94. (7) Conditions affecting increase in area.—The area under cotton fluctuates largely, the reasons being the prospects of future demand based on the previous market, irrigation facilities and nature of rainfall.

It will increase with the demand to a certain limit if the climatic conditions are favourable. The factors limiting the increase are—

- decline in prices;
- cultivator's own distribution of his holding over other necessary crops; and
- crop rotations.

95. (8) Uses of seed and seed selection.—Seed is used as cattle food, chiefly to milk buffaloes to increase the outturn of *ghee*.

Seed selection is practised on the principle of getting good and reliable seed ready at hand at the sowing time. The good cultivators keep the seed from their own crop and specially hand-gin it. Women of the family help in the selection a great deal, as they want the best *rui* for their home use for which purpose they pick up the best-looking bolls which naturally produce the sound seed. The selection is made without regard to the type or producing capacity of a plant.

96. (9) General economic conditions.—When there is a demand for indigo colour, the cultivator, in the irrigated tracts, gives preference to indigo over cotton, no matter what the price of *kapas* he may expect to get.

(b) "Deshi" long staple cotton.

97. (11) Varieties.—The yellow-flowered country cotton or a mixture of yellow and white-flowered:—

Length of staple $\frac{11}{16}$ to $\frac{13}{16}$ ths inch.

Percentage of lint—Maximum 34, average 33.

98. (13) Yields and profits and comparative returns.—As compared with the *deshi* short stapled cottons, the returns are less where the price of *kapas* is based on the percentage of lint, but are equal if not better where the quality of staple is considered, for instance, in Kashipur, Ujhani and Chandausi. The commercial grade of the baled cotton is superior to that in Muttra, Hathras and Aligarh, etc. I suppose they grade it as 'Bengal fine' which is better than the "fully good" of Aligarh and round about.

99. (15) Conditions affecting increase in area.—The better cotton of this type is grown entirely with the rains in Rohilkhand near about Ujhani and Chandausi and in Kashipur, district Naini Tal. The area there can be increased if means of irrigation are provided. Wells do not stand and canals do not exist. Had the Sarda project been sanctioned, the most suitable tract for growing long stapled cottons would have been utilized. The soils are light and well drained. The climate favours length and softness.

100. (16) Suitability of existing varieties.—There is a wide field to select and push still superior types, provided that they are as hardy and as good yielders as the existing ones. There must be Government farms specially for cotton to study, acclimatise and demonstrate the varieties.

101. (17) Prevention of mixing of different varieties.—To prevent the mixing of different varieties in the field, supply pure seed, organise supervision of expert and reliable trained men, keep the crop pure by pulling out the other varieties, compensate for the plants pulled out, give training to the growers in the villages by organising village unions and demonstrations. To prevent mixing in the factories, have trade unions for the markets, do not buy mixture for any appreciable price, pay better for purity and award prizes and medals at exhibitions. The ginners will gladly gin separate. There should be seed farms and firms to supply pure and reliable seed.

(c) Exotic cottons.

102. (20) Experience.—I have conducted experiments at the Government Farms at Cawnpore, Aligarh, Kashipur (abandoned), Nawabganj, Bareilly, Muttra, Agra, Saharanpur and Bulandshahr. I have been in touch with the cultivators of Aligarh, Etah, and Bulandshahr, where exotic cotton has been introduced for the last twelve years.

103. (21) Varieties.—Cawnpore American and *buri* are the varieties grown.

104. (22) Size of holdings.—Exotic cotton has not been taken up by the cultivators as their common crop. They sowed it for trial on a small scale on the inducements given by the Agricultural Department.

105. (23) Comparative returns.—The yields in favourable years have been about six to ten maunds per acre, but only in a year or two. In most of the years it has been a disappointment to the grower. The produce was purchased by the Department at Re. 1 or Re. 1-8 per maund over the country *kapas*, and, in two years, small amounts of bonus were paid after disposing of the outturn.

106. (24) Rotations and manures.—These are the same as in the case of short staple cotton, but no second crop like peas and barley, etc., can be taken after it the same year as is done on the land which grows *deshi* cottons, since the exotic takes longer period to finish. This is a disadvantage to the cultivator and one of the objections he raises against this kind of cotton.

107. (25) Conditions affecting increase in area.—The types so far tried in this circle can successfully be grown only when sown early with irrigation. When sown with the rains, they have never done satisfactorily for the reason that they take a longer period to grow and the winter sets in before this cotton is finished, while the *deshi* types finish before the commencement of winter. The *deshi* types are hardy and can be grown on any kind of land not subject to water logging, both with irrigation and with the rains. They are not subject to the diseases to which the exotics are. The cultivator is more certain of the *deshi* and he can raise a catch crop after it. His produce readily sells anywhere he likes to sell. Under these circumstances, so long as there is a demand and competition for purchase of *deshi* cotton in the market, no cultivator would like to grow the exotic gladly. Irrigation facilities better than for *deshi* and ready markets for the disposal of the produce at a decidedly high rate in comparison with the *deshi* so as to compensate for the disadvantages and still leave a margin for profit will, I think, induce the cultivator to go in for exotic cottons side by side with *deshi*. He must have a variety fully acclimatised and proof against the leaf-roller which is the deadliest enemy to some of them, such as *buri*. The ginners will lengthen their season when they find work. This does not concern the cultivator.

108. (26) Suitability of existing varieties.—The Agricultural Department introduced the most suitable type available, viz., the Cawnpore American and the *buri*, but both of them have been found unsatisfactory. The Cawnpore American stands the leaf-roller and the rains better than *buri*. But its percentage of lint to seed is a little lower. *Buri* is badly attacked by the leaf-roller. None of them could be grown

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[Continued.]

successfully with the rains. There is therefore need for a better type than either of these two for these districts if an exotic cotton is to be introduced.

109. (28) **Importation of seed.**—In my opinion, the seed selected and acclimatised in the country in which it is intended to be grown is better and safer than the fresh seed imported from America or Egypt. My previous experience of Cawnpore with the fresh seed is as below :—

First year.—All the seeds did not germinate. All the plants did not fruit. Fruiting was scanty. All the bolls did not open well. The opened bolls contained a larger portion of the seed-cotton shrunk and insect eaten. The staple of the sound and well opened bolls was excellent in fineness, length and glossiness. The next year's crop from the seed produced was better, but the fine qualities began to deteriorate. This happened year after year until we arrived with some varieties to a limit where deterioration stopped and the seed was acclimatised sufficiently to give a satisfactory crop when sown early with irrigation. The Egyptian cotton was found more delicate than the American. For expert opinions on the lint see Cawnpore Farm Reports for 1893-94 and 1897-98.

110. (29) **General economic conditions.**—For *deshi* long stapled types better than the existing ones the chances are much better than for exotics. There should be local Government Farms to test and select the types and study the conditions. Climatic conditions differ greatly in different localities not far from each other, so that the type suitable to one place is found unsuitable to another.

ANNEXURE.

Statement showing maximum outturns of kapas (seed cotton) as given in the annual reports of the Aligarh Farm.

Year ending 30th June.	Aligarh White Flowered.	Yellow flowered or country.	Cawnpore American and buri.
	Mds. S. Ch.	Mds. S. Ch.	Mds. S. Ch.
1907	7 4 6	7 17 9	5 21 7
*1908	*7 6 6	*5 37 1	*11 17 9
1909	Not sown.	10 5 14	5 5 14
1910	3 13 11	7 20 0	4 32 3
1911	7 32 8½	5 12 14½	Not in report.
1912	13 36 9	12 32 8	Experiments re-started but no figures given in the report.
1913	17 29 14	11 20 9	8 14 5
1914	10 21 2	6 34 12	9 33 9
1915	8 38 5	(K.21)6 29 6	4 0 5
1916	12 36 11	(K.22)9 25 8	9 28 1
1917	11 17 5	7 21 1½	6 16 3
AVERAGE	10 3 10	8 12 8	7 9 15

* Dry year.

N.B.—The outturns are for the year preceding the year given in the first column.

Rai Sahib GANGA PRASAD called and examined.

111. (Mr. Henderson.) This has been a very bad year for cotton. Of the two cottons, *deshi* is the better this year. I think it will give the better outturn. Taking the farm as a whole, I think the *deshi* outturn per acre will be about 1½ maunds and that of American about 1½ maunds. There are still some bolls of American to open but it is doubtful whether they will yield anything. There is very little difference in yield between the two on the farm land but on the cultivators' fields, American is a total failure. The actual maximum outturn of seed cotton at the end of the season (1917) was 4 maunds 25 seers of *deshi* and 2 maunds 7 seers of *buri* American at the farm. The cultivators have got something from *deshi* but nothing from American because the *deshi* stands the rains better. Boll worms generally attack American as much as *deshi*. As a rule, there is very little boll-worm or none in *deshi* in a dry year. I am not sure that American cotton is worse than *deshi* as regards boll-worm but I am quite confident that leaf-roller is worse in the case of American than in that of *deshi*. On the *deshi* cotton at Aligarh, we have no leaf-roller. On an average, I should say that in a good year the outturn of American may be better than *deshi* but in a year of excessive rainfall, *deshi* is better than American.

112. As to whether if a premium of Rs. 3 per maund over *deshi* were given for American cotton, it would be grown in preference to *deshi*, I should say that it would take some time before it became a general crop; it depends upon the market. I do not think that even if you paid a premium and established a buying agency, it would help American cotton to be taken up largely by the growers. I do not think the chances of American are very promising. The cultivator prefers *deshi*.

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Mr. H. M. LEAKE.

113. About fifty or sixty per cent. of *deshi* cotton on irrigated areas is followed by a catch crop of barley or peas. That is sown in November. You could not sow it in the case of American cotton as American cotton remains on the ground very late; picking goes on even up to the end of January. As a rotation, wheat is usually grown after *deshi* cotton. Wheat does not follow cotton in the same year. It follows it after a year's fallow. I am recommending sowing in lines after the plough for American cotton as in America. That is cheaper and easier. The cultivators are also recommended to use the tined hoes when sowing in lines. These hoes can be used when the crop is sown in lines. There is no system of ploughing cotton by the *deshi* plough followed here. Only *juzr* and maize are ploughed. The cotton crop is hand weeded three or four times, by hand *khurpas*. The contract price for such weeding is Rs. 1-8 per acre for one weeding only.

114. (Mr. Roberts.) I do not remember the acreage under irrigated cotton in my circle. In the irrigated tracts about seventy per cent. of the cotton is grown under irrigation. I have stated in my written evidence that the average yield of American cotton and Aligarh White Flowered is about the same; i.e., about ten maunds per acre. At present prices, American would get Rs. 9 per maund as compared with Rs. 8 per maund for Aligarh White Flowered. The point in favour of *deshi* cotton is that the cultivator does not like to keep American cotton standing in the field up to the end of January. He has to clear his fields so that he can sow some other crop. It is the case that most land cultivated is *abi*. This year that is particularly the case because we have had plentiful rains and there is plenty of moisture.

115. We have induced some people to grow American cotton. The *kapas* is brought into Aligarh from a radius of about eight miles, and the Agricultural Department makes arrangement to gin it. We give a premium of about Re. 1 or Rs. 1-8 a maund. In some years, we have been purchasing from the cultivators' houses. We have been sending round our own people to collect the *kapas* and we were also paying a premium. In Aligarh there are two customs in vogue. In some places, the *deshi* cotton is sold at the cultivator's house, the purchasers going there. So in this case we have to send our men to purchase the American cotton because the cultivators are not accustomed to go outside their villages. In the other case, they bring the cotton to the market. Where this system prevails, we make our purchases in centres. When we send round our men for collecting the cotton, the cultivator does not sell to anybody else. He has to wait; he does not sell. The cultivators keep the cotton collected at their house: they do not dry it. The Agricultural Department has to dry it after collection and weighing.

116. I consider that the *deshi* cotton yields better than the American from a comparison of the yield in different years. The length of the staple of the *deshi* cotton varies between 7/20ths to 14/20ths inch. I have been in charge of this circle for two years. I have been working in it since the circle was formed. My service began twenty years ago. I have been at Aligarh for 12 years. I am an inhabitant of a district near Aligarh.

Mr. H. M. LEAKE, Economic Botanist, United Provinces.

EXAMINED AT CAWNPORE, NOVEMBER 3RD, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) and (b) "*Deshi*" cottons.

117 (1) **Experience.**—I came to India in 1901 and joined Government service in 1904, as Economic Botanist to Government, United Provinces. Since the latter date the question of the improvement of cotton has been my main subject of research. My experience has been practically confined to the United Provinces till last year when I accepted a position as adviser to Mr. Coventry on questions of growing cotton in the Central India States.

118. **Definitions.**—In the questions issued by the Committee, cottons are divided into three sections, *deshi* short staple, *deshi* long staple, and exotic. It will prevent misunderstanding if I define the sense in which I interpret these descriptions in the following. Short staple cotton is one from which the lower counts up to 20s or 25s, can be spun, long staple one spinning counts above this. A further definition, and one on which I should be prepared to lay greater stress, is that a long staple cotton is one which would find a ready sale on the Lancashire market.

(2) One further introductory statement will also help to explain my subsequent remarks. The Departmental organization places the work of seed distribution and direct dealings with the cultivator in the hands of the Deputy Directors to whom I make over any seed I have for disposal. I have not any large experience therefore of direct dealings with cultivators. To these officers also falls the strictly agricultural aspect of the question—such questions as cultivation and manuring. Though such questions naturally come under my notice and I have consequently formed opinions on some of them, I propose to leave the statistical and agricultural aspects aside and limit myself to that portion of the cotton problem with which I have more especial concern.

119. **Cotton problems in the United Provinces.**—That problem can be very simply defined. At the present time we find cotton growing in certain tracts of the United Provinces. The area under cotton is very varied in different districts and is greatest in Muttra, the south-west corner of the province, where it forms some 33 per cent. of the *kharij* area, and diminishes as we pass east and north. The reasons for this distribution have been dealt with by me (Memoirs of the Department of Agriculture, Botanical series, Volume VI, No. 4).

(2) The essential point, however, is that this distribution is the result of economic conditions and depends on the value of cotton in relation to other crops in the eyes of the cultivators. From my point of view this relative value is unimportant. The actual area sown to cotton is a measure of the relative value of that class of cotton for the particular tract and the problem of cotton improvement and of the increase of area is simply that of finding or producing a cotton which will pay the cultivator better—in other words, produce a larger money return for a unit area. This can be done by increasing the yield or by improving the quality—the former is largely an agricultural problem, but a difficult one. Cotton is not a hardy crop; it is very susceptible to wet and other unfavourable conditions and it is extremely difficult, in a case where fluctuations are so great from year to year, to ascertain the real yielding value of a particular race or of a particular set of conditions of cultivation and it is still harder to persuade the cultivator that there is such an increase.

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[Continued.]

(3) A further difficulty is that yield has, in the case of cotton, a double meaning. Of the crop yield (*kapas*), only the smaller portion (*rai*) has the major value. Hence the proportion of *rai* in the *kapas*, in other words the ginning outturn, is a vital and, under present market conditions, a dominating consideration.

120 (2) **Varieties.**—The cottons of the United Provinces come entirely under the class of "Bengals" and the plant grown throughout the main cotton tracts is a form of *G. neglectum*. In the eastern districts of the United Provinces, a form known as *G. intermedium* is found but the extent to which it is grown is negligible. The *neglectum* cottons are all short staple and, as grown by the cultivator, consist of a variety of types mixed together. As a general rule, the ginning percentage of these is about 33 which may be considered as the standard. In recent years a type has been introduced known as the "White Flowered Aligarh," practically identical with the *roseum* of the Central Provinces. Its favourable characteristics are its hardiness and its high ginning percentage, about forty. Its good qualities end there. The lint is coarse and short and I hold a letter from a Bombay mill-owner in which he pertinently asks if I am aware that a cotton requires two ends to spin. Nevertheless I do not consider its introduction a mistake. It undoubtedly pays the cultivators to grow it and it will continue to do so as long as *kapas* is bought mainly on a basis of ginning percentage. Indirectly it has permitted the development of friendly relations between the Department and cultivators and developed an organisation which will be of use for the spread of better forms when available.

(2) On the other hand, it has increased the difficulty of developing a better class of cotton. As I have said, the test of any crop is the money return given by a unit area. The introduction of the Aligarh White Flowered cotton has undoubtedly raised this return for the grower and has set a higher standard against which new forms have to be judged. In the absence of payment for quality, it has been essential that any new form should possess a ginning percentage equal to that of the Aligarh White Flowered. So, and so only, can the cultivator be asked to grow it. Given a plant equalling the Aligarh White Flowered in yield and ginning percentage, the cultivator can be asked to grow it with confidence. He will not lose by doing so and, if it possesses quality as well, it will have a potential value which can be taken advantage of as the development of a system of purchase by quality develops.

121. **K. 22 and K. 28.**—This is the problem I have set myself to solve. I may say at once that the problem of producing length of staple is comparatively simple and working on a 33 per cent. ginning basis, improved cottons as regards staple would be readily produced. The production of high ginning cotton is a different matter. From the breeders' point of view, ginning percentage is a most elusive and complex problem (*vide* my paper in the Journal of Genetics, Volume IV, 1914). Nevertheless I have had some success in solving it. I have now two races which will, I think, hold their own even against the Aligarh White Flowered. One of these, known as K. 22, has been in my possession for some time as a type with good lint quality. That quality is shown by the following facts:—

1914.—Quotation in Bombay.

Basis M. G. Rajputana Rs. 225; value Rs. 290.

1915.—Basis Cawnpore *deshi* Rs. 25 per 100 lbs.: 15 bales sold at Rs. 30.6 per 100 lbs.

The following is an extract from a report on K. 22 and K. 7 cottons of the same year, *i.e.*, 1915.

"It (K. 22) is considerably superior to the best *deshi* which we usually get. This year, however, owing to the exceedingly poor quality of the majority of the *deshi* crop, it would be worth at least Rs. 2 per 100 lbs. above this season's fine *deshi* making it, I think, about Rs. 28. The particularly good points about this cotton are its fineness and regularity in length of staple."

1916.—Basis Cawnpore *deshi* Rs. 32 per 100 lbs.

8 bales sold at Rs. 36 per 100 lbs.

The following is an extract from a report on K. 22 from a Lancashire broker.

"The sample of cotton you sent is certainly usable by a considerable number of Lancashire spinners provided they could not get anything better, they being very conservative."

(2) K. 22 is now being grown on a considerable area in Etawah and elsewhere. I have, however, only recently worked up its ginning figure to forty. In this condition, it is now pure and it is merely a question of time for the multiplication of seed.

(3) The second is known as K. 28. It is only recently isolated but it has a lint undoubtedly superior to K. 22. At present its ginning percentage fluctuates between 37 and 40 and I have little doubt, with the experience gained, I shall be able to purify out a race ginning forty per cent.

(4) From the above reports it will be seen that K. 22 practically reaches my definition of a long staple cotton while I anticipate that K. 28 will fully do so.

122. **Fuzzy versus naked seed.**—This is not the limit of improvement I hope to achieve and I may revert to my fundamental statement that the crop must be judged by the value of the produce from a unit area. The lint is the most valuable, but not the entire, produce. There is also the seed. The cotton seed industry in India is in its infancy but will develop and Indian cotton seed is handicapped by the pressure of the fuzz adherent to the seed. This fuzz not only lessens the value of the cake derived but it diminishes the value of the seed as a direct fodder. The advantages of a naked seed are clear. At present no Indian cottons are naked seeded. I have, however, been able to produce such forms and the process of adding this character to the already existent good qualities of K. 22 and K. 28 is now in course of development. Here again the main difficulty has been that of the ginning percentage, most naked seeded plants having a low ginning figure (even as low as eight). A second difficulty has been found in the poor habit—susceptibility to wet weather—of naked seeded plants. Both these difficulties have been overcome and I now possess naked seeded plants both resistant and ginning forty per cent.

123. **General aspect.**—I have so far dealt in some detail with the particular problem I have set myself to solve. I may now deal with a more general aspect of the case. The United Provinces cottons are entirely short staple and the long staple *deshi* cottons of other tracts have all failed to grow as an economic crop under the United Provinces conditions. For improvement of staple, therefore, it is necessary to turn to breeding of new races. The question arises whether there are any reasons for anticipating a limit to the extent of improvement available. I think there are. The cotton season of the United Provinces commences in September and continues throughout October and even later. This is a season marked by a rapidly falling temperature, of hot days and heavy night dews. The effect upon the lint is marked. In any race there is a marked diminution of quality, both in length and silkiness of successive pickings. Produce made up of such picking cannot be uniform. First and second pickings may fully satisfy the Lancashire market but the

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subsequent ones will not do so. I consider, therefore, that the United Provinces must remain, as it is at present, an essentially short staple tract and the improvement limited to one which will give a cotton normally supplying the local demand but, in emergency, capable of being used in Lancashire. Our first duty as members of the Agricultural Department is to look to the interests of the cultivator and if we can introduce a cotton of this type we shall benefit him. As the report I have quoted shows, we have made appreciable progress towards that object.

(c) *Exotic cotton.*

124. (20) **Experience.**—I have not personally any large degree of experience with these. General experience has not been of any marked success and I was early led to the conclusion that improvement of indigenous races, rather than acclimatization of exotics, was the most promising line of success. The work of acclimatization is not so technical and what has been done is under the direction of the Deputy Directors.

125. (25) **Conditions affecting increase in area.**—The exotic cottons are not, as a rule, hardy in the sense that the Indian cotton is hardy. In a good monsoon, they flourish exceedingly and run to leaf and wood in place of fruit. I consider the main defects, however, to be agricultural. They require a long growing period and must establish themselves before the ground becomes water-logged. They must, therefore, be sown early to establish the necessary root development. This requires that the land shall be prepared and the crop sown at a time when the cultivator is busy harvesting and threshing his *rahi*. The economic conditions are thus largely against their extensive cultivation. They require, further, more careful cultivation, especially better spacing, than the *deshi* cottons. This means a change of practice, always of slow development, with a conservative class. While, therefore, I do not consider their introduction on an economic scale impossible, I consider that it is improbable and that the best results will be achieved with *deshi* forms.

126 (9 and 29.) **General economic condition.**—The main economic feature which comes out from what I have said above is the absence of any market for quality. I believe it true that the consumer will pay for quality but that, in the absence of any direct buying agency, controlled by the consumer, whatever is paid for quality is absorbed by the middleman and does not reach the cultivator. Of the actual control of the market I have no personal practical experience. My main concern is with the extension of the improved races produced by me. Under the Departmental organization, I control a farm which permits of the growth of some forty acres of cotton annually. This seed is made over by me to the Deputy Directors for issue to cultivators from whom the Department buys back *kapas*. Clearly this, if it is to be efficacious, involves a large amount of work and a considerable capital. Of this aspect the Deputy Directors can speak with greater knowledge. My experience is limited to the sale of the few bales produced from my forty acres. In these transactions, I am repeatedly met by the remark that if I could provide 100 or 1,000 bales of the same quality a considerably increased value would be paid. The production of such a quantity is beyond the capability of Government farms and beyond the financial and staff capacity of the Department. Consequently there is a hiatus between the stage at which the Department leaves the distribution and the stage at which the trade is prepared to handle the produce. The tendency, therefore, is for distribution to reach a certain figure at which it remains constant. It is not so marked in the case of a cotton, such as I hope K. 22 and K. 28 will prove to be, which holds its own on its merits on the present trade basis, excluding quality, but the full stimulus to development will only be given when a fair portion of the value for quality reaches the grower.

127. **Summary.**—I may briefly sum up my remarks on the United Provinces as a cotton-growing tract.

1. It is a tract which will never produce long staple cotton in the full sense of the word but there is considerable room for the improvement of the staple of the crop commonly grown.

2. There are no *deshi* cottons among the types commonly grown which give at the same time a good staple and a satisfactory yield. Such forms have to be produced.

3. The main difficulty in this lies, not in the staple but in the ginning percentage which, under present economic conditions, is the controlling factor in determining the price obtained by the grower.

4. Such forms are now available but their extension is limited owing to the fact that the point up to which extension by Departmental agency is effective is below that at which the trade is prepared to undertake the handling. This hiatus requires to be bridged.

5. It is improbable that exotic forms will to any extent replace *deshi* forms for general cultivation in the United Provinces.

Central India.

128. **Central Indian cotton tract.**—My experience of this tract is limited to a fortnight's tour in the autumn of 1916 in the company of Mr. Coventry, Agricultural Adviser to the Central India States. The problem here, as far as I understand it, is twofold. The first portion concerns the main bulk of the crop grown on natural moisture during the rains; the second the crop growing on the irrigated and more highly cultivated lands near villages. I will take the former problem first.

129. **Varieties grown in Central India.**—The typical cottons of this tract are true *deshi* cottons and are classed in the trade as Ujjains or Oomras. Botanically the plant is very similar to *G. neglectum* of the United Provinces but the lint is very much finer and also the ginning percentage is low—25 to 28 only. Unfortunately of recent years the temptation given by the high ginning percentage of the *roseum* cotton has led to its introduction and throughout my tour I failed to find a field in which the *roseum* form, or crosses between this and the typical Malwa plant, did not occur. The process of deterioration of quality due to this introduction is thus in an advanced stage. The spread of these high ginning forms is due, I believe, not merely to deliberate cultivation of high ginning forms but to the importation of *kapas* from surrounding tracts, such as Nimar, with the object of reaping the high prices given at Ujjain for inferior cottons. The practice leads to a mixing of seed in the gineries which is subsequently carried into the fields. There is thus a general recognition of quality but this recognition is limited to the source of the baled cotton, that is the locality from which the bale is raised. This defective organisation reacts adversely in two directions. The cottons will lose their good name on the market and the source of supply of the good quality—the field—is becoming adulterated. Two lines of action are necessary to control this—the local crop requires to be purified and the practice of importation of *kapas* to the gins requires to be checked. The first alone falls within my province.

130. **K. 22 in Central India.**—Under my advice, Mr. Coventry is starting a process of selection to obtain pure races of the original Malwa types. There is, however, another, perhaps a quicker, method. Samples of K. 22 seed were supplied by me for cultivation in 1916. The results have been so promising that

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I have this year sent a considerable bulk of seed of this type to various localities in this tract. The quality of lint of K. 22 when grown in Malwa is shown by the following extracts from reports forwarded by Mr. Coventry on the cotton grown in Malwa.

"K. 22.—This cotton grown out of Cawnpore seed on the Indore Farm seems to have improved in staple and feel, though it has not so much acquired the strength and length of Indore cotton. Can spin up to 20s. weft. Value Rs. 350."

"We place them in order of merit as under:—

First No. 7 (Dewas). Then No. 6 (Ujjain) and last No. 5 (Indore). Dewas seems to be very able and clean. Ujjain is uniform and strong: but for its leafiness we would place it over Dewas. Indore is short in staple, weak in strength and very able. Dewas and Ujjain are both good for 20s weft and both may be valued at Rs. 365. Indore is good for 14s to 16s reeling. Value Rs. 340."

Basis of prices on 23rd March 1917.

F. Bengal	R
F. Khandesh	300
F. Akola	340
Indore Ujjain	370
F. Broach	365
Sawginned	410
Madras Cambodia	410
Bani Hinganghat	440
	450

(2) This is a great advance on the quality of the same kind grown in the United Provinces. K. 22 is, thus, intrinsically, a far better kind than would be anticipated from an examination of United Provinces samples only—a fact which adds force to my conclusion that the United Provinces will never grow really long staple cotton. In the Malwa tract, cotton does not ripen on a rapidly falling temperature. The air remains moist and warm and the fibre dries off, when the boll opens under the most advantageous conditions.

(3) In the Malwa tract itself, the cultivator is accustomed to a cotton ginning 25–28 per cent. The prospects for a race with a quality equal to Ujjains and ginning 36–40 per cent. are thus very promising.

131. *Yield in Central India.*—Two other points I may mention briefly on this subject. The first is the low yield. I consider this an essentially agricultural problem and my remarks on exotic cottons in the United Provinces bear on this. The cotton soil of Malwa, owing to the way the soil expands on wetting, soon becomes water-logged, root development is checked and consequently the plant remains stunted. In the absence of irrigation facilities early planting is not possible, and it must be on the first rains. Improvement in cultivation should, I think, overcome the difficulty but I have no personal experience of such soils.

132. *Dirty nature of Central India Cotton.*—The second point is the dirty nature of these cottons. I believe this to be mainly a labour difficulty. The villages are scattered and the fields frequently distant. Picking is, therefore, made at long intervals with the result that a large portion of the crop is gathered off the ground.

133. *Cotton under irrigation in Central India.*—The second problem is to find a cotton suited to the irrigated lands near villages. These are, to a large extent, poppy lands which have been liberated by the policy of closing down the Malwa poppy area. Of the tracts of which I have personal experience, I consider these the most suited for the growth of really long staple exotic cottons. Success will depend on the selection of a suitable kind and on the provision of the extra cultivation which, in my opinion, all exotic cottons require. I have been able to suggest no particular kind likely to answer the purpose but Mr. Coventry is, I understand, experimenting with numerous forms.

134. *Conclusion.*—I have in the above given the Commission an outline of my work and its aims. I think the experience obtained in Central India indicates that the work is of more than Provincial value and that it is possible that some of the forms I have produced will be found suited for wider tracts than the United Provinces. I have this year supplied seed of K. 22 to several places in the Central Provinces but have as yet received no reports on them.

Mr. H. M. LEAKE called and examined.

135. (*Mr. Henderson.*)—I do not think that, owing to the war the problem of the improvement of cotton growing in India as a whole has altered. The war has not altered the problem but has made it more emphatic. The demand for long staple cotton is more acute now and is much greater than before. The war has shortened the number of years in which the problem will become intensive.

136. I think it is a very doubtful policy to continue to push Aligarh White Flowered cotton. It has got its advantages as well as disadvantages. Hitherto, the advantages have, to my mind outweighed the disadvantages. It has given Agricultural Officers a means of getting in contact with the cultivators. Whether this will continue to be, or even now is still, the case is a doubtful question. I think its cultivation is likely to spread as long as it pays the cultivator, and as long as it pays the cultivator, I do not see how it can be stopped. It pays the cultivator at present but I do not think that it will pay in the long run if a market for long staple cotton can be organized. There is undoubtedly a serious danger of the spread of Aligarh white flowered cotton destroying the reputation of a tract of country famous for a certain kind of cotton such as Malwa. This is a serious danger because the price of cotton depends on the name of the district from which it comes and if bad cotton is given out the name of the district will eventually be spoilt. No one has a good word to say for Aligarh White Flowered cotton except the grower. A few years ago, when Mr. Johnson was here, he paid a premium for it but now the mills will not look at it. Mr. Johnson used it and knew about it. Opinion has swung round altogether since then but I am not prepared to say what has been the cause of the change. In hot dry weather, Aligarh White Flowered cotton curls up and cannot be straightened out. I am inclined to think that most of the Aligarh White Flowered cotton is bought up for Japan. If this is so and there were an alteration in the Japanese market, the cultivator would be badly let down. There is another danger, namely, that if the spinners find that it does not suit their purpose, the price will go down. Of the two, I believe the greater danger lies in the alteration of the Japanese market. There is a distinct danger of the price suddenly dropping and the cultivator being badly let down. I am not prepared to go so far as say that the policy of giving out Aligarh White Flowered cotton is more or less suicidal as I do not know

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enough about the commercial aspect, but I do say that on general grounds of policy there is a decided risk attaching to it.

137. As to the question of improved *deshi*, I think it is possible to increase the length of staple up to an inch. I hope still to improve on K. 22 and K. 28 and to get them up to an inch but they will not be as good as American cotton of the type which constitutes the bread and butter of Lancashire. I cannot say what the average length of the staple of K. 22 and K. 28 is, judged from the commercial standpoint, as I only handle the *kapas*. Some merchants say that the staple of K. 22 and K. 28 is about an inch whilst others it has 7-8 inch. but K. 22 is silkier than K. 28. From the botanical point of view, there is more difficulty in increasing the ginning percentage than in increasing the length of staple. That is all my trouble in breeding work. Even were the ginning percentage to cease to be the controlling factor, I still think that there will be a gap between the best *deshi* and the best American. We shall get *deshi* up to what is called Middling American. That is not the best grade of American. It is only taken by the Lancashire market when it cannot get any other. We shall have to get the staple of *deshi* up to an inch to be of any use to Lancashire. There will then be no gap between the best *deshi* and Middling American. The question is mainly one of climate. K. 22 has been grown in Malwa for two years and there it had a longer and finer staple and there was no difference in the ginning percentage. It is a more difficult problem to raise the staple in the United Provinces than in Malwa but still in the United Provinces, I hope and expect to get a *deshi* up to the standard of Middling American. It will be as hardy as the ordinary *deshi*, but not perhaps as hardy as Aligarh White Flowered cotton which is particularly resistant to rain. There will be difficulties in getting it taken up in the earlier stages. If we can get forty per cent. ginning percentage, it will go by itself. I have never bothered about putting out any strains until I have got an improved ginning percentage, for the cultivator would not have got a sufficient premium to make up for the lower ginning percentage. An organization is wanted which would be prepared to work at a loss for a few years, as long as the amount of cotton produced is insufficient to secure its full value. There ought to be a very considerable premium for my improved strains over ordinary *deshi*—a premium which should be as big as the difference between Middling American and *deshi*. If ginning percentage is not taken into account, my improved strains should give as good a yield as *deshi*. The present prices are Rs. 43 for Punjab American, Rs. 31 for ordinary *deshi* and Rs. 25 for Aligarh White Flowered cotton per maund of lint. Taking the ginning percentage of Punjab American and ordinary *deshi* at 33 and that of Aligarh White Flowered at 40, this works out for *kapas* at Rs. 14-3 per maund for Punjab American, Rs. 10-3 for ordinary *deshi*, and Rs. 10 for Aligarh White Flowered. Taking the figures in my written statement of Rs. 14-4 per maund of *kapas* of K. 22, this gives it a premium of Rs. 4 per maund over *deshi*.

138. My varieties ought to be as profitable or more so to the grower than Aligarh White Flowered cotton when sown on irrigated land. On non-irrigated land, the prospects of my varieties are absolutely the same as those of *deshi* from all agricultural points of view including yield. The question of *barani* land (land dependent on rainfall) is a question of initial growth, i.e., sowing with heavy rain means water-logging and a check to the growth of the young plant which may weaken it permanently. This applies equally to ordinary *deshi* and to my improved varieties. No American cottons I have come across are as hardy as *deshi*. Of the two botanical groups of cotton, the one including the Egyptian and the American is not so hardy as the second group which includes the cottons grown from Italy to China. I have had twelve years' experience of the American type of cotton as I first grew it in Saharanpur in 1905. I have never personally grown American cotton on a yield testing scale. My general opinion is that there is too much rain for American cotton in the United Provinces, and that as far as the United Provinces are concerned, it is necessary to rule out exotics as a solution of the main problem. That is the reason why I am not working on exotics but on *deshi*. For success with exotics, you have to go outside the United Provinces to the more rainless tracts in the Punjab. There are years when American cotton would do well in the United Provinces, but they would be famine years. I do not think that there are any reasonable grounds to hope that varieties could be evolved that would be suitable to the conditions of the United Provinces. There are definite problems in regard to *deshi* cottons. I should not know how to set about work on American. I do not know if there are any tracts in America where similar climatic conditions to those in the United Provinces prevail, but I do not think there are any tracts there where monsoon conditions prevail. I certainly have not formed any opinions on the subject. It might be possible to go to America and investigate conditions there. I have grown an extensive series of American cottons but have not found any kind of American cotton suitable to conditions in the United Provinces. The question could only be settled by an examination on the spot of conditions in America by an officer with knowledge of conditions in the United Provinces. If every method is to be tried, this should be done. It is the only way to set about developing an American type of plant in the United Provinces. The experiment is worth trying but I would not warmly advocate such a step. It is a possibility that something might be found. I think it is for the Committee to settle the question finally but if it is to be settled finally, this is the only way in which it can be done.

139. I have not seen any samples of Punjab American. I have seen the selections of Cawnpore American that we have got on the farm at Cawnpore. They seem to be of very fair quality, but I have not investigated them thoroughly. I cannot therefore give an opinion as to the comparative merits of the Punjab and Cawnpore American. There is no reason why as good American cotton should not be produced in the United Provinces as in the Punjab so far as quality is concerned, but to my mind the real difficulties which rule out American cotton in the United Provinces are the agricultural difficulties. The chief agricultural difficulty is the monsoon over an average of years and the other main factor is the length of the growing period. Then there is the economic question. American cotton has to be planted very early and the conditions of the country side make it impossible. It has to be sown at a time when the whole of the labour, human and cattle, is engaged on the *rabi* harvest.

140. Boll worm danger is very extensive in some years in the United Provinces. It is appreciable in all except very dry years. It attacks all classes of cotton but red flowered plants, such as *sanguineum* and *narma*, are more immune than others. Red flowered plants are not, however, sufficiently immune to justify the evolution of a red flowered type. As to my experience of smooth *versus* rough leaf plants, smooth leafed plants, that is plants without hair on the under surface, are attacked by aphids. Plants with a hairy leaf surface are not attacked by aphids. If you have climatic conditions which favour the development of aphids, then a hairy leaved plant will survive and grow well, while a smooth leaved plant will remain dwarfed. Aphids is the only damage as far as I can see. I know of only one class of smooth leaved cotton which is not attacked by aphids. I do not pay much attention to leaf-roller. It has not done enough damage to be of any consequence.

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141. (Mr. Roberts).—As to the work that I am doing here in the way of breeding and the principles on which I am working, the first step was to find out what cottons there were and to obtain them in a pure condition. The next thing was to make up my own mind as to what the ideal cotton was—I mean ideal within reasonable limits—and then, by breeding from the material I had at hand, to get as near the ideal plant as I could. The ideal plant had, of course, to be within a reasonable limit, i.e., it was no use to aim at a staple of 1½ inches. The characters were studied from a Mendelian point of view, i.e., crosses are made and from the offsprings raised by selfing pure races are selected out. By this means, I got a number of cottons which, on examination, showed different qualities but the size of the culture is naturally limited by the amount of self fertilisation that can be practically effected. This does not afford a test for agricultural characters, and it is only by going on further with them that I could know which were the better ones. In this preliminary selection, every plant is judged on its offspring of the following year. This selection is a scientific selection. With a sufficient number of offspring all bearing the character, it is possible to conclude in one year that it is fixed. The selection is not field selection but scientific selection. The principle of work is applicable for the whole of India. There is a good deal of scope for this work outside this province.

142. As regards the staple of American cotton, the constant selection of long staple types seems to be followed up by a decrease in yield. It is very difficult to explain this in simple terms. I think that there is confusion between two fundamentally different scientific factors. In one case, you are dealing with fluctuations and in the other you are probably dealing with unit characters. Field tests are of extreme importance in breeding work. There is no *a priori* reason why K. 22 should yield less than Aligarh White Flowered because it has a longer staple. A practical test must be made in regard to yields. I have evolved much better types than K. 22 if merely considered for their quality of lint but they had to be discarded on account of low yield. The factors controlling yield cannot be fully defined. They may be botanical characters subject to environmental influence, for instance, you cannot get a tree cotton which gives a good yield in the United Provinces on account of the length of growing season required. You must have a cotton producing fruiting branches early. There is too short a season in the United Provinces for anything requiring prolonged growth. Other factors in regard to yield are purely climatic. For instance, three years ago I got a yield of thirteen maunds an acre from K. 22. On exactly the same land, I got 1½ maunds an acre this year. This was due purely to excessive rain. Rain affects the yield in two very distinct ways. In the case of the irrigated cotton, you get germination before the rains. The young plant is formed and sends down its roots. If there is heavy rain when the plants are still small, you get water-logging conditions throughout the region occupied by the roots of the cotton. If that condition persists for any appreciable length of time, the plants get so sickly that they never recover. This is probably more marked in American than in *deshi* though I have not studied this development for want of time. The other case is that of a good plant in fruit. You then get a week's heavy rain with cloudy weather. For some reason, which I am unable to dogmatize about the whole fruit falls. After heavy rain for a week recently, the bolls, both nearly mature and young ones, fell off at the junction with the stem. This shedding is not due to the rise in the water table in the United Provinces, whatever may be the case in Egypt. Continuous rain in the flowering period causes falling off in the rate of flowering and the flowers that do develop are much more likely to fall off. I am doubtful if the flowering period of American is longer than that of *deshi* in the United Provinces. The exact meaning of the term 'flowering period' is not always understood. A plant can only produce a certain amount of fruits—that is, it is capable of producing food material sufficient for ripening off a limited number of seeds only. As soon as that number of seeds has been formed, flowering will cease. The length of time the plant goes on flowering therefore depends on the season. *Deshi* plants start flowering again after the flowers have been knocked off by rain. There is thus a certain correlation between rainfall and the length of the flowering period but I cannot give details. I have not studied the difference between *deshi* and American from this standpoint. *Deshi* has, however, one characteristic which enables it to stand heavy rainfall better than American, viz., that it is not so leafy as American. Owing to the spread of leaf in American, there is too much shade and the atmosphere round the plant in a moist climate is much more moist and therefore unfavourable to flowering. If you sow American and *deshi* at the same time, the *deshi* commences flowering before the American and will thus have been flowering for a much greater period than the American at the time when rain comes. Consequently it exposes much more fruit to damage. For this reason, American may be more resistant to rain in the Punjab. If you get *deshi* cotton of an inch and an American cotton of an inch in staple, it is for the spinner to say which of the two will spin the higher counts. The fibre of *deshi* cotton is thicker than that of American except in the case of *Hinganghats*.

143. The only way to control the distribution of seed is to start with a central farm from which you send out seed to certain areas which will in their turn pass it on to others. The central farm should be under strict control. It should supply seed to co-operative societies which would supply areas outside. The societies should not grow the seed of the crop they produce but should pass it on to areas outside, getting fresh supplies from the farms. A crop, unless put out like this, would lose its character in about three or four years from the botanical point of view even when such factors in producing impurity as the mixing of seed in the gins are excluded. Most American seed is not pure to start with. The danger is from cross fertilization and you get the same problem with American as with *deshi* once you try to replace a low grade American by a better type. I cannot imagine any climatic conditions in which K. 22 would be likely to deteriorate in quality of lint as it has been raised under climatic conditions which are all against quality. The problem has to be studied by tracts. I lay great stress on yield tests before cotton is finally put out. The trouble about yield tests is the variation from year to year. It is difficult to know what an average year is.

144. I have not worked on American cotton as I have on *deshi* cotton. One reason for this is that American types have too long a season. I am not prepared to say that work on American types is likely to prove fruitless but it is not so likely to yield good results as work on *deshi*.

145. The present custom of the market is simply to buy on ginning percentage without much regard to staple. The only way to improve matters is to eliminate the middlemen. Last year, I put out fifty maunds of K. 22 seed round my farm at Kalai in the Aligarh district and I made private arrangements with a Cawnpore Mill-owner to send up men there to buy up the *kapas*. Unfortunately owing to continuous rain, including seventeen inches in one day, the crop was spoilt. For a bigger crop, an organized body is necessary.

146. (President).—Government sales are only a temporary arrangement. The mill-owners must start an organization. Some one must be prepared to drop money in bad years. The mill people can assist us a great deal. The Cawnpore merchants are quite sympathetic; they are quite prepared to do all that they can but there is no assurance of continuity. Improved cotton will not be established naturally in bulk. There must be assistance from the trade in the earlier and intermediate stages. My concern is with the production

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of improved cotton rather than with its production on a commercial scale. A crop that does not cross fertilize can be handed over for multiplication much earlier. In order to get out cotton in sufficient bulk with a sufficient standard of purity, I have a farm at Kalai. My research station is at Nawabganj. Seed is taken from there to Kalai where fifty acres are under cotton. Pure seed is issued from Kalai, which is the multiplication centre. I am satisfied if the seed issued from Kalai is pure and I do not follow up the crop after it has left Kalai. In any system of seed distribution such a farm as Kalai is a most important stage.

147. I consider Central India a very hopeful tract for K. 22. I supply seed straight from Kalai to Central India but I cannot supply enough seed. More seed farms are necessary to which seed would be supplied from Kalai. These would supply seed to intermediate farms working under Departmental supervision.

148. As to the question of a Standing Cotton Committee or Cotton Research Department, it would have two different problems to deal with. One is the scientific and the other is the economic; in the one case, the question is of production and, in the other, of an organization to deal with the produce. The two are fundamentally different aspects. A Standing Committee consisting of two or three scientific men and two representatives of the trade, one of the shipping and the other of the milling interests, would not cover the intermediate interests, i.e., the ginning and pressing interests. In any case, a strong body is desirable. Some better method of co-ordination than the Imperial Cotton Specialist is required.

149. (Mr. Roberts.) As regards yield tests on my farm at Kalai, I have always grown till this year two acres of Aligarh white flowered for comparative purposes but the fluctuations were so enormous that I came to the conclusion that it was useless. I have not been able to carry out tests on any plan designed to produce the experimental error to a minimum for want of time. This is work for an independent officer. I am not satisfied that full tests are being carried out. The only practical solution is to have an agriculturist for the college who would be given a local farm on which he could undertake such experiments. There is at present a hiatus between the work of the Botanist and the Deputy Director. As a result of the smallness of staff in relation to the field of work, the Deputy Directors have more and more passed to the district work and ceased to be experimenters. Hence the hiatus. My proposal is to give the agriculturist facilities for conducting experiments which would fill the hiatus. I am sure no agriculturist that could be got would be content with teaching only and would require greater scope. It might be possible to give him a small circle but I recognize there are considerable difficulties in the way of this. That is undoubtedly a practical measure in the reorganization. The Deputy Director has charge of the experimental farm at Cawnpore at the present time. The appointment of an Agriculturist for the College has been sanctioned but he has not yet been recruited.

150. My impression is that fluctuations in yield are so great from year to year that the cultivator is unable to appreciate the relative yields of *kapas*. I think that in work on cotton it is possible to avoid big mistakes without detailed experiment. It is on such general considerations and not on experimental results that I ruled out some of the best cottons. The fluctuations must be very marked for cultivators to spot them. Field tests give valuable information and I should like to see field tests done but it is possible to get on without them without very great risk.

151. The system of marketing at present followed is to go for short staple with a high ginning percentage. The market favours a high ginning percentage and for reasons which I have not been able to discuss the tendency of high ginning cotton is to be short staple. Staple is ignored in marketing.

The Hon'ble Rai Bahadur LALA JANKI PRASAD, Khurja, Bulandshahr.

EXAMINED AT CAWNPORE, NOVEMBER 5TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE

(a) *Deshi* short staple cotton.

152. (1) **Experience.**—I have lived in Khurja, district Bulandshahr, since my birth. I have ginning and pressing factories at Khurja, Hapur, Rohtak (the Punjab), and Chandausi (Moradabad District). As I am a landlord, I often come in contact with the cultivators.

153. (2) **Varieties.**—There are two kinds of *deshi* cotton—yellow flowered cotton and white flowered cotton.

154. (3) **Size of holdings.**—The cultivator who holds forty *kachha bighas* or thirteen *pukka bighas* or eight acres of land, uses one-fifth or one-sixth of it for growing cotton.

155. (4) **Yields and profits.**—The average of the cotton produce is six or seven maunds per acre. Deducting husbandry expenses and rent at the rate of Rs. 3-8-0 per maund, the net income is Rs. 3-8-0 per maund.

156. (5) **Rotations and manures.**—If the cultivators grow American cotton, they can have only one crop a year, while if they grow *deshi* cotton they can have a second crop of barley, gram or peas; therefore they prefer *deshi* cotton to American cotton. Dung manures and the like are applied.

157. (6) **Comparative returns.**—Long staple cotton sells dearer than short staple cotton; therefore long staple cotton can be more profitable.

158. (7) **Conditions affecting increase in area.**—The area under short staple cotton does not fluctuate in these districts. The increase of area under short staple cotton is possible if the landlords induce the farmers to grow it.

159. (8) **Uses of seed and seed selection.**—In these districts, cotton-seed is used for feeding cattle. Seed selection is practised for sowing purposes and that one which has yellow marrow is preferred. Hand-ginned seed is selected for sowing, and oil is also pressed.

160. (9) **General economic conditions.**—As the cultivating classes are generally illiterate, no improvement can be expected in any cultivation whatever. I therefore think it advisable that the *zamindars* be induced to make their tenants grow the best kind of cotton, and to supervise if the fields are properly manured.

161. **General.**—In my opinion, yield from the long staple cotton can be greater to the cultivators than that from any other variety, because its rates are higher. Good cotton can be had from good raw cotton

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The Hon'ble Rai Bahadur LAL JANKI PRASAD.

[Continued.]

and it fetches higher prices, but in India people follow old methods and pay little heed to progressive ones. If landlords induce their tenants to take heed to growing long staple cotton, much improvement can be expected. Cotton grown at present can be spun into counts 10½s or 12½s only. In order to spin counts of better quality, cotton is sent for from Akola, Khamgaon and Ujjain, etc. If the cotton of this sort begins to grow in this Province too, the cultivators can be more benefited, because to the market value obtaining in those places the transit charges can also be added and thus will be paid at a higher rate here.

II.—COMMERCIAL ASPECT.

162. (30) **Local trade customs.**—In every district, there are some cotton markets where the customers buy cotton through the *aratis* (brokers). Either the cultivators themselves or the *beoparies* bring cotton to the shops of the *aratis*. These *beoparies* are the people who go to the villages and buy raw cotton from the cultivators. Future contracts are not made here as in Rajputana and the Punjab.

163. (31) **Standardization of commercial names.**—There is no commercial name given to cotton. Of course, the outturn of cotton of every place is different— from sixteen seers to eleven seers. Rates are fixed according to the outturn. With regard to the outturn, cotton is named '*kulon*.' The names of cotton staples are (1) good, (2) fully good, (3) fine, and (4) superfine, and these names are popular everywhere. The '*superfine*' is considered to be the best.

164. (32) **Buying agencies.**—If cotton purchase be made through co-operative societies, there can be an improvement in its quality.

III.—STATISTICAL.

165. (33) **Improvement of cotton forecast.**—In my opinion, the present method is satisfactory. Only so much change is required that the forecasts should be published as soon as possible. It would be better if they are published in the month of August before the cotton season, so that the traders may make the best use of them.

166. (34) **Improvement of other statistical information.**—The present way is quite satisfactory.

167. (35) **Publication of Liverpool and Bombay Prices.**—The cotton rates of Bombay and Liverpool markets must be published in upcountry markets.

IV.—MANUFACTURE.

(a) Ginning and Pressing.

168. (36) **Type and number of gins and presses.**—I have in my factories gins by Platt Brothers and presses by Nasmyth Wilson. The number of gins in our factories is as follows:—

Khurja.	Hapur.	Rohtak.	Chandausi.
100	88	44	50

169. (37) **Size of bale.**—Each bale produced by our factories is 49 inches long, 19 inches wide and 17 inches thick.

170. (38) **Saw gins versus roller gins.**—Roller gins are preferred to saw gins.

171. (39) **Effect of saw gins on Indian cotton.**—The staple of Indian cotton is spoiled in saw gins and therefore the gins of this kind have proved a failure.

172. (40) **Factory labour.**—We often experience difficulty in obtaining factory labour.

173. (41) **Conditions of cotton.**—Certainly, cotton of bad quality often finds its way into factories the remedy for which I have suggested in paragraph 164 above.

174. (42) **Effect of replacement of short staple cotton by long staple.**—To gin long staple cotton, an alteration will have to be made in that mechanism which sifts seed from cotton.

V.—GENERAL.

175. (46) **Attitude of buyers to improved cottons.**—I have never seen any cotton purchaser advancing money to the cultivators in order to encourage the growing of cotton of a good quality.

VI.—IRRIGATION.

176. (56) **Watering of cotton.**—Cotton fields are irrigated for the first time towards the end of April or in the beginning of May. They are watered three or four times. The first instalment of water reaches the height of three inches and others that of four or five inches.

177. (67) **Cotton versus wheat.**—Wheat is preferred to cotton. Cotton is grown in rainy season and therefore there is always a danger of its being damaged on account of heavy rains, while wheat is grown in winter and hence there is less danger of its being injured.

178. (72) **Adequacy of supplies to increase in area.**—Cultivators do not like irrigation under canals as they do not get water in time.

179. (73) **Deshi versus American cotton.**—American cotton is not given preference to *deshi* cotton only, because if it (American cotton) be sown, only one crop can be reaped in a year. Besides this, it needs more water.

The Hon'ble Rai Bahadur LAL JANKI PRASAD, called and examined.

(Translation.)

180. (President.) I have never bought Aligarh white flowered cotton. The ginning percentage is good and so is the quality and the colour but the staple is very short. Bulandshahr is between Aligarh and Meerut. I have had no experience of Cawnpore American cotton. I do not use American cotton in my mills. This cotton cannot be procured in sufficient quantities. On one occasion, the Agricultural Department sent their cotton to me for ginning and they took away the seed and the ginned cotton. It was *deshi* cotton but I am not sure whether it was the Aligarh white flowered cotton or not. This cotton was bought by the Agricultural Department from the cultivators to whom they had sold the seed. The Agricultural Depart-

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ment distributes the seed, gets the cotton ginned and practically trades in it itself. They do not sell the cotton necessarily to the mills but anybody can buy it.

181. No long staple cotton is grown in this district. It is grown only in Berar. I buy it at Akola and Ujjain. I bought some last year. I think it would be a good thing to get some long staple cotton grown in the United Provinces. The cultivators cannot be easily persuaded to grow this cotton. They are quite ignorant people. They only look to high ginning percentage and must be forced to take it up by the *zamindars*. If the *zamindars* insist on long staple cotton being grown and get all the seed required through co-operative societies and distribute it to the cultivators, then the cultivators could grow it. I mean that the cultivators in this province look to make immediate profits. Last year indigo was sold at a very high price and the cultivators, in the hope of deriving greater profits from this crop, put large areas under indigo this year. The result has been that the price of indigo has fallen very much this year and, in consequence, a very small area will probably be put under indigo next year. The same may be the case with long staple cotton. When the cultivators see that long staple cotton will benefit them, then they will grow it but, at the beginning, they must be given help and inducements. As to inducements, I would suggest that the co-operative societies should explain to the *zamindars*, who will in turn explain to the cultivator the advantages to be derived from this cotton. Then the cultivators will be persuaded to try a small plot in the first year and then when they realize the benefits of growing this cotton, they will naturally increase the area in the following years. From my experience of cultivators, I do not think that American cotton will be very paying in these provinces. I think that *deshi* long staple cotton will be more paying. The reason is that in the case of *deshi* long staple cotton, the cultivators can grow other crops after it, which they cannot grow when cultivating American.

182. As to the present cotton forecasts, they seem to me to be suitable but I think that it might be better if they were printed in the vernacular. The forecasts should be printed earlier, and should be issued monthly. Returns are at present only taken from cotton presses and not from gins because the only check is what goes to Bombay and that goes from the presses. Returns should be obtained from both gins and presses and should be made compulsory by legislation. In places where there are pools, the manager of the pool gets the returns from various factories and sends them in regularly but where there are no pools, some of the presses do not return the statement. I am in favour of legislation to make the return compulsory with a penalty of fine if the statement is not returned. In my opinion, a warning should first be given and after the second offence the offender should be punished by fine. The returns should be sent in fortnightly but, if the owner of the press sends in both his returns at the end of the month, then in my opinion, no penalty should be imposed. The Agricultural Department should publish the returns as soon as they receive them. The returns should be promptly published; their submission should be made compulsory and they should be printed in the vernacular.

183. I think that the Bombay and Liverpool prices should be published. I get Bombay prices daily. If Bombay and Liverpool prices are published, the commission agents will get to know them and they will inform the cultivators.

184. (Mr. Wadia.) I sometimes get damped cotton. From the Punjab we get little damped cotton, but here we get rather more. In the beginning of the season, there is more damp in the cotton. The cotton is picked here every third day, whereas in the Punjab it is picked every fifth day and therefore the Punjab *kapas* is drier than the *kapas* here. The greater part of the *kapas* here comes in damped. The European firms do not buy damp *kapas* but we buy it and we find it is very badly yellow stained and therefore it cannot be put in a good class. This is particularly the case this year when late rains have been unusually heavy and have consequently, very badly damped *kapas*. Whenever we buy this damped cotton, we get it hand-picked before ginning, separate the yellow stained cotton and sell it back in the bazaar. For the yellow stained cotton we get less than half price. I get mixed cotton, both short and long staple. Even if the cotton came separately to me, I cannot keep it separately as I have to buy all the cart loads whether good or bad quality together. As to artificial damping, I may mention that sometimes the cultivators damp the cotton on its way to the market. There ought to be legislation for stopping damping and adulteration. It is no use licensing gineries because in these provinces the gineries do not mix or damp cotton themselves. That is done in Akola and Berar. I have got a spinning mill. My brother is a partner in the Hathras ginning company. It would be better for the mill if long staple cotton could be grown in this part of the country. The *deshi* cotton here is so bad that I only get three to three and a half ounces per spindle per day for counts 20s. This is from the local *deshi* cotton.

185. (Mr. Roberts.) I have no experience of Cawnpore American cotton. I have spun up to 24s. I know nothing about American. I prefer roller gins to saw gins. I put up sixteen saw gins at Hathras, but they ruined the staple so much that I had to discard them. I have got four saw gins but they are not used. I had originally sixteen gins. The objection to them is that they ruined the staple. I have not used saw gins for long staple cotton as I have not been able to get the cotton. I prefer a single roller gin to a double roller gin. The price of double roller gins is about double that of single roller gins while the production from the double roller is only about one and a half times that of the single roller gins. Even where there is a pool, payment to it is made on the basis of one and a half times more for the double roller gin than for the single roller gin.

186. (President.) I am in favour of extending tube wells.

Mr. TEWARI RAM GHULAM, Zamindar, Honorary Magistrate and Member, District Board, Kodarkot.

EXAMINED AT CAWNPORE, NOVEMBER 5TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "*Deshi*" short staple cotton.

187. (1) **Experience.**—I am an inhabitant of Kodarkot, Tahsil Badona, District Etawah.

188. (2) **Varieties.**—In my district generally, white flowered *deshi* and yellow red flowered varieties of cotton are grown. In my tract I introduced the white flowered Aligarh variety, the seed of which I

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[Continued.]

obtained from the Agricultural Department. This was introduced in the neighbouring agricultural area but mostly the Malwa variety is sown. Formerly more than one-third of the area used to be under cotton but for the last two years indigo has been grown on a larger scale thus reducing the area under cotton by less than one-third.

189. (4) **Yields and profits.**—The average outturn per acre is seven maunds and profit Rs. 20 per acre.

190. (5) **Rotations and manures.**—The fields commanded by the canal are sown with peas if they are watered at the proper time. The scarcity of water is generally complained of by the cultivators and most of the land in the canal irrigated tracts is left unsown and comparatively little land is brought under sugarcane after cotton is harvested. Manure is scarce in the villages. If it can be obtained, *gobar* (cattle dung) is used as a manure.

191. (6) **Rotations and manures.**—I obtained seed from the Agricultural Department and introduced it in my village. Its average production is comparatively more than the *deshi* seed which is generally sown in the district.

192. (7) **Conditions affecting increase in area.**—Twenty years ago, there were many indigo factories in the district and cotton was sown in a smaller area. With the close of indigo factories, a greater area was sown with cotton. The last two or three years have again seen indigo factories revived and with a fall in the price of cotton, the area under cotton has again gone down. In order to secure an increase in the area under cotton, I would suggest the following steps:—

- (i) The cultivators should get a good price for their produce.
- (ii) Their *kapas* should be purchased in their villages.
- (iii) They should get selected and cheap seed at the proper time.
- (iv) There should be gins in every *tahsil*.
- (v) The cultivators should be liberated from dealing with brokers and *mahajans* (middlemen) to whom they now sell their *kapas*.
- (vi) In the areas commanded by canals, every effort should be made to give water for the sowing of *kapas* at the proper time.
- (vii) The water rates should be reduced.
- (viii) The land revenue assessed on cotton should be reduced.
- (ix) Government agricultural farms should be established in each *tahsil* with a godown attached to each of them and thus selected seed of good varieties should be made available to cultivators.

193. (8) **Uses of seed and selection.**—Oil is extracted from cotton seed. Tradesmen generally adulterate this oil with ghee. The cake made from the seed is used as cattle fodder. There is no process of selection. Cultivators generally sow hand-ginned seed. Traders who buy cotton for selling it in the market generally damp it with water so as to increase its weight. Seed is generally cut in the process of ginning in factories and on account of its being damped, it becomes pressed. The cultivators do not buy such seed as it does not germinate well.

194. (9) **General economic conditions.**—Students should be given agricultural education in village schools. Big *zamindars* should start demonstration farms on their land.

(b) "*Deshi*" long staple cotton.

195. (11) **Varieties.**—Long staple cotton is, I think, not sown in this district. In the current year I got thirty maunds of seed of K. 22 cotton from the Agricultural Department and had it sown in my village. On account of heavy rain, no correct estimate can be formed of its production. Its staple, of course, is long and fine.

196. (15) **Conditions affecting increase in area.**—I have already given my views in paragraph 192 above as to the improvement of cotton. The Agricultural Department should select seed of fine stapled variety out of the *deshi kapas* according to season. The seed should be multiplied. Selected seed should be sown on the demonstration farms started by *zamindars*. In this way, the cultivators can get seed easily.

197. (17) **Prevention of mixing of different varieties.**—The big *zamindars* should sow long, short and exotic cottons on their fields separately, sell the out-turn separately and gin each variety separately in a separate gin. In this way a profitable variety can be evolved, and the cultivators will abstain from mixing seeds.

(c) *Exotic* cotton.

198. (21) **Varieties.**—Cawnpore-American cotton is the only variety grown. The area of this in my district is very small.

199. (23) **Comparative returns.**—The production of this cotton round my village has been small as compared with that of long and short stapled *deshi* cotton for the following reasons.

- (i) Greater harm is done to *kapas* of American cotton by rain than to *deshi kapas*.
- (ii) American cotton cannot stand dry weather in comparison with *deshi*.
- (iii) American *kapas* occupies the field for a longer period than *deshi* does. In this way, the chances of sowing other crops are minimised.
- (iv) As far as I know, the cultivators sold American *kapas* to dealers who in their turn sold it to Government. The cultivator's profit was in this way reduced by one-third, i.e., he got a profit of Rs. 13 per acre.

200. (25) **Conditions affecting increase in area.**—American cotton can be extended in this district if its price be increased by 25 per cent. and arrangements for purchases be made at the cultivator's place and a sufficient supply of water from the canals be allowed at the proper time.

201. (26) **Suitability of existing varieties.**—Experiments have shown that American cotton does not suit my district. These two divisions of my district are known as *ghar* and *pachar*. There is always scarcity of water in *ghar*. American cotton cannot be sown in the district at the proper time. In *pachar*, American cannot stand heavy rain. In both cases, American does not do well.

II.—COMMERCIAL ASPECT.

202. (30) **Local trade customs.**—The cultivators take their *kapas* to the markets nearest to the villages and sell it to the ordinary dealers, who take it to Etawah and sell it there. There is no system of contract.

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[Continued.]

203. (31) **Standardization of commercial names.**—In my district, *kapas* is known under the name of *ghar*, i.e., *kapas* which grows across the Jumna and (2) *pachar*, i.e., *kapas* grown in the Eastern portion of the Etawah District. *Ghar kapas* is comparatively better than *pachar kapas* and obtains a better price. When long staple or other kinds of cotton are sown and the more profitable variety is introduced, there will be no difficulty in altering the names of cottons.

204. (32) **Buying agencies.**—Big merchants should buy *kapas* from the big markets of towns so that the cultivator may not have to deal with the middlemen.

III.—STATISTICAL.

205. (33) **Improvement of cotton forecast.**—Forecasts are not generally accurate as they cover a wide area. If the forecasts can be compiled for smaller tracts, they would be useful.

206. (35) **Publication of Liverpool and Bombay prices.**—It would be very useful to publish daily the cotton prices of other countries in the districts, where cotton is abundantly grown, to facilitate the farmers, in disposing of their produce profitably.

V.—GENERAL.

207. (48) **Desirability of alteration in water rates.**—The following complaints of which I am aware of have been made by cultivators in regard to water rates:—

- (i) The present record of water supplied from canals does not seem to be correct. Formerly when a distributary had its full water supply, the fields had their proper share but now a general scarcity of water has been complained of. Though the fields do not receive proper watering, the records show the supply as heretofore and the cultivators have to pay the same amount of assessment which means a pecuniary loss to them. This point requires investigation, so that the cultivator may not have to pay for the water which he has not actually consumed.
- (ii) It has often been noticed that field irrigated by a well adjoining a canal irrigated field has also been assessed although it has not utilized canal water. In my opinion, the rules relating to joint water supply should be revised.
- (iii) It has also been rumoured that if the canal irrigated fields in which short stapled or inferior crop is sown happen to contain a few plants of superior quality they will be assessed on the same scale as is done in the case of the superior variety. In my opinion, this should not be allowed as in an inferior crop it is probable that ten to twenty plants of superior quality may grow.
- (iv) It has been observed that if a field has obtained a first watering from a canal but, owing to want of a second supply, fails to produce an average crop, the cultivators has to pay the full rate. In such cases, certain concessions in rates should be granted and the charge for a first watering should only be made.

In such circumstances, the cultivators cannot improve their fields and cannot apply manures to it.

VI.—IRRIGATION.

208. **General.**—The crop is injured for want of canal water supply at the proper time. It appears canal water is not sufficient to irrigate the present areas. If the first watering is given, the second supply fails—which leads to failure of crops. Many difficulties arise especially where the water distributaries end. If water cannot be provided for the cultivation of cotton in those tracts the cultivators are deprived of sowing cotton.

209. (66) **Watering of cotton.**—The cotton is sown in the month of May and June after first watering. In canal irrigated tracts, two waterings are given if the rainfall is late, and if it is in time, only one watering is given. In the case of no rainfall, several waterings have to be given though I cannot say what volume of water is necessary.

210. (67) **Cotton versus wheat.**—As timely water supply is uncertain, the cultivators prefer to sow wheat instead of cotton. Besides this they sow *juar* first and follow it with wheat.

211. (68) **Wells and tube wells.**—Where canals and wells both exist, the cultivators prefer to utilize canal water for the sake of convenience but at the end of distributaries where the water supply is insufficient, the cultivators have to dig out wells to irrigate their fields. In my opinion, *pukka* wells should be constructed in such areas. Canal supply should in my opinion be closed where *pukka* wells are constructed. *Takavi* (loans from Government) should be advanced for the construction of such wells.

212. (70) **Suitability of existing water rates.**—In my opinion the rate of assessment on cotton should be reduced by one-third.

213. (71) **Cropping and causes affecting it.**—In an area of 100 acres, it would be suitable to grow *kharij* in one-third and *rabi* in the remaining two-thirds and there should be a supply of water from wells. With one-third *kharij* crop, the cultivator will have ample fodder for cattle. The yield of the area becomes affected by the fluctuations of rain. It has also been noticed that the cultivators are naturally induced to sow next year the crop which obtains a better price in the current year, extensively without any rhyme or reason.

214. (72) **Adequacy of supplies to increase in area.**—In my opinion the present area under cotton suffers for want of proper water supply and if the area is extended still greater difficulties will arise.

215. (73) **"Deshi" versus American cotton.**—Cultivators do not like American *kapas* much in this vicinity because it is sown earlier than the *deshi* and requires more water, is destroyed by excessive rainfall, and, in the rainy season, it is comparatively susceptible to more attacks from insect pests. The cultivators who have had two years' experience with this variety are of opinion that its yield is comparatively less than that of the *deshi* variety and this is the reason why *deshi* is given preference over American. In the year when American *kapas* was grown in this village there was great deficiency of water here.

Mr. TEWARI RAM GHULAM called and examined.

216. (Mr. Roberts.) I come from Etawah District in which I am a *zamindar*. I have grown American cotton on my land both this year and last year. Owing to the rain both this year and last year, it has proved a failure. I sold my American *kapas* at a premium of Re. 1 to Rs. 1-8-0 per standard maund over the price of ordinary *deshi*. The farm overseer at Etawah purchased the *kapas*. Etawah is 24 miles

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from my village. I have sold both Aligarh white flowered cotton and American. I derived a greater profit from the latter. I sold my Aligarh white flowered at Rs. 8 and Rs. 9. The outturn of the Aligarh white flowered is greater. I sold my Aligarh white flowered in the usual way without any premium. The yield per acre of the Aligarh white flowered is larger than that of *deshi* but the price is the same. Last year we did do any business with American. The cultivators do not like this cotton. Aligarh white flowered is a bigger yielder than *deshi* but I do not know the amount of the difference. If the cultivators were to get a premium of Rs. 3 per maund for American, if they were to get water from the canals in proper time and if the cotton were grown in larger quantities, then it would prove profitable. In the districts, the people are frightened of buying it because they consider that it is a Government cotton and that they might be punished if they bought it as Government have bought all the crop up to the present.

217. (Mr. Ashton.) I have stated in my written evidence that, in my judgment, the water rate on American cotton should be reduced. The present rate is ten annas and twenty annas per *pukka bigha*. My opinion is that the *zamindars* should reduce the rent they take from the cultivators. There is less supply of water available from the canals than there used to be. We do not get water at the proper time. We do not get it when we want it, i.e., we do not get it early enough for the first watering or late enough for the second watering. The first watering is in May and the second watering, if there is no monsoon, is in June. The water rate is the same for all varieties of cotton. I should like to mention, as an example, the case of wheat this year. It has been announced that water rates have been reduced and there has consequently been a large increase of area of cultivation under wheat. If the water rate for American cotton were also reduced, there would probably be an increase in the area under it. Irrigation is recorded by the Patrol *Amins*. Their pay is from Rs. 7 to Rs. 8 per month. The work of the Patrol *Amins* is checked by the superior officers and there can be no hesitation in trusting them. American cotton is more susceptible to damage by rainfall than *deshi*.

Mr. NARAIN PRASAD KURMI, Zamindar, Macha, Cawnpore District.

EXAMINED AT CAWNPORE, NOVEMBER 5TH, 1917.

Written statement (Translation).

I.—AGRICULTURAL EXPERIENCE.

(a) "*Deshi*" short staple cotton.

218. (1) **Experience.**—I am a resident of Cawnpore. I have all along been in this province and have also come in contact with many other cultivators.

219. (2) **Varieties.**—The varieties of *deshi* cotton grown in this province are white flowered as well as broad and narrow leaved. They are often mixed. No pure variety is sown by cultivators in general. It is two years since the cultivators began to sow the Aligarh White Flowered seed, which they get from the Agricultural Department. It is liked by the cultivators on account of its thick growth and heavy lint.

220. (3) **Size of holdings.**—About one quarter of the cultivators' land was under cotton a few years ago, but the abundance of grass in the field and difficulty in procuring labour for weeding have reduced it to one-sixth. The average area under cotton at present in each holding is not more than $1\frac{1}{2}$ to two acres in all. An increase or decrease in the cotton cultivation is partly due to the gain or loss of the farmer from the previous year's cultivation and partly to the increase or decrease in canal water. In the case of those who sow cotton in the beginning of the rains, the percentage of sowing largely depends on the nature of the monsoon, i.e., if the rains continue incessantly at the sowing time, the percentage of the acreage under cotton is decreased.

221. (4) **Yields and profits.**—Three years ago when the climatic conditions were suitable, the produce varied from five to seven maunds per acre, but now their unsuitability has reduced the produce to two maunds per acre. Here the crop being generally sown mixed with pulses and oilseeds, the cultivator is able to get a profit of Rs. 15 to Rs. 20 per acre, to meet his expenses.

222. (5) **Rotations and manures.**—Peas are sown after cotton. Cotton is generally sown in the fields of *bajra* and gram and no manures are applied.

223. (8) **Uses of seed and seed selection.**—The reason why seed is not found in any great quantity with the cultivators is that they dispose of the unginned cotton, and, in the sowing season, purchase it either from the bazaar or from the ginning factories, for the machine ginned seed is held to be better than the hand ginned seed. But a few clever cultivators who know that the machine ginned seed is partly cut down and at the same time is parched by the heat of the machine and that thus its germinating power is decreased, preserve a small quantity of cotton and gin it in the *churka* to get pure seed for sowing. Seed is purchased from the bazaar for feeding cattle, but it is never used for oil seed in this province. Cultivators here are not accustomed to select good seed for sowing.

224. **General.**—If the cultivation of the Aligarh White Flowered short stapled cotton is extended in this province, the existing mixed inferior quality will soon vanish, as the former variety is better in growth and quality.

(c) *Exotic cotton.*

225. (21) **Varieties.**—The Agricultural Department has been encouraging the extension of exotic cotton for the last three or four years, but no great success has been achieved, because the area under this cotton is still comparatively very small. In spite of its produce being nearly the same as that of *deshi*, the area under its cultivation has never exceeded three thousand acres in all in this district.

226. (25) **Conditions affecting increase in area.**—Ever since its spread the climatic conditions have not been favourable and therefore the cultivators could not hold a good opinion of it.

(2) There are some other causes which hinder the spread of this cotton. They are the following :—

- (1) There is a lack of water for irrigating the crop in the month of May, without which it proves a failure.
- (2) The crop remains longer on the ground than *deshi* and thus in *rabi*, peas, etc., cannot be sown.
- (3) The American cotton suffers more from boll-worm than *deshi*.
- (4) The difference in the price of long and short stapled cotton is not sufficient. It is only one rupee per maund and this goes away in ginning, etc.

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(5) Other crops, such as pulses, can also be grown in *deshi* cotton because its plant is not of great height.
(3) The experience of the last two or three years shows that if there can be any extension of Cawnpore American, it can be only in the following ways :—

- (1) The Canal Department should take an interest like that of the Agricultural Department in inducing the cultivators to grow American cotton.
- (2) The price of American cotton should be so high as to meet the loss to the cultivator, which results from his not being able to grow any other crop with this variety and by his inability to sow peas in *rabi*.
- (3) Cultivators of American cotton should be given some advances for two or three years to grow this variety as is done by the Opium Department.
- (4) The cultivators have generally not been given, so far, such facilities to dispose of their American cotton, as they ought to have been given in the early stages. The chief necessity is that the cultivator should not bear the cost of ginning the *kaps* himself, but he should be able to dispose it of unginned at any time. This can be done if there is increase in the number of customers.
- (4) The best seed of a variety of long stapled cotton, which does not remain longer in the field than *deshi*, should be distributed to the cultivators at reasonable rates at different farms, which should be opened at different places. The present system of distribution is very defective.
- (5) The price paid for the long stapled variety is too small and should be considerably increased.

II.—COMMERCIAL ASPECT.

227. (30) **Local trade customs.**—There are two sorts of buyers, who purchase cotton from the village people—(i) those who go to the cultivators' houses and get the whole quantity they hold and (ii) those who spread their blanket in the bazaar where the cultivators come and sell different varieties of cotton. In the latter case, the cultivators bring small quantities of cotton, which the customers (shop-keepers) go on mixing irrespective of the good or bad, dry or wet—whatever they bring. In both cases, the rate at which the purchase is made both of good and bad quality is the same and they manage to get the cotton from the cultivators by various mischievous tricks, by which the poor ignorant cultivator not only stands to lose, but is encouraged to bring adulterated cotton to fetch more money. If the agents of big firms were to purchase small quantities of pure cotton in villages it is possible that the dishonest customers might not get the chance of spoiling our cotton.

Mr. NARAIN PRASAD KURMI, called and examined.

228. (Mr. Henderson.) I possess thirty acres of land. I sow five or six acres with *kharij* (hot weather) crops. This year I have got four acres under American cotton. I have put $1\frac{1}{2}$ acres under *deshi*. On an average I put one-sixth or one-seventh of my land under cotton. American cotton is more profitable than *deshi*, but owing to the bad seasons, I have not been able to derive much profit from it. The yield is about one to $1\frac{1}{2}$ maunds per acre this year. This is due mainly to the rain. I cannot say what profit I should derive if the year were a normal one and there were no rain, as I have only taken to the cultivation of American cotton during the last three years and all those years have been bad ones. The yield was about four to five maunds per acre last year. I got a premium of Re. 1 over *deshi* cotton. I have got five pairs of cattle. I have also got a demonstration farm. There is very little American cotton grown in the plots surrounding my land. The reason is that the people are ignorant about American cotton. The Agricultural Farm has given me much help. It gave me implements and also seed.

Mr. CHIRANJI LAL BAGLA, Zamindar, Honorary Magistrate and Chairman, Municipal Board, Hathras.

EXAMINED AT CAWNPORE, NOVEMBER 5TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "*Deshi*" short staple cotton.

229. (1) **Experience.**—I reside at Hathras, Aligarh District, and have an experience of cotton of about fifteen years. Being a *zamindar* I have been in actual touch with cotton cultivators.

230. (2) **Varieties.**—There are two kinds of *deshi* short staple cotton, generally known by the name of yellow and white flowered. They contain two sorts of staple, rough and silky.

231. (3) **Size of holdings.**—A cultivator who holds about eight acres of land, usually reserves one-fifth or one-sixth part for the purpose of cotton sowing.

232. (4) **Yields and profits.**—The production of raw cotton is about six or seven maunds per acre. The net profit to the cultivator is estimated at about Rs. 25.

233. (5) **Rotations and manures.**—Fields of *deshi* short staple cotton are resown with barley, *chaina* and peas, and hence the cultivators prefer *deshi* short staple cotton to American, because the latter cannot be followed by another crop. The manure generally used consists of rubbish and cowdung.

234. (6) **Comparative returns.**—Long staple cotton should be more profitable than short staple cotton as the former can be sold at a higher price than the latter.

235. (7) **Conditions affecting increase in area.**—The fluctuations in the area under *deshi* short staple cotton in our tract are not great. In the case of any possibility of an increase, the *zamindars'* persuasion would limit that increase.

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[Continued.]

236. (8) **Uses of seed and seed selection.**—Cotton seed in our side is generally used as fodder but to some extent elsewhere oil is also extracted out of it. Its refuse (*khal*) is used as manure. Seed is selected for the purpose of sowing. The seed which has blue colour, a round shape and contains a yellow kernel (*migi*) is preferred. Hand ginned seeds are used for sowing.

237. (9) **General economic conditions.**—There is little or no hope that any improvement can be anticipated from the cultivators as they are generally uneducated and, therefore, I am of opinion that by the aid of the *zamindars*, good seed should be provided to the cultivators in order to obtain fine quality of raw cotton. They may also be requested to supervise manuring.

II.—COMMERCIAL ASPECT.

238. (30) **Local trade customs.**—There are cotton markets called *manlis* in every district where customers, both cultivators and others, import their raw cotton to a shop-keeper called *ararya* for sale and wherefrom the cotton merchants buy it for the purpose of ginning and pressing. There is no future contract system as is in Rajputana and the Punjab.

239. (31) **Standardization of commercial names.**—Raw cotton does not bear any commercial name here. Raw cotton coming from certain villages has different outturn ranging from eleven seers to sixteen seers, but in general the outturn is estimated at one-third of a maund and the value of it is fixed and paid on the outturn and is known in the market by the name of the village from which it comes.

240. (32) **Buying agencies.**—For the purpose of buying agency, I would recommend the establishment of co-operative societies at each centre of raw cotton-growing areas which would greatly improve the quality.

III.—STATISTICAL.

241. (33) **Improvement of cotton forecast.**—I would recommend that publication of the forecast may be done in each district monthly indicating therein the condition of the crop. It should be published at an early date before the cotton season commences. The public would be much benefited if it could be published in Hindi as well.

242. (34) **Improvement of other statistical information.**—The present system of obtaining statistical informations from factories appears to be quite sufficient.

243. (35) **Publication of Liverpool and Bombay prices.**—I am in favour that the Liverpool and Bombay cotton prices should be published in upcountry markets.

IV.—MANUFACTURE.

(a) Ginning and Pressing.

244. (36) **Type and number of gins and presses.**—I use single gins made by Platt Brothers and a press by Nasmyth Wilson & Co., Ltd. The details of factories and presses are given below:—

Hathras (Two factories)	80 and 40 gins.
Hardnagunj	30 gins
Hathras	Spinning Mills
Do.	Press.
Cawnpore	Press.

In addition to this, I am a shareholder in ginning and pressing factories at Kurja, Hapur, Chandausi and Rohtak.

245. (37) **Size of bale.**—The length of the bale is 49 inches, width 20 inches and thickness 17½ inches.

246. (38) **Saw gins versus roller gins.**—On our side we prefer roller gins as the saw gins spoil the staple. Saw gins had not been successful here. There were sixteen which were replaced by roller gins.

247. (41) **Condition of cotton.**—Bad qualities of raw cotton do come in the factories and the remedy I have pointed out in paragraph 240 above.

(b) Spinning and Weaving.

248. (43) **Counts spun and market.**—Generally our factory spins counts 10½s to 14½s and, in case of demand of lower and higher counts are also spun, ranging from 6½s downwards to 34s upwards.

249. (44) **Condition of cotton.**—Cotton of bad quality admittedly comes to the factories and if the remedy suggested in paragraph 240 above be adopted, the defect at present will surely be removed.

V.—GENERAL.

250. (46) **Allotment of buyers to improved cotton.**—In my experience, the buyers in the past have not offered a premium to encourage the growth of improved cotton.

VI.—IRRIGATION.

251. (66) **Watering of cotton.**—First watering is done at the end of April or beginning of May. It is about three inches and generally three or four waterings are required ranging from four to five inches.

252. (68) **Cotton versus wheat.**—Cultivators prefer wheat to cotton because the former is sown in the winter season when there is no fear of its being damaged by excessive rain whereas raw cotton is sown in the rainy season and there is every fear of its being damaged by excessive rain.

253. (72) **Adequacy of supply to increase in area.**—Owing to scarcity of water in canals, cultivators find much difficulty in getting sufficient quantity of water in time.

254. (73) **“Deshi” versus American cotton.**—*Deshi* raw cotton is followed by another crop of barley, *chaina* and peas while the American one gives no such advantage. Generally cultivators look to their present immediate gain, and are not willing to wait.

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Mr. CHIRANJI LAL BAGLA.

[Continued.]

Mr. CHIRANJI LAL BAGLA called and examined.

(Translation.)

255. (President.) I know Aligarh White Flowered cotton. The staple and quality are good but the ginning percentage is poor. The outturn of this cotton grown on the Agricultural Department farms is good because the seed there is selected seed, and the cultivation is done properly. The cultivators do not sow selected seed and their outturn is therefore poor. The average ginning outturn of Aligarh White Flowered is about 13½ seers per standard maund of *kapas* of forty seers. It goes up to sixteen seers. The method that I would venture to suggest to get over the difficulty of getting good seed for the cultivator is the establishment of seed farms run by co-operative societies. There is only one co-operative society in my neighbourhood. It is in Aligarh and I am one of the Directors. It would be a good thing to have more of them. These co-operative societies would gin the cotton and distribute good seed. They would give back the best seed to the cultivators.

256. The cotton forecast now published is a good thing but it should be published earlier. The forecasts are now published in August, October, December and February but I would suggest that these forecasts should be published every month and that the condition of the crop should be shown by districts. In order that the forecast may be beneficial to the public as a whole, it should be printed in the vernacular as well. As regards the returns from cotton presses and ginneries, I am of opinion that the submission of these should be made compulsory by legislation. Where there are pools, the reports are sent regularly, but where there are no pools, the reports are not regularly submitted.

257. The publication of Liverpool and Bombay prices in upcountry markets would be useful. At present every merchant gets private wires regarding rates from Bombay, but these are always treated as private and confidential. If the rates are published by the Government, it would benefit the cultivator as he would get to know all about them. The rates published will be for *ru* (ginned cotton) and the cultivators will have to calculate the price of their *kapas* on that rate. The *zamindars* sell their *kapas* through the commission agents, and if the prices are posted up, these *zamindars* or commission agents will work out the ginning percentage and, in consequence, the price of *kapas*. Of course, all the cultivators would not be able to work out the price of *kapas* from the rates and it would therefore be useful to the cultivator if he could get the price of *kapas* worked out when the rates were posted up in the market. As the outturn of *ru* (ginned cotton) varies, it would be difficult for Government, when putting up the price of lint, to put up the proper price for *kapas* as well. In these circumstances, it is doubtful if the publication of prices would be of much use to cultivators.

258. I buy most of my cotton in the United Provinces. It is all *deshi*. I spin mostly 12½s to 20s. I spin some cotton up to 34s with cotton that I buy from Broach. I have 120 gins at Hathras. I also own a spinning mill there. I gin my own *kapas*. In the beginning of the season, wet *kapas* comes to the factory which I get dried. When I get damp *kapas*, I make an allowance for it in the rates.

259. (Mr. Wadia.) This allowance is based on the percentage of dampness in the cotton. If I get *kapas* which has been picked in the morning and brought to me on the same day or the next day, then the *kapas* is damp. But if the *kapas* is brought to me three or four days after it is picked, then I always get it dry. In this part of the country there is no other kind of damping. Artificial damping is not resorted to. Such damping is done in Khandesh, Akola and in many other places in the south, but not here.

260. Sometimes *kapas* of good and bad qualities is mixed together. The top portion of the cart load of *kapas* is good, the middle is bad and the bottom worst. We fix our rates or prices according to the quality of the top cotton, but when we get bad in the middle or at the bottom we make an allowance for it. I buy very little *ru*. I buy mostly *kapas*. In the Punjab, the ginners buy the *kapas*, do their own mixing and then send it to Bombay. But in the United Provinces, the ginners do not do any purchasing business; they only gin on commission and charge their ginning charges. I think that we can only stop this mixing by co-operative societies buying the cotton and selling the *ru* themselves.

261. (Mr. Henderson.) I am a member of the Aligarh Co-operative Society. If Government distributed seed to co-operative societies, they would distribute it to cultivators. My co-operative society has not distributed any seed. It was established in 1913. The Agricultural Department is already helping cultivators by the distribution of seed. I am in touch with the work carried out by the Agricultural Department. If the Agricultural Department could supply as much seed as the cultivators want, the cultivators would take it in preference to seed sold in the local market. They would then give up buying seed in the market. If small shows were held on farms and prizes were given, it would be a good thing. I am in favour of demonstration plots and small sub-stations scattered all over the districts. The cultivators would take advantage of them.

262. (Mr. Roberts.) I would like to see longer staple cotton grown. At present I find it difficult even to spin 10s with the present cotton. My production is very much less than it would be if the cotton were improved. I get some staple cotton from the Punjab (Lyallpur), Khandesh, Berar and Akola. Short staple I purchase from Chandausi. I buy at Lyallpur by sending my own man there, who gets in touch with commission agents. Messrs. Lakshmi Chand Mohan Lal of Kasur are my commission agents. I have been buying for four years at Lyallpur. There are two kinds of cotton from the Punjab, one is the Punjab *deshi* and the other is known as American. I have only purchased the Punjab *deshi*. I have not purchased Punjab American. As to whether I pay a better price for that cotton in comparison with the cotton here, I should say that I pay slightly more for Punjab cotton than for United Provinces cotton as the quality is slightly better. I only buy ginned cotton from the Punjab; I pay very slightly more than here in Cawnpore. I have bought American cotton in Cawnpore. I purchased it for 34s counts, but I only spun 24s out of it. I bought it last year. I paid Rs. 42 per maund at Cawnpore. The price of Cawnpore *deshi* was Rs. 36 at the time.

263. (Mr. Hodgkinson.) I spun 24s out of the American cotton that I purchased. I had it spun on ring frames. Its strength was 50 lbs.

264. I consider saw gins useless. My uncle originally imported fifteen saw gins. He has four left which are not working. They cut the staple of the *deshi* cotton. I prefer single to double roller gins. The price of the latter is double that of the former while the production is only one-and-half times that of the single roller gins. Even where there is a pool, the sum paid into it for double roller gins is one-and-half times that paid for single roller gins.

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Thakur NIRANJAN SINGH.

Thakur NIRANJAN SINGH, Zamindar, Mahmoodpur, United Provinces.

THIS WITNESS WAS NOT ORALLY EXAMINED.

Written statement.

I.—AGRICULTURAL EXPERIENCE.**(a) and (b) "Deshi" cotton.**

265. (2) **Varieties.**—In the districts of Aligarh and Etah (United Provinces) in which I know some thing of cotton cultivation, white flowered cotton mixed with yellow flowered was mostly sown formerly. Thereafter some people began to sow white flowered cotton separately and it was called *bakandi*. *Bakandi* cotton being richer in *rui* was given preference by the Agricultural Department, and on account of this virtue, a higher price was offered for it. The *baniyas* also were willing to take it at an increased price, and thus it became popular with the cultivators, and now white flowered cotton is seen in the field almost everywhere.

266. (3) **Rotations and manures.**—As the *deshi* cotton crop ends before winter, barley and peas can be grown easily for a second crop. Sometimes ordinary manure is made use of, but it is not generally so, nor it is necessary. *Deshi* cotton surpasses American and *buri* cotton in produce; also the former requires less labour and time comparatively.

267. (7) **Conditions affecting increase in area.**—In the recent years the cotton area has extended. The reasons for this are as follows:—

- (i) Before this time indigo was the predominant agricultural industry and it was all of a sudden supplanted by artificial indigo.
- (ii) The sugarcane industry has been suppressed by foreign sugar. Scarcity of rains and *dimak* have also been among the causes of its decline.

(2) Now the only thing left to the cultivator, as a source of income, was cotton. But for the last two years both sugarcane and indigo have revived slightly, and these have, to some extent, proved rivals to cotton. Indigo is more desirable, as it is more profitable, being a costly product, and its crop is a strength to the next crop, wheat, etc.

268. (8) **Uses of seed and seed selection.**—Cotton seed is used for feeding cattle, and it is also transported for the same purpose; perhaps it might be used for oil also. No selection of seed in particular is made. Ordinarily, the cultivator keeps apart the best bloomed cotton, and its hand ginned seed is used for sowing. This seed is preferable to factory ginned seed.

(2) Cotton is usually sold wet and the *baniyas* collect it in heaps without exposing it to the sun; this spoils the seed and the fibre, and the former is also rendered unfit for sowing on account of its internal heat and want of air. The cotton left to dry well before it is collected in heaps, will give us the best seed even if factory ginned. I say this from my own personal experience.

(c) Exotic cotton.

269. (20) **Experience.**—I have been personally in contact with cotton cultivation, both with my own cultivation and that of my neighbours and peasantry in my villages in the districts of Etah and Aligarh, for the last fifteen years.

270. (21) **Varieties.**—American cotton used to be almost equal to the produce of that of *deshi* cotton. As long as the Agricultural Department guaranteed to purchase the produce, the cultivators gladly used to sow it, also because the price offered was somewhat higher than that for *deshi* cotton. All of a sudden, the Department refused to purchase it in the year in which it was sown on a very large scale. Also it did not undertake any other measure to get it sold otherwise for the cultivators. This gave a very great shock to the cultivators and they got very discontented and disappointed. As it was not so rich in *rui* as *deshi* cotton, the *lanias* were not slow to take advantage. They offered a low price and succeeded in getting it at that price. Since then, it has practically been put a stop to.

(2) In this quarter, it was myself alone who continued it. I used to sell it mixing it with *deshi* cotton. Meanwhile, seed selection was also made. Some years later, the Department again felt the necessity and took up the question of its cultivation. I was requested to supply cotton for seed. The cotton supplied by me gave satisfaction to the Department. It was given the name of Mahmoodpur American cotton. The cultivators were requested to cultivate it and some of them acceded to the request.

(3) After that Dr. A. E. Parr recommended to me *buri* cotton and asked me to try the experiment. Accordingly, it was sown in an acre or two and its produce proved more profitable than *deshi* cotton. That year cultivators of the vicinity saw it in the field, and the Director of the Agricultural Department, accompanied by the Deputy Director, also travelled to visit the spot and expressed their satisfaction. Next year, cultivators too tried it and its produce, though not so good as that of the former year, on the whole was successful. In the third year, it was attacked by a disease (leaf-roller) and it badly affected its produce. Thenceforward, the disease has continued and has lessened the produce. For the last two years, *buri* has greatly declined, and it is due partly to this disease and partly to abundance of rainfall. American cotton was stopped for danger of its being mixed with *buri*. I hold that the crop will be successful in a dry season and that lateness and abundance of rain will destroy it. It was only one year that *buri* surpassed *deshi* cotton in produce, otherwise it has never equalled *deshi*. After *buri* or American cotton, nothing can be sown for the *rabi* (winter) as the picking season lasts so long.

271. (24) **Rotations and manures.**—In my opinion, no manure is required for *buri*. The experiment shows that the crop in a manured field was attacked by disease more severely. It is found that this crop is very successful in a field which has yielded one other crop with manure previously.

272. (25) **Conditions affecting increase in area.**—*Deshi* cotton is largely liked for the reason that it is sown at the middle of *Jath* (May-June) whilst *buri* is sown at the middle of *Chait* (March-April). During the two months of summer, labour and water supply are very much needed. Secondly, *deshi* cotton picking is finished before winter and *buri* continues to bloom through winter. In this way the expenses of its picking and watching have to be borne for two months more. Even then its produce does not equal that of *deshi*.

(2) *Deshi* cotton allows barley and peas for the second crop which is not possible in the case of the other. The disadvantages are not amply made up for by the nominal increase in price granted in the case of *buri* Cotton by the Department. Moreover, the way in which it is purchased is not favourable.

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273. (27) **Prevention of mixing of different varieties.**—I do not think that American cotton is sown mixed with *deshi*. When the cultivators feel inconvenience in selling the former pure they resort to mixing it with *deshi* to obtain a fair price, as the market prefers *deshi* cotton. This can be prevented by contriving such means as to reduce the price of the mixed cotton to the least and direct factory-owners not to gin mixed cotton without getting it separated. There will be no difficulty in managing it as the exotic cotton is very different from *deshi* in appearance. *Deshi* long stapled cotton is not produced here. It will be still better if particular factories are kept for dealing with exotic cotton only, as it is also notable that, on account of its seed being bigger in size, exotic cotton cannot be ginned in every factory. This being done, seed will be saved from being injured and *rui* being spoiled.

274. (28) **Importation of seed.**—I consider it is advisable to import seed for trial. It is probable it might be free from the disease called leaf-roller, as the experience shows there was no such complaint in the first two years, when we got the seed fresh imported. Increase in produce was also noticed.

275. **General.**—Facilities should be offered in the way of cotton cultivation. Suitable arrangements should be devised for water-supply in the summer. Remedies for disease should also be introduced. Sympathy and encouragement, and not prestige and influence, should be foremost in the minds of those dealing with the cultivators. Business capacity, and such tendency, and not the power of control and authority, should be the qualification for officers appointed for the task, if cotton cultivation is really to be improved. Labour should be amply paid. Facilities should be placed in the way of the cultivators to sell their produce.

(2) Exotic cotton is mostly sown in rows, and, for this purpose, the Department should undertake to supply machines for weeding, as labourers are not easily obtainable in these days.

Machines should also be introduced for watering fields on higher levels, as experience shows that the produce is more successful in fields of high level where rain water does not stay long but flows away just after rainfall, while the crop on low-land fields have utterly failed.

VI.—IRRIGATION.

276. (65) **Experience.**—The villages in my possession are mostly irrigated by the Upper Ganges (anal (Aligarh Division) and by the Lower Ganges Canal (Narora Division). Generally wells supply water for fields of cotton cultivation, and in some places oil engines have also been lately set up.

277. (66) **Watering of cotton.**—Exotic cotton is sown two months earlier and consequently it requires longer water supply.

278. (67) **Cotton versus wheat.**—Wheat is preferred to cotton, because the former requires watering only thrice. There is abundance of water supply in the wheat season, and besides, it does not require so frequent watering as cotton. In the cotton season canals work by turns, and its *qulabas* do not supply the demand sufficiently, as the canals are not granted the desired quantity. Wheat can be grown with personal labour alone, but cotton cannot be produced without the help of neighbours and labourers, because cultivators have to depend upon others for its frequent weeding out. Well irrigation is insufficient for exotic cotton as the water supply, by ordinary methods, is very short. It will be very profitable for the cultivation of exotic cotton if engines are set up at big wells to irrigate the area. In my opinion it will prove even more helpful than canal irrigation, because it can be controlled as desired. But it is not for every well and every cultivator that this is suitable. The cultivators can neither bear the expenses nor can they repair the engines. The only suitable method for its working, as far as I can see, is that the Agricultural Department should undertake the responsibility and manage its working through its engineers. The cultivators should have nothing to do with it except that they should be charged moderate water rates.

279. **General.**—Small canals that irrigate exotic cotton area should be granted enough water supply, and no *qulabas* (sluices) of less than six inches should be kept within the area of exotic cotton. *Buri* cotton cultivators may be provided with new *qulabas* (sluices). The water rates cannot be said to be higher on cotton when compared with other crops, still I think it will be very helpful to allow special concession for exotic cotton. Chain pumps and other machines may also be set up on canals by the side of the *qulabas* (sluices), wherever desired by the cultivators.

II.—Central Provinces.

Sir FRANK SLY, K.C.S.I., I.C.S., Commissioner, Nagpur Division, Central Provinces.

EXAMINED AT NAGPUR, NOVEMBER 4TH, 1917.

Written statement.

280. (*Preamble.*) I was Commissioner of Settlements and Agriculture in the Central Provinces from 1901 to 1904, during which period I was responsible for the very small amount of agricultural improvement work attempted before the organization of a separate Department of Agriculture. From 1904 to 1906, I held the post of Inspector-General of Agriculture in India, my principal work being connected with the organization of the separate departments of agriculture. I was Director of Agriculture in the Central Provinces in 1907-8, and then became Commissioner of Berar, one of the most important cotton tracts of India, which appointment was held by me until 1912. For the past six years, I have been out of touch with cotton cultivation and with the work of the Agricultural Department, and had decided in consequence not to submit any memorandum to the Indian Cotton Committee, but at the special request of the President, I record the following note, which I confine entirely to the question of the possibility of introducing a long staple cotton in the Central Provinces and Berar.

281. **Attempts to introduce long staple cotton into the Central Provinces and Berar.**—For the past fifty years, attempts have been made to substitute a better grade cotton for the varieties usually grown in this tract, and all have ended in complete failure. From 1866 to 1871, there was a special cotton department in charge of a Cotton Commissioner, which endeavoured to introduce American and Egyptian varieties. These were tried at cotton farms in charge of European gardeners, but were abandoned as a hopeless task. An occasional American cotton plant, known as Upland Georgian, still found in cotton fields, is the sole survival of these efforts. Attempts were also made to extend the cultivation of the indigenous varieties;

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and special efforts were made to popularize the best local variety known as *bani* in the Wardha district and by different names in other parts. These efforts to spread the cultivation of *bani* also failed, for the cultivators found it more profitable to grow coarser varieties. By the irony of fate, the result of these measures was to bring into general popularity still coarser varieties of heavy yielding capacity, which are believed to have first been brought from the Nerbudda valley and to be the origin of the varieties now classified as *roseum* and *roseum cutchica*. A full account of these measures will be found in an article in the Agricultural Journal of India for April 1907 (Volume 11, part 2). The subsequent history of general cotton cultivation has been the steady ousting of *bani* by the mixture of coarser varieties, generally known as *jari*, until the former is now grown only as a partially pure crop in the more distant and isolated tracts above the southern ghats of Berar and even there is rapidly disappearing with the spread of the more profitable *jari*. Later attempts have been made on the Nagpur farm and elsewhere to test American and Egyptian varieties and also better staple cottons from other parts of India, but all have ended in failure. At one time there seemed a small hope of success for Egyptian cotton under irrigation, but this hope had to be abandoned. Acclimatized American varieties, known as Upland Georgian from the Central Provinces, *buri* from the Sonthal Parganas and Cambodia from Madras, which seemed more hopeful than newly imported seed, have also been fully tested and have failed. During my service in Berar, a considerable effort was made to introduce *buri* into general cultivation, partly because it was likely to suit the heavier soils and partly because it was resistant to the cotton wilt disease, and cultivators were induced to sow it in a few thousand acres, but abandoned it after a fair trial. It was also found that the fibre of these exotic varieties gradually weakened and deteriorated. The recent work of the provincial department of Agriculture is rapidly resulting in the disappearance of the less coarse varieties in the mixture known as *jari*, and the substitution of pure *roseum*. The rapidity of this change is evidence of its popularity with the cultivators and the increased profits that it has put into their pockets.

282. *Causes of failure.*—I now proceed to give my views as to the causes of these repeated failures to improve the quality of the cotton, prefacing them with the remark that I have no scientific knowledge of agriculture. The ultimate fact is that it has hitherto been impossible to find any variety of long staple cotton that can approach the coarse variety as a profit-producer. *Bani* is a light yielder with a ginning percentage of 26 per cent. as compared with the heavy outturn of *roseum* with its ginning percentage of 39, the result being that the yield of lint from *bani* is only half that given by *roseum*, and the difference of price on account of the superior quality covers only a small fraction of this difference in yield. American varieties and long staple Indian varieties have informally failed to give any favourable result. The rainy season is restricted to about 3½ months and the growing season to about five months. In the stiff black soil of the cotton tract, the plants suffer from excessive moisture and water-logging during the rainy season, checking their growth, and a break in the rains with a spell of hot sun causes substantial damage. The growing season is too short to allow them to come to full maturity and, consequently, the yield is small and the fibre weak. So far as my experience goes, long lint means a long growing season, and this cannot be secured under the ordinary conditions prevailing in the Central Provinces and Berar. Experiments in the breeding of new varieties have hitherto not succeeded in producing a cotton of long staple with early maturity and a good yield. Until science is able to solve this problem of combining the qualities of long lint, early maturity and good yield, there is no prospect of securing a long staple cotton suitable for this tract. It is not for me to say that the problem is insoluble, but until it is solved, I have no doubt that the policy of the Provincial Department of Agriculture in providing pure supplies of the coarse heavy-yielding *roseum* variety has been in the best interests of the cultivators and has added greatly to their material resources.

283. *Prospects of long staple cotton under irrigation.*—There is one new factor that has to be taken into account, which is the construction of irrigation works. These have generally been undertaken as protective works against famine in the rice tracts, where cotton is not usually grown. The stiff black soil of the cotton tracts is not well adapted to irrigation, and I do not believe that there is any future for irrigated cotton in these tracts. As stated above, experiments on a small scale on the Nagpur farm failed. Most of these irrigation works depend on storage in reservoirs, and there is not a supply of water available at the end of the hot weather for use in advancing the sowing season before the start of the monsoon, and irrigation after the close of the monsoon is not very suitable for cotton in black soil, which is tenacious and not well drained. Experience seems to show that finer lint is produced from the same cotton grown on light soils than on heavy soils. There remain the light porous lateritic soil of Chhattisgarh (known as *bhata*) and the light sandy soil of Chanda, which are suitable for irrigation. Owing to labour requirements it is difficult to combine cotton with rice, and I doubt if there is much hope for irrigated cotton in Chanda. In Chhattisgarh, the trial of irrigated cotton on the *bhata* ridges has, I believe, been successful in three years out of four, the fourth being a failure on account of insects. This seems promising enough to continue the trial of long staple cottons, but I doubt whether there is much prospect of any substantial area of long staple cotton, even if trials confirm its possibility, owing to the sparsity and character of the cultivators.

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284. (*President.*) I have had a long experience of these provinces. I am of opinion that the present policy of the Agricultural Department in pushing *roseum* is sound. Judging by past experience of exotia and long staple cottons, I consider there is no ground for hope of their success unless the Agricultural Department can produce a long staple cotton that has the combined qualities of early maturity, good yield and high ginning percentage. Although experiments have been going on for the past fifty years, that problem has never been solved. The province has never had a botanist working on cotton as his principal subject. The Agricultural Department, however, tried experimentally a very large number of American cottons, as well as long staple cottons from other parts of India and have examined botanically the cottons grown in the province. Some years ago, when I was Director of Agriculture, hundreds of varieties of cotton were tried but they all failed. The experiments were conducted under the supervision of Mr. Mollison, who was then Inspector-General of Agriculture, and Professor Gammie, the Imperial Cotton Specialist, who visited the province on several occasions and gave us a lot of advice. The only line of work on the botanical side which the Provincial Department has not pushed to its logical conclusion is hybridization. A good deal of hybridization was done in the old days by the agriculturists before the province had a botanist, but it failed to produce any variety of cotton of any value. I should not like to go so far as to say that all scientific possibilities have been exhausted. I am not a scientist, and whether the problem is soluble or not, I cannot say, but in the Central Provinces hitherto it has not been solved. So far as I am aware the botanist in this pro-

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vince, Mr. Graham, has not devoted very much attention to cotton, but has been employed more on other crops. Whether there is any chance of the problem being solved by a botanist is a matter for decision by scientists. It might be advantageous to get a botanist to take up the problem as a separate subject if it is considered by botanists that the problem is capable of solution. I am not an expert on cotton; but I believe that long staple cottons are almost invariably coincident with a longer growing period. In my opinion you cannot get a longer growing period in the Central Provinces than at the outside five to five and-a-half months. If there is a reasonable chance of growing long staple cotton with a good yield and high ginning percentage successfully within a growing period of five to five and-a-half months, then I think it would be worth while to go on with the problem, but not otherwise. As far as I know, this has not been found possible in any other part of India. The staple of *roseum* apparently suits a particular market. For several years past, I have not been in touch with cotton problems, but some ten years ago, we made enquiries into the point and found that a substantial part of the coarse cotton of the province went to the Continent of Europe, and was there, I understood, used not for the manufacture of cotton goods but for admixture with wool for the manufacture of coarse fabrics consisting partly of wool and partly of cotton. On that account, it had a higher value of its own than it would have had purely for cotton goods. There certainly was a steady demand for it. It was mainly required for export and, so far as I could trace, went mostly to the Continent of Europe, to Germany and to France. In the interests of the Indian cultivators, it is very undesirable to stop a profitable crop, a crop that is more profitable than any long staple cotton yet tried. If the statistics for this province are examined, as I have stated in my written evidence, it will be found that the outturn of *roseum* in lint is practically double that of our long staple *bani*. The price that *bani* fetches is nothing like double but only a small premium over *roseum* in the local market.

285. I cannot say much about the experiments carried on by Mr. Clouston at Chandkuri, for I have not seen them, but what I would like to put before the Committee is that, even assuming that these experiments are thoroughly successful, and it is found that long staple cotton can be grown, and profitably grown, on the laterite *bhata* soils of Chhattisgarh, it is still a very long step between that and the production of a long staple cotton in any substantial quantity in Chhattisgarh. There are several reasons for this. In the first place, there is the character of the Chhattisgarh cultivator. I was stationed in Raipur for several years and know him. He is not an enterprising cultivator and his cultivation is not of a high standard. On the other hand, his wants in life are comparatively small. Until about thirty years ago, Chhattisgarh was a landlocked tract with no rail communications, in which food grains were ridiculously cheap, and in which it did not pay in a good year to cut some of the crops which were left to rot in the field. The standard of living there was very low. With the opening of the railways, the cultivators have had a very prosperous time and the difficulty has always been to get them to take up any new crop even if it had big money in it because they already had sufficient to meet their needs. Some irrigation projects have now been constructed in Chhattisgarh. If these canals are to be a success, there must be a much larger population in the tract than there is at present. If unirrigated rice is to be irrigated and broadcast rice is to be transplanted, it must mean a very large increase in the labour supply of the country. Rice is popular with the ryots and for many years their attention will be directed more towards the improvement of rice cultivation than to the introduction of a new crop like cotton. The labour question in Chhattisgarh is a very big one. I think that progress will be very slow, because the labour is not there to grow irrigated crops and secondly, because the cultivators are so well off under the present system that they will not take to intensive cultivation as in more highly populated tracts in north India. As to the possibility of success with long staple cotton, I think that, so far as the true cotton tracts are concerned, there is no reasonable possibility of success, unless the scientist can produce a cotton with the qualities I have mentioned. In Chhattisgarh, even if a long staple cotton can be successfully grown on the *bhata* soil, it will take a very long period of years before any very large quantity of it can be obtained.

286. As to the value of an Imperial Cotton Specialist, my own view of that question is that the appointment of the Imperial Cotton Specialist was probably justified when it was made because very little was known about cotton in India at that time and it was desirable to have an officer whose special attention was directed to it, but, at the present stage of development, I doubt whether there is much advantage in the appointment of one specialist. The problem seems to me to be too diverse in the different parts of India and the area too large for any one man to be able to control and the money that is spent on the Imperial Cotton Specialist could, in my opinion, be spent to better advantage on separate botanists employed in limited areas, each working in his own charge. I think we have passed the stage when there is any great advantage to be derived from one Imperial Cotton Specialist who is a botanist.

287. As regards the suggestion that a committee should be appointed to direct cotton operations for the whole of India, my own impression is that you will get much better value for any funds that are available by employing additional botanists or additional agriculturists in the provinces than by centralization. So far as the co-ordination of the work of these men is concerned, I am not at all sure that any co-ordination is necessary or that it would be advantageous. Each province has its own problems in connexion with cotton cultivation and each province is desirous to do its best to solve these problems. I am inclined to favour provincial development, but I do not thereby mean that the various staffs should be provincial but that development should occur in the cotton growing tracts by specialists stationed in those tracts, each working out his own particular problems rather than by a centralised staff. In that case, I do not think that the appointment of an Imperial Cotton Specialist or of an Advisory Committee would be advisable. More value would be got out of the same money if it were put into the cotton tracts in the provinces.

288. The Industrial Commission is, I believe, considering a scheme for centralising the staff of scientific men in India. The scheme that was put before me for my opinion was one which involved taking chemists out of the Agricultural Department and centralising them in a big research institute for chemistry. I believe there is a similar scheme for botany. It is undoubtedly a fact that at present the scientists of the Agricultural Department in the different provinces are isolated and have no real directing or co-ordinating agency for their own special branch. Whether it would be desirable that all botanists should be placed in one department with a Director of Botany at the head and Deputy Directors for particular branches, is a very large question. It has very decided advantages. I should say that one of the essential conditions, on which the Agricultural Department would have to insist if it participated in that scheme, would be that certain posts in each province should be filled and that the men appointed to those posts should be left in the province for a minimum period of, say, ten years, unless for any particular reason the province desired to change. I think it would be detrimental to the work of the Agricultural Department if all the present scientists on the staff were taken wholly out of the control of the Provincial Governments and were liable to

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be sent here and there in different parts of India on short jobs, but if a condition were secured that each province should have a staff which should remain in that province for a substantial period of years, say, a minimum of ten years, without change unless the province desired it, I think that that would fairly well meet the needs of the Agricultural Department and at the same time it would get considerable advantages in the matter of direction.

289. (Mr. Wadia.) I was in Berar for five years and I used to see a good deal of the cotton ginning factories. I know that there are pools amongst the factories. My impression was that they were detrimental to the interests of the cultivator, that they were formed wholly in the interests of a ring of ginning proprietors, that they kept up the rates substantially higher than were necessary to cover the cost of ordinary ginning, and that they had the disadvantage of increasing the number of gins hopelessly out of proportion to the real requirements of the tract. In a small town in Berar, there were several ginning factories to do the work which really one ginning factory could have done ordinarily. Cases occurred in which a gin was put up solely with the object of sharing in the profits of the pool, and never worked from the day it was put up. It had to be let into the pool but never ginned a maund of cotton. A system of working licenses would have to be coupled with conditions regulating monopoly. There would have to be fixed rates if a monopoly was granted. I personally would like to see all these pools smashed if it were possible to do so. The only trader who ever took any action in that line in Berar was Ralli Brothers and they endeavoured to smash the pool by refusing to come into the pool and ginning at a lower rate. The result of their action was that they experienced great difficulties in the buying of cotton; the rest of the trade combined against them, and put every difficulty in their way in the purchase of cotton. I think that, in the end, Ralli Brothers had to give way to the extent of promising that they would only gin the cotton that they bought for themselves. The exorbitant profits which the pools make for division amongst themselves must of course come in the end out of the cultivator's pocket. Whether this monopoly should be stopped by legislation or something of that kind is a very big question, which I should not like to answer without consideration. The suggestion involves a serious interference with public trade, and would create a monopoly in favour of licensed ginning factories though abolishing pools. It might stop the present evil, but it would create a monopoly in favour of licensed ginning factories. It would meet some of the evils of the present system, but whether it would have greater evils itself, I cannot say. It is a very serious interference with the freedom of trade.

290. I am afraid I cannot say whether the ginning and pressing factories send their weekly and fortnightly returns regularly in due course because I am not in touch with that question. If difficulty is experienced in getting the returns regularly from ginning factories for statistical purposes, I can see no objection whatever to requiring them by legislation to submit such returns.

291. When I was in Berar, I saw a tremendous lot of damping of cotton. You could go into a pressing factory and see a hose pipe playing over the heaps of cotton. I believe that even respectable firms deliberately watered cotton. It was the common practice in a large number of pressing factories. This was about 1906—1908. If it was clearly proved that watering was done at factories and a system of licensing were adopted, it might be made a condition if fraudulent practices were proved, that the license should be withdrawn. We made a certain amount of enquiry when I was in Berar into this damping of cotton. The main difficulty was to fix the responsibility for it. The pressing factories in Berar bought a certain amount of cotton on their own account; they also pressed cotton belonging to other people brought to the factories. The question arose therefore as to whether it was the ginning factory or the owner of the cotton or some one else who was responsible for the damping. I have not seen ginning factories damping the cotton. When cotton arrives at Bombay and is found to contain an excess percentage of moisture, the question will arise as to who is responsible for having damped it. Another considerable difficulty that would arise would be in fixing a percentage of moisture by statute. So far as I recollect, when the question came up, experts said that it varied considerably. It would therefore be necessary to fix a fairly high percentage to cover exceptional cases and this would permit addition of moisture. Finally it was considered that the trade had the remedy in their own hands if they only liked to enforce it. If the trade were prepared to accept and co-operate in such a measure, it might be a good thing to establish a testing house on the lines followed at Havre. I see no *prima facie* objection to such a course, but the question is one for the trade. The difficulty in regard to a penalty enforced by law is very much greater than in regard to a penalty connected with the failure or breach of contract. The Cotton Trade Association of Bombay manage for themselves without legislation. The proposal now suggested for consideration is that a law should be passed making it a criminal offence to possess cotton above a certain percentage of moisture. My opinion is against it. Even if instead of making it a criminal offence it were enacted that the license should be taken away, there would be very great difficulties in the way. Why should not the trade exercise the absolute remedy that they have in their own hands? If the Bombay Cotton Trade Association were to provide penalties in contracts for moisture above a certain percentage, that would be a more satisfactory solution of the problem.

292. As to the mixing of poor varieties of cotton with better ones in Berar, in my time, there was only the common variety known as *jari*, which itself is a mixture of varieties but it is not a mixture in the trade sense of the term. Above the *ghats*, a fair amount of *bani* was grown. It was mixed with *jari* in the field to a certain extent and there was also adulteration after the crop was picked. There was a distinct mixture of varieties in the ginning factories. Sand was not mixed with *bani*, only a proportion of coarse cotton. The fine *huri* that was produced in the field where it might be fairly pure was adulterated by mixture with a certain amount of coarser cotton. The result was the mixture of seed and the crop deteriorated in a few years.

293. I am really not a very great expert in the cotton business but there was one striking feature which I noticed in Berar and that was that the marks of different stations had different values in the Bombay market. For instance Khamgaon cotton with Khamgaon railway station mark had a higher value than cotton from markets higher up the line and so, at Khamgaon, I have seen carts that had come in all the way from Hyderabad State, travelling by road over a distance of a hundred miles, in order that the cotton might be disposed of at the Khamgaon market instead of being taken to the railway station in Hyderabad that was not more than fifteen miles from the place where the cotton was grown. I was told that this was due partly to the higher value of the cotton in the Khamgaon market and partly to inefficient arrangements in the local cotton markets.

294. The question whether you could prohibit by law the transport of cotton by rail except in fully pressed bales is one I have never considered, and I would not like to give a rash opinion about it. As to preventing the mixing of cotton, the question seems to be whether the trade has not got the remedy in its

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own hands. I would not advocate anything on the lines of the old Bombay Act. From what I have read on the subject, it was a complete failure. The abuses of such a system would be greater than the advantages that would accrue.

295. I have never examined the question of an export duty on cotton. So far as I have given any thought at all to subject I can see no *prima facie* objection to a small export duty on cotton. I understand that there are considerable practical difficulties connected with the levy of such a duty. So far as the Central Provinces are concerned, I do not consider that a small export duty on cotton would be open to any great objection.

296. (Mr. Hodgkinson.) As to the question of bridging over the gulf between the time when long staple cotton is grown in small quantities until such time as it could be grown in commercial quantities, I am sorry that I cannot express any definite opinion. That problem has been considered by the Agricultural Department for a considerable number of years. Two or three different plans have been considered in considerable detail, but I am not in touch with the actual results of the trials of these. There is the system of auction managed by Government; there is the system of giving a small premium to the cultivator on long staple cottons; in another province a co-operative system has been tried. I cannot give an opinion as to which would be the best system and I doubt very much whether you could get a solution for the whole of India. It is a problem which should be worked separately out for each province.

297. There is one question which I might possibly mention and that is the question of railway freights on cotton. A few years ago there used to be an extraordinary anomaly in regard to rates of freight of cotton from the Central Provinces. Cotton from Nagpur was carried to Bombay at a lower freight than cotton from any other place lower down the line. In Berar, the people considered that they had a distinct grievance against the railway as higher rates of freight were charged for considerably shorter leads. It was cheaper to rail cotton from Wardha to Bombay *via* Nagpur than to send it direct from Wardha. It was the rates of one railway only that were concerned.

298. (Mr. Henderson.) Chhattisgarh and Chanda are not the only two districts where the extension of irrigation is possible. There are other districts where there has been considerable extension of irrigation in recent years and where extensions are contemplated. There is the Waingunga canal in the Balaghat district, but this is a purely rice tract and the land is hardly suitable for cotton. I mentioned Chanda and Chhattisgarh because these were the most favourable districts for cotton. In Bhandara there is a good deal of irrigation, but it is purely a rice tract. *Bhata* is a term for the lateritic muram soil that prevails on the high ridges in Chhattisgarh. The soil which is actually under irrigation is a substantially better soil. At the bottom of the valley in Chhattisgarh, you get a rich black soil; higher up the slopes, the soil is mixed black and red until at the top of the ridges you get pure gravel. The lower soils are much enriched by particles from the upper soils. In Chhattisgarh and Chanda, the type of cultivator is much the same, but the type of land is entirely different. The great difference between the two is that Chhattisgarh has a lateritic soil whilst the greater part of Chanda is of crystalline formation. The character of the cultivator and the scarcity of population are great drawbacks to the development of the country, but it is not possible to remedy these defects by colonization. There have been several attempts at colonization in this province, but none of them has ever been a substantial success and as the result of past experience the policy of Government is not to undertake any colonization scheme on a big scale but to trust to immigration without Government assistance and the natural increase of population in the tract. There are substantial tracts in Chanda at present under forest which are irrigable. They are being taken up at a fairly satisfactory though slow rate of progress. In Hoshangabad district, we tried to colonise a particular tract and brought down cultivators from the United Provinces but it was not a success. I do not know that there would be any objection to land being taken up by a company to grow cotton on a big scale. Such a measure has never been contemplated in this province. The only parallel that I can mention is certain areas which are set aside in the Chanda district under irrigation for sugarcane companies. For reasons which it is unnecessary to enter into, the efforts made in this direction have hitherto not proved successful.

299. As regards tree cotton, it was once tried on a substantial scale but proved a hopeless failure.

300. As to growing Cambodia cotton on irrigated land, it must be remembered that the experiment in Chhattisgarh is still young. It has been going on only for four years. In one year the crop was wiped out by insect disease. You still require to test whether *bhata* land is going to be productive under continuous cultivation. The point to be remembered with regard to Chhattisgarh is that there is not merely an agricultural but also a very big economic problem. As to whether *bani* means almost anything with a long staple, my experience of Berar was that though *bani* was substantially mixed in the field, it was a particular variety. The figures in my written evidence were based mainly on experiments carried on by the Agricultural Department to test *bani* as compared with ordinary *jari*. The tests were carried out only on the agricultural farms but all the cultivators would tell you exactly the same thing. As regards to the list of purchases given by Sir B. Mehta in which he classifies his cotton as *jari* and *bani* and according to which the ginning percentage of *bani* rose as high as 34 per cent., and his statement that he has bought *bani* with a ginning percentage of nearly 35 per cent., and that this was pure *bani*, I can only say that the ordinary ginning percentage that was obtained on the Government farms from a pure selection of *bani* was 25 per cent. The ordinary name of *bani* in Berar is *ghat kapas*, and it is the only remaining part where fairly fine cotton is still produced. From the percentage given by Sir B. Mehta, I should imagine that there must have been a very substantial mixture though he may be quite satisfied that it was pure *bani*. As to whether it would not be worth while to make further investigation in regard to the *bani* types, the question has been under investigation for fifty years off and on starting with the time of the Cotton Commissioner and finishing with Mr. Clouston, and the unanimous opinion has been that if you want to get a long staple cotton for the Central Provinces, you must get something very much better than *bani*. The cultivators will not grow it. In the past the Central Provinces had a very fine reputation for its excellent cotton which is now practically lost. It must have paid the cultivators to grow such cotton in the past, but now it does not pay to anything like the same extent as the coarse variety at present. The finer varieties were pushed in the past not because, at that time, the coarser varieties brought less profits but because the coarser varieties were unknown at the time. With the extension of the railway, the coarser varieties have been introduced. As far as one can gather from the records, *roseum* was introduced by the Cotton Commissioner in the seventies from the Nerbada Valley, and ever since it has gone steadily ahead. Mr. Clouston's work has consisted in getting it pure instead of its being grown as a mixture with other varieties. In the Nizam's territory, they still grow a certain amount of *bani*, but it is getting less and less. Above the *ghats* in Berar ten years ago, there was a more substantial amount of *bani* being grown than there is at the present time. Some of that

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bani must have been among the best Indian cotton that existed. I understood that *bani* stood almost the first amongst the indigenous cottons. When work on cotton was started, samples of all the cottons grown in the province were collected and grown and tested on the Government farms; they were botanically examined and the different varieties were selected pure and tested pure, and I do not think there is any possibility in the Central Provinces of a pure *bani* type having been overlooked.

301. (Mr. Roberts.) In my written evidence, I have stated in regard to *buri* that it was found to become weaker in fibre; this deterioration was not due to any mixture. The *buri* was grown absolutely pure under the supervision of the Agricultural Department. I do not think that the deterioration could have been due to presence of other American types, but Mr. Clouston would be able to tell you better about that. My experience in Berar was that pure *buri* was supplied by the Agricultural Department, and was sown under a certain amount of supervision by the Agricultural Department; the cotton was collected and special arrangements made on behalf of the cultivators for the ginning of this cotton separately and for sale. I do not, therefore, think that there was any possibility of the weakening of the fibre being due to admixture. *Buri* has been growing in the Central Provinces for many years. It came in from the Southal Parganas in Chota Nagpur. The Cotton Commissioner was responsible for bringing in the type of cotton known by the name of Upland Georgian which is still to be seen as isolated plants in the Central Provinces. *Buri* cotton is an American type of cotton of a distinctly better class than the local Upland Georgian. So far as I am aware, but Mr. Clouston will be better able to tell you, I do not think there has been any distinct selection of *buri* for length of staple.

302. As to the suggestion that irrigation is a new factor and that, if cotton proves a profitable crop on the *bhata* soils of Chanda and Chhattisgarh, it is possible that the economic factors with regard to labour will disappear gradually and that it is merely a question of how profitable it proves, in my opinion this is only true within limitations. You have to reckon with the habits and prejudices of the cultivators. My impression is that the inclination of the cultivators will be directed towards the improvement of rice cultivation rather than to the growing of cotton.

303. As to the spread of *roseum* cotton in tracts where it had not been tested against the staple varieties, for example, in the Nizam's territory and even in Madras in preference to Cambodia cotton, my view would be that the cultivator would certainly not discard his own indigenous crop of cotton for the sake of imported *roseum* from any other part of India unless he was perfectly satisfied that it was a much more profitable crop. Mr. Clouston's work was not original. The cultivators themselves in Berar, before the Agricultural Department took up *roseum*, were themselves selecting it and gradually increasing the percentage of *roseum* in the mixture that they grew. The Agricultural Department merely hastened the process. The idea of putting a ring fence round the Central Provinces *roseum* until it has been tested elsewhere seems to me impracticable. The factors which are necessary for the success of long staple cotton in this province are high ginning percentage, greater yield and early maturity. The yield of *bani* is poor and the ginning percentage is low. If the Agricultural Department could produce something in the nature of a medium cotton with a better yield and a better ginning percentage, there would be no difficulty in getting the cultivators to take it up, but until you can put on the market a variety of cotton which is going to give a bigger profit than *roseum*, you cannot possibly expect the cultivators to grow it. I have always understood that this particular type of cotton has, as I stated before, an artificial value as a material for mixing with wool and so it cannot be judged purely on its cotton value. This applies to all coarse cotton. If the factor of freight becomes of sufficient importance to influence the price of short staple cotton as compared with that of long staple, the position may have to be reviewed, but it has not affected the position so far.

304. The actual study of the breeding of cotton has not been taken up in the Central Provinces in the same way as it has been taken up by Mr. Leake in the United Provinces. A certain amount of breeding work was done for some years, but I cannot say that it was carried out very systematically or perhaps according to a very high standard. The results were negative, but it was not in charge of a botanist with special knowledge of hybridization. I think there has been no work done in the Central Provinces comparable to Mr. Leake's work in the United Provinces on cotton.

305. As to stand pipes in pressing factories, the excuse was often given that they were there for fire insurance purposes, but I have myself seen the hose playing over the heaps of cotton.

Mr. C. G. LEFTWICH, I.C.S., formerly Director of Agriculture, Central Provinces.

EXAMINED AT NAGPUR, NOVEMBER 14TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

306. (1) **Experience.**—I was Deputy Commissioner of Nimar District (Khandwa) from 1906—1911 and of Chanda, 1912-13, both of them important cotton-growing districts. I was Director of Agriculture in the Central Provinces from November 1914 till March 1917. I have been a good deal in actual touch with cotton cultivators.

307. (2, 11 and 21) **Varieties.**—*Deshi dharwari* and *jari* were all grown in Nimar, and *jari* in Warora Tahsil of Chanda. *Bani* and *buri* were tried by enterprising cultivators in Nimar, but were not very successful. "Upland Georgian" was also tried in Nimar during my incumbency there, but it was not a reliable crop.

308. **Comments on Mr. Clouston's Notes.**—I regret I have not had time to collect detailed information for other questions in this part. I offer the following comments on Mr. Clouston's Notes:—

I.—MR. CLOUSTON'S NOTE ON IMPROVEMENT OF COTTON CULTIVATION IN THE CENTRAL PROVINCES.

Paragraph 8.—I am rather doubtful whether the investigations mentioned have been persistent and continued long enough for us to say finally that it is not possible to select a wilt-resisting *neglectum* cotton.

Paragraph 10.—I am strongly of the opinion that we should do much more to experiment with cotton crosses in order to improve the staple, while maintaining a high production of *kapas* per acre and a high

* Vide p. 79 et. seq.

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ginning percentage of lint. I speak as a layman of course, and the problem may be impossible of solution, but I do think that a plant-breeder should make a special study and work out the Mendelian factors of cotton varieties and set up a large series of crossing experiments. The economic result would be tremendous in these provinces if a marked improvement in staple could be worked out for a species retaining the high production and ginning percentage of *neglectum roseum*.

Paragraphs 12, 13 and 14.—To my lay mind, it seems that we ought to make more persistent and co-ordinated efforts to improve the staple of *roseum* by plant selection, presuming the botanists hold out the hope of any success. From these paragraphs of Mr. Clouston's Note, it would appear that all efforts made hitherto in the past seven years have been with a view to improve the ginning percentage.

II.—MR. CLOUSTON'S NOTE ON ATTEMPTS TO INTRODUCE LONG-STAPLED COTTON.

In Nimar, the old *deshi* variety survived the attempt to introduce "Hinganghati" in 1868, but about 1892 some Khandwa *bani*s brought *dharwari* seed from Berar. The name suggests that this cotton may have had some connection with Dr. Forbes's efforts to improve the cotton of Dharwar; but, if so, it was not a success from the point of view of staple. It instantly became immensely popular in Nimar, and almost entirely ousted the old *deshi* cotton in a few years. It was probably closely related to Berar *jari* and, as described by Mr. Clouston, largely consisted of different varieties of *neglectum*.

III.—MR. CLOUSTON'S NOTE ON THE ORGANIZATION OF DISTRICT AGRICULTURAL WORK.

Mr. Clouston has shown that we have passed beyond the stage in which we depended on enterprising individual farmers for getting improvements taken up. The Agricultural Department and the people of the provinces ought never to forget the immense value of the work done by Messrs. Clouston and Evans in winning the confidence of more promising individual cultivators, and through them of villages, then of *parganas*, *taluks*, *talukds* and districts. To me, as a layman, what seems even more amazing than the visible improvement in crops and cultivation in great areas of these provinces during the last ten years is the breakdown of that stubborn intractable attitude of our cultivators themselves, summed up in the words "bap dada neise nahin kiya." It was that inevitable reply which completely baffled my own efforts as a junior assistant to get rudimentary improvements taken up, such as sowing in lines, embanking to prevent erosion, and so on. Therefore I say "Give us ever more Cloustons and more Evanses."

IV.—MR. CLOUSTON'S NOTE ON "DESHI SHORT-STAPLED COTTON."

Paragraph 7.—These provinces produce a large surplus of rice. It would therefore be perfectly safe economically to institute a series of experiments on a field scale through selected cultivators (probably members of agricultural associations who could be trusted to give reliable results) to test the relative commercial profit of growing transplanted rice or long-staple cotton on the porous lands of Bhandara, Balaghat and Chanda. There would be no need to worry about the danger of supplanting a food crop with a fibre crop.

V.—COTTON FORECASTS.

I do not agree that our forecasts are very accurate and very much doubt if we should waste time compiling them when our staff is still so inadequate. Large buying firms like Ralli Brothers and Volkart Brothers make their own forecasts and their purchases are little influenced by our forecasts.

Mr. C. G. LEFTWICH, I.C.S. called and examined.

309. (President.) I certainly think that we could do more to improve cottons by hybridization in these provinces. I would recommend the appointment of a botanist to tackle the question. *Roseum* meets the present emergency, but I think the price of it is sure to drop after a short time in relation to the other cottons. The present price of *roseum* is quite uneconomic. It has a high productive power and a high ginning percentage, but when the production is in greater quantity, i.e., when the supply is more than the demand, the market is bound to be affected. I would strongly recommend systematic plant breeding by a botanist of standing, particular attention being devoted to hybridization. As *roseum* and the other *neglectums* have such a high productive capacity and ginning percentage, I would like numerous crosses of *roseum* and other *neglectums* with long stapled varieties to be tried, to see if we could not get a cotton with the high ginning percentage and outturn of *roseum* but with a better lint. I know that Mr. Clouston has done a certain amount of work in this direction. Our present Economic Botanist has done very little work on cotton. It has not been his fault because he has been very busy with other work which he has just completed. He has been engaged on rice, the classification of wild rice, selection work on different varieties and so on, and also on special observations of pollination in work on *juar*. He has been doing a good deal of work on wheat and fruit so that he has had his hands very full. Of course, cotton is one of the most important crops in these provinces, and is widely distributed. Another Economic Botanist is required. If he were here, he would have begun work on cotton. There is enough work on cotton to keep a botanist employed. I do not think that the present policy of putting all our eggs in the *roseum* basket is sound. I think I have hinted as much in my annual reports.

310. (Mr. Wadia.) I have not recently watched whether the difference in price between long and short staple is rapidly increasing.

311. (Mr. Henderson.) The question of colonising the *bhata* lands, is a very difficult one. I had some little experience of it as Deputy Commissioner of Nimar where I had to push the cultivation of excised forest lands. I was able to get some Punjabi colonists down to two villages. So far as I have heard, the experiment was a success but I have not been in touch with that district for the last three or four years. I do not know whether it would be possible to get colonists from the United Provinces. I did not try those provinces. From Nimar I went to Chanda, where an irrigation tank had been constructed. It commanded large tracts of jungle which had to be cleared. I had to try to get colonists for that area. A special officer was sent round to many centres in this province, the Bombay Presidency and the Nizam's territories, but I do not think that he went to the United Provinces. We did not get any colonists. We offered them very favourable terms, but we did not offer them proprietary rights. Of course, it might be said that if they had been

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offered proprietary rights they would have come. I also tried to get colonists from Chhattisgarh just over the border. Some actually came and looked at the land, but they decided on the whole that it was too far from their homes. I think that it might be possible to get colonists from Bihar and Orissa for the Chhattisgarh plains. The proprietary right here is vested in the *malguzars*. I do not know whether they would be willing to sell their proprietary rights. I have heard that they are becoming convinced of the value of their waste lands and would be glad to get cultivators to break them up. From what I have seen of Cambodia on irrigated *bhata* land, I am most optimistic about it, but the experiment has been of short duration. It was not recommended strongly in Chanda on the ground that it required labour at the time that labour was also required for transplanting rice, but I think we ought now to examine very carefully the comparative economic advantages of transplanting rice as against growing long staple cotton on those areas when the conditions are favourable for the cultivation of both. If Cambodia proved successful on these lands, the area that we could work up to might be anything from one hundred thousand and upwards to a million acres. I am including in that the light soils in Bhandara and Balaghat which are irrigated by village tanks. As to labour, it is a question of comparative value: if we were prepared to give up rice land to cotton, the labour supply would be adequate. If you leave the present rice land out of calculation, then the additional lands available for cotton would only be in the Chanda and Chhattisgarh districts. But the class of cotton would be very superior which is really what matters. I am very optimistic about the possibilities of the *bhata* land of Chhattisgarh. Of course I say this as a layman.

312. As to non-irrigated tracts, I am afraid that the present *bani* is practically hopeless. I am not sure whether there has been sufficient plant selection work on *bani*. I do not think that very much has been done in the way of keeping the types separate, selecting productive plants, and so forth. As regards Sir Bezoni Mehta's statement that the *bani* which he had purchased had been ginning at 35 per cent. while the *jari* purchased by him ginned 31 per cent. and the idea that this indicates that we ought to go on selecting, I am not, however, very hopeful.

313. When I was in Nimar, we tried both Upland Georgian and *buri*. We tried to get them introduced because we believed in them and we induced some of our more advanced cultivators to cultivate large areas. They cultivated well; sometimes they got good results and sometimes bad. *Buri* was a most uncertain crop and it was liable to be damaged either by excess of rain or by want of it. We distributed the seed to the *malguzars* and they distributed it to the cultivators. The *malguzar* grew it on his own home farm and the *patels* (village officers) looked after its cultivation in the *ryotwari* villages in which the seed was distributed. It really got a fair trial. We induced the Burhanpur Tapti Mills to give a small premium on small quantities. The mills were hopeful the first year, in the second year they were less hopeful and in the third year they said that the yield was too uncertain. This was in the Nimar district which is practically Khandesh.

314. (Mr. Roberts.) We sold the cotton by arrangement with the Burhanpur Tapti Mills which was in one of the selected tracts. I do not remember whether we got the real Bombay price, but my recollection is that we discovered that it was not very liberal. The difficulty in getting a premium during the three years in which it was grown was that the quantity produced was very small; and that the mills objected to having such small quantities separately ginned and kept entirely separate. Some *buri* cotton is still to be found in the fields. The proportion varies very much. Sometimes there is forty to fifty per cent. of it in ordinary *jari*. I am sorry I cannot say whether it is very common in Nagpur. The produce of the field would be sold as *jari*.

315. (President.) I am not in favour of the proposal to publish Bombay and Liverpool prices in upcountry markets. I do not recommend it because it is rather a big thing to arrange for. So far, there is keen competition in buying in our cotton markets, and the result is that the cultivators are not deceived by the purchasers in regard to prices. I do not think that it would be any advantage to the cultivator to publish the prices.

316. As to the forecasts, we are really too short-handed to undertake the collection of the figures and we have a lot of work for our men to do. We have been recently ordered to take over the whole of the crop cutting experiments and that means that it will take up much of the time of the whole of our staff and keep it very busy. I doubt the advantage of the Agricultural Department taking over the work of collection of the figures. The forecasts are actually compiled by the revenue staff, i.e., by revenue inspectors under the Deputy Commissioner. The Deputy Commissioners send their returns to the Director of Agriculture. The Director of Land Records is also the Commissioner of Settlements. The statistics are compiled by him. We criticize the Deputy Commissioner's forecast, but the Director of Land Records actually compiles the forecast. The forecast is issued over his signature.

317. Cotton suffers much from insect pests, but I cannot say to what extent. It suffers from boll-worm and to a less extent from wilt. I think these provinces ought to have a whole-time entomologist not only for cotton but for other reasons. We have had several times to call in entomological assistance from Pusa and our entomological report is always a very meagre one.

The Hon'ble Mr. J. F. DYER, I.C.S., Third Secretary to the Chief Commissioner of the Central Provinces.

EXAMINED AT NAGPUR, NOVEMBER 14TH, 1917.

(No written statement was submitted by the witness.)

318. (President.) I am giving evidence as Secretary to the Local Administration in regard to the matters referred to in the three papers I have submitted, that is to say, the increase in the number of demonstration farms, the expansion of the Agricultural Service and the improvement of crop forecasts. The intention is that there should be in time a farm in each district for the testing and propagation of seed and for demonstration, central farms, such as those of Nagpur and Akola, being kept on for general purposes, including experiment and research. Some of the new farms are to be financed from the wheat profits and considerable progress is already being made in the programme. Proposals have been submitted for increasing the number of Deputy Directors from three to seven, with a suitable number of assistants and for the appointment of a second botanist, a mycologist and an entomologist. I do not think that the Chief Com-

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missioner would have any objection to a botanist devoting a considerable portion of his time to the cotton breeding question.

319. The differences between the actual outturn of cotton and the estimates in the forecasts during the last three years have been one, three and seven per cent respectively. I consider, however, that the figures are fallacious as mutual errors have cancelled out.

320. The weaving done locally is done principally from factory yarns brought from such mills as the Empress Mills. Everything is against the grant of large plots of land in Chhattisgarh to capitalists for the cultivation of cotton. The tract consists of *malguzari* and *zamindari* estates varying in extent from 1,500 square miles down to small villages. All is private property. There is no Government land available to be given out for cultivation in the Provinces except land cut out of forest reserves in Chanda, Mandla, Nimar and Balaghat and the amount of waste at the disposal of Government is very small. The question was recently examined with reference to the possibility of grants to soldiers and it was found that there was next to no suitable land available.

321. I have been Settlement Officer in the Nagpur district. About half the district is cotton country, roughly that part of the district west of a line running due north through Nagpur City, but the cotton is all short staple. Cultivation in the district is very backward. Figures show that, in recent years, cotton has diminished in face of rising prices, as some years ago much cotton was grown as a speculation on land not really suited for it.

322. (Mr. Wadia.) To propagate pure seed I think it quite feasible to start from the seed farm and to work through selected cultivators. The trouble is that the Nagpur cultivator is very backward and is ready to buy any seed from the ginners, blaming Government or the season, or anything or anybody except himself if the crop goes wrong. There are very few cultivators in the district who realised the importance of pure seed. There has not been nearly as much progress made in the Nagpur and Wardha districts as in Akola.

323. The letter I have put in about the expansion of the Agricultural Service only deals with the additional staff required for the Indian Agricultural Service. A very strong provincial and subordinate service is required as well. That is one of the difficulties in the way of development. At present we have to take any man we can get into the Agricultural Department. We are doing our best to expand the lower grades as well. It would be no use opening another college in the Province until we are able to fill the one we have already at Nagpur with suitable candidates. At present we have a roll of 76 and accommodation for 110 in the hostel, all students being resident. The cultivators do not yet sufficiently realise the necessity of a good agricultural education. The type we want to get into the College, if possible, is the local man from a cultivating family and recently we have had more success in this direction than when the College first opened.

324. (Mr. Hodgkinson.) The bridge between the cultivator and the buyer could be crossed by only giving out seed to trustworthy cultivators, who would grow it on their own seed farms and pass it on to other cultivators. This will be easier than in the case of wheat, as the seed rate of cotton is lower than that for wheat. I do not think that any definite price should be guaranteed to the cultivator. We shall have to get the mills interested in the production of a better class of cotton to take cotton from these farms. Until the people realise that the cotton is commanding a price higher than that of the ordinary product, some superintendence would be necessary on the part of Government. In time, cultivators would grow it of their own accord. The local mills would for a long time take the full quantity produced. Mr. Frederickson wants about five thousand bales for his mills alone, but there are at present only a few acres of long staple cotton. I do not think that any system of guaranteeing prices to the cultivator would work, but I am convinced that the local mills would take all that they could get and all that would be produced, which would ease the situation, as the less American or Egyptian cotton India took, the more would be left for Lancashire.

ANNEXURE I.

Letter from the Hon'ble Mr. J. F. Dyer, I.C.S., Third Secretary to the Chief Commissioner, Central Provinces, to the Secretary to the Government of India, Revenue and Agriculture Department, No. 169-A-XIII, dated Nagpur, the 16th August 1917.

I am directed to refer to your letter No. 1083-252-1, dated the 5th December 1916, regarding the method of framing estimates of the outturn of crops for the purposes of forecast reports. In paragraph 4, the Government of India ask for replies to certain specific questions, but the Chief Commissioner proposes, in addition, to deal with the question generally at some length and to explain the difficulties that have been experienced in the Central Provinces and the measures that it is proposed to take towards overcoming them.

2. It is the established practice in these Provinces to convert the sixteen anna crop of the cultivators into the American notation at 120. This is in accordance with the definition adopted by the Government of India, as quoted in the letter under reply, for a sixteen anna crop is, according to the word of the cultivators, very rarely obtained and a thirteen anna crop—or a crop of 100 in the American notation—is what they may expect, if the conditions of season and rainfall are “neither very favourable nor the reverse.” The Chief Commissioner is opposed to any alteration in the definition, as the present practice is now well established and any change would lead to confusion.

3. The primary reporting agency in the Central Provinces is the Revenue Inspector who, in talking to the cultivator, naturally uses the anna notation, but converts it into the American, on the principles explained above, before submitting his report to the Superintendent of Land Records. Sir Benjamin Robertson does not think that it is necessary to adopt any special measures to impress the definition of a normal crop on the Revenue Inspector, as he already knows well what is required of him. Improvement in his work will come only with general improvement in the class of men appointed to such posts, and this the Chief Commissioner hopes to attain, in the Central Provinces, by widening the prospects of promotion open to them, and, in Berar, by improving their pay. The next stage is the check of the estimates of the Inspectors by the superior Land Record staff before they are submitted to the Deputy Commissioner. This can only be effectively done by the Superintendent of Land Records and his Assistants satisfying themselves by personal observation of the area and prospects of the crop that the Revenue Inspectors have done their work intelligently and honestly. The Superintendent of Land Records should always be in a position to give the Deputy Commissioner good reasons for accepting or modifying the figures he receives. Steps have already been taken to improve the quality of the Superintendents of Land Records and

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Assistant Superintendents of Land Records, and it is hoped that in time they will bring more intelligence to bear on this important branch of their work than has always been the case in the past.

4. The difficulties of obtaining accurate estimates of the area and quality of crops is, however, small, compared with the difficulty of forecasting the outturn. There is, for each crop in each district, a standard outturn which is examined and revised, if necessary, every five years by the Director of Land Records, but Sir Benjamin Robertson has grave doubts if these standard outturns can ever be of much practical use in ensuring accuracy in forecasts. In the past, the crop experiments, on which the standard outturns are based, have been arrived at by the District Staff, and experience shows that they have not, as a rule, the necessary knowledge to conduct experiments in such a way as to give results of value, and many of the experiments have to be rejected as more or less worthless. When a district is under settlement, crop cuttings of more value are carried out by the Settlement Officer and his Assistants, but a settlement occurs only once in twenty years, and these experiments are directed more towards ascertaining the relative value of soils than towards arriving at average outturns for the district. Arrangements have recently been made for the gradual transfer of the work of experimental cuttings from the District Staff to the Agricultural Department, but it will be some time before that Department is strong enough to take over all the work, and longer still before it has collected sufficient data to draw inferences from the experiments which it conducts; and though these experiments may, in the end, prove useful for agricultural and settlement purposes, it is perhaps open to doubt whether they will prove of real value from the point of view of crop forecasts. I am to illustrate the difficulties in the way of accepting them from the three chief crops of the Provinces, for which forecasts are prepared, viz., cotton, wheat and rice.

5. Cotton is grown by cultivators of all degrees of merit, from the man who sows carefully selected seed on properly prepared and manured land and who keeps his crop clean by frequent intercultural, to the man who sows damaged and impure seed from steam gins on unmanured land that has been harrowed once and who weeds his crop in a perfunctory fashion, and, more important still, it is grown on a very wide range of soils from the poorest to the richest. The crop is gathered in a succession of pickings over a period of two to three months, and while the good cultivator picks his plants bare, the bad often leaves much of the last picking to rot. With infinite trouble it might be possible to arrive at a standard that allowed for all the varying conditions of soil and cultivation, were it not that the vagaries of the season may upset the calculation. Thus a heavy fall of rain in September will make the poor soils yield a much increased crop while the prospects of the cotton in the richest soils will decline, as water-logging will stunt its growth and cause the bolls to rot. If, on the other hand, September be rainless, the poorest soils will give a very poor yield, whereas the richest may be able to carry on with the moisture they already contain and give a fair crop. No standard outturn and no amount of care in estimating the quality of the crop in any year can allow adequately for all the varying factors in the calculation.

6. Wheat is not grown over such a wide variety of soils, but the range is still considerable. A good early monsoon has the effect of expanding the *kharif* area and hence less room is left for *rabi*. If the late rains be poor, the lighter soils, which in a year of heavy rain are put under wheat, are devoted to gram or some other less important *rabi* crops. And rain in the cold weather, or the lack of it, has the effect of drawing together or putting further apart the outturns of the worse and better soils.

7. For rice there is the further complication of irrigation. In a year of plentiful rainfall the difference between the outturn in irrigated and unirrigated land and in light and heavy soils contracts. The water in the tanks is not used for irrigation, because without irrigation, the land can yield as much as if it were irrigated, while the outturn of the uncommanded land in many cases rises to the same level. Besides, the degree of skill and care taken in the cultivation of the crop, even within the limits of one district, varies as much as is the case with cotton.

8. At present the variations in the outturn due to the causes mentioned above are supposed to be allowed for in the fraction representing the relation of the crop reported on to the normal per acre, for the estimate of outturn is the multiple of the area under the crop, the standard outturn and this fraction. But no agency can take all the factors pointed out above into consideration, and the result is that the forecasts must always be unreliable. This difficulty has been overcome, to some extent, in the case of cotton, by prescribing that the estimate of outturn should be given as a percentage increase or decrease on the outturn of the preceding year. Much better results can be obtained by cross-examining cultivators as to the relative merits of this year's crop and last than by estimating this year's crop in the *anna* or American notation, even though the superior staff devote much care to the matter. And Sir Benjamin Robertson would accordingly suggest that the instructions in Government of India, Revenue and Agriculture Resolution No. 12-Agriculture, dated 18th April 1905, which now apply to cotton, should be applied to all crops for which forecasts are required.

ANNEXURE II.

Letter from the Hon'ble Mr. J. F. Dyer, I.C.S., Third Secretary to the Chief Commissioner, Central Provinces, to the Secretary to the Government of India, Revenue and Agriculture Department, No. 1-c-XIII-c-155, dated the 1st June 1917.

I am directed to reply to your letter No. 1121-262-8, dated the 18th December 1916, on the subject of the expansion of the Provincial Agricultural Departments after the war. The Government of India express the hope that it will shortly be possible to exceed the scale already sanctioned, a course justified by past success, and suggest that, after the cessation of hostilities, new economic conditions may involve a still further increase. The Chief Commissioner proposes therefore to review briefly the situation in the Central Provinces and to explain what he considers to be the line of development which the Department should follow, indicating at the same time the immediate steps which he thinks should be taken, as soon as suitable recruits are forthcoming, to attain the object in view.

2. I am to deal first with the staff of Deputy and Assistant Directors. Three officers of each class are sanctioned, but at present there are only three Deputy Directors, one of whom is absent on Military duty and another is officiating in a privilege leave vacancy as Director of Agriculture. The single Assistant Director whom it was found possible to engage has proved unable to stand the climate and has recently left the service. But even if all six officers were on duty, Sir Benjamin Robertson contends they would not be able to cope for long with the growing activities of the Department. In Mr. Hullah's letter No. 106-XII-c-9, dated the 4th March 1915, in which sanction for the present staff was asked for, the Chief Commissioner, as a temporary

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[Continued.]

expedient, adhered to the original scheme of dividing the Provinces into three roughly homogeneous tracts, representing the cotton, the wheat and the rice country with a Deputy Director in charge of each and an Assistant under him, but, as far back as 1910, Sir Reginald Craddock, in a note which accompanied Mr. Standen's letter No. 2221-1-15-2, dated the 22nd September 1910, indicated that this sub-division inadequately represented the agricultural characteristics of the Provinces.

3. There are in reality six distinct tracts, each with its separate problems. These tracts are :—

- (1) the cotton country, comprising the four districts of Berar, the Nagpur and Wardha districts, the Warora tahsil of Chanda, the Sausar tahsil of Chhindwara and the Burhanpur tahsil of Nimar;
- (2) the eastern rice tract, consisting of the Chhattisgarh Division;
- (3) the western or Wainganga rice tract, into which fall the Bhandara and Balaghat districts, and the Chanda district, except the Warora tahsil;
- (4) the Satpura plateau, containing the Seoni, Betul and Mandla districts and the Chhindwara district excluding the Sausar tahsil;
- (5) the Nerbada valley, comprising the Hoshangabad and Narsinghpur districts. In this it is also proposed to include the remainder of the Nimar district, for although the latter contains a great deal of cotton, it is also important as a wheat-growing tract, especially in the northern portion, and it can be more conveniently looked after as part of the Nerbada valley;
- (6) the north-western wheat districts of Jabulpore, Saugor and Damoh. The Jabulpore district has been included in this tract, as, although the southern part of it might have been included in the Nerbada valley, the district can more conveniently be included with Saugor and Damoh as a working circle.

In other words, the rice and wheat countries which have so far been treated as single units are really two and three distinct areas respectively, the rice country comprising (2) and (3) above, and the wheat country (4), (5) and (6).

4. Sir Benjamin Robertson does not propose to dwell on the manifold and rapidly growing activities of the Department, of which the Government of India are already well aware. It will suffice, he considers, if he shows that the six tracts into which the Provinces have above been divided will soon require the attention of seven Deputy Directors.

The cotton country, which is the present Western Circle, covers a large area and is the most advanced portion of the Provinces. Though cotton is its most important crop and the one to which the Department has so far almost exclusively devoted its attention, there are large areas of wheat, linseed and *til*, which present problems of their own, as the rainfall of the tract is much less than that of the real *rabi* country further north and the season is earlier. The greater rainfall of the portion near Nagpur differentiates it from the greater part of Berar, and it is by no means yet established that the *roseum* cotton, which is doing so well in the latter, is best suited to the Nagpur country. Apart therefore from the mere volume of work, the Chief Commissioner holds that this tract must before long have two Deputy Directors to itself, one for the eastern and one for the western portion.

The eastern and western rice countries differ from each other chiefly in that, while in Chhattisgarh the people and the methods of cultivation are backward, the cultivators of the Wainganga area are much more advanced, and while the work in Chhattisgarh might be described as bringing the people forward to the present Wainganga standard, as for instance in the important matter of transplantation, the work in the western rice tract is more of the nature of inducing the growth of better kinds of rice and the spread of sugarcane and garden crops under irrigation. The amount of work in these tracts, which form the present Southern Circle, will soon be too much for one man.

In the *rabi* country, conditions of soil and climate differentiate tracts (4), (5) and (6) detailed above, which are all included in the present Northern Circle. And already the Deputy Director in charge, whose main farms are at Jabulpore and Hoshangabad, is unable to devote adequate attention to the Satpura country and to the districts of Saugor and Damoh; besides, the distances to be covered are very great and much time is wasted in travelling. The people of the two latter areas are calling for Deputy Directors of their own and their demands are backed up by the district authorities. In the Satpura country, one farm has been started and two more are projected, and in the Saugor-Damoh tract, there is a small farm at Damoh which requires extension and another is planned at Saugor. It is becoming apparent that wheat varieties which have proved their worth in the Nerbada Valley proper are not as a rule suited to these other tracts, in the former of which also there are questions of well irrigation, garden and sugarcane cultivation which must be taken up, whilst in the latter, there are promising irrigation projects towards the success of which the Department must lend its help.

5. The Chief Commissioner has therefore no hesitation in affirming that before very long the provinces will require seven circles and seven Deputy Directors, but he realises that this stage of development, which is still not likely to be the final one, can only be worked up to by degrees. The Department must lead the people whose attitude is one of rapidly increasing interest in its activities, but it must not be too much in advance, and there is further the difficulty of providing an adequately trained subordinate staff. Besides, even if an unlimited number of candidates for the Imperial Service were available, too rapid recruitment would lead to congestion and consequent discontent which the existence of a time-scale would alleviate, but not remove, as men of seniority would remain Assistant Directors long after they were competent to hold charge of circles. Sir Benjamin Robertson therefore proposes to proceed gradually in the matter of recruitment, and I am to set forth below the proposals which he wishes to recommend.

6. As the object to be aimed at in the near future, Sir Benjamin Robertson advocates the establishment of five circles as follows :—

- I. The cotton country.
- II. The eastern rice country.
- III. The western rice country.
- IV. The Satpuras.
- V. The Nerbada and north-western wheat country.

Each would require a Deputy Director and the first, second and fifth, being heavy charges, would need an Assistant each in addition. Of the three present Deputy Directors, one should be left out of account to allow for the post of Director of Agriculture being filled from the Department. Three men are therefore immediately required to train for the charge of circles, and Sir Benjamin Robertson would ask for them to be obtained as soon as the close of the war renders recruitment possible. For the three Assistant Director-

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[Continued.]

ships, and to allow for the expansion of the circles to six and afterwards to seven, and also for possible casualties, it would be advisable to recruit in each of the two succeeding years two men and in the fourth year at least one. This seems as far as it is necessary to estimate as matters stand at present; but, as already remarked, the Department's activities are constantly expanding and in a few years the whole situation may require consideration afresh.

7. In dealing with the research and instruction side of the service, the Chief Commissioner finds himself in some doubt as to the intentions of the Government of India. He still holds the view expressed in paragraph 6 of this Department's letter No. 536-XII-1-6, dated the 3rd February 1917, that if a Central Agricultural College is established for Upper India, direct appointments to the Provincial Service should be reserved for those who have graduated at it, and that, assuming for the moment that that college will be located elsewhere than at Nagpur, the local college should train only for the Upper and Lower Subordinate Service. This coincides with what the Agricultural Adviser to the Government of India has stated at pages 90 and 91 of his report for the year 1915-16. But in paragraph 3 of the letter under reply, the Government of India say that they consider it most desirable to bring the Provincial colleges as soon as possible up to the standard of instruction necessary to enable students to qualify for direct admission to the Provincial Service. For research work, a mycologist and entomologist are necessary in any case, and the Chief Commissioner would ask for their appointment as soon as conditions permit. But if, in the development of agricultural education, the Nagpur College is to aim only at giving the requisite education for the Subordinate Service and the preliminary course for a Central College, the present staff of a Principal, a Chemist and a Botanist, the two latter of whom are largely engaged in research work, is sufficient. If, however, it is decided that the college course should qualify for a direct admission to the Provincial Service, a separate chemist and a separate botanist for research will be necessary.

8. For the present the Chief Commissioner refrains from discussing the question of a regular leave and training reserve. He has given his reasons for advocating a gradual scheme of recruitment so as to do something towards avoiding a block in promotion.

Though he considers that it will be necessary in the long run to make provision for leave and training, to contemplate this now would only lead to more concentrated recruitment and accentuate congestion in the cadre. For this reason he is of opinion that the question should lie over for the present.

ANNEXURE III.

Proceedings of a Conference called by the Chief Commissioner to consider the policy to be adopted regarding District Agricultural Farms.

The Conference met on the 30th May 1917 and there were present :—

The Chief Commissioner (Sir Benjamin Robertson).
The Financial Commissioner (Mr. Crump).
The Officiating Director of Agriculture (Mr. Clouston).
The Deputy Director of Agriculture (Mr. Evans).
The Third Secretary (Mr. Dyer).

2. It was agreed that, as funds became available and the expansion of the agricultural staff rendered it possible, the policy should be to establish a farm in each district for the purposes of seed-testing and seed production, demonstration and instruction. The farm should be situated as near as possible to the district head-quarters so that it may be easily controlled, be readily accessible to all visitors, and as much as possible in the public eye. In acquiring land, future requirements should be kept in view, and sufficient land taken up at once to meet them. Thus the possibility of having in time on each farm a hostel and school of the type contemplated at Powarkhera should be borne in mind. Where possible, cattle-breeding should be combined with arable farming.

3. In the wheat districts, an area of 150 acres was accepted as the standard for a district farm. Owing to the high seed-rate and relatively low outturn of wheat, most of this area is required for the propagation of pure seed, improved strains being introduced as they are thoroughly tested and proved to be suitable to local conditions. Without this source of pure seed every year, seed distributed by the Department would, under the prevailing conditions of cultivation and harvesting, soon tend to become impure.

4. In the rice tracts the area of district farms need not be so large, as the seed-rate of rice is lower and the outturn higher. The Chandkuri Farm of sixty acres is a suitable model.

5. In the cotton country, Mr. Clouston considered 100 acres a proper limit of size.

6. The main objects of cattle breeding should be the production of good stud bulls for sale to *malguzars* and the stimulation of their interest in improved methods of breeding and feeding. Technical matters, such as the evolution of a dual purpose animal for milk and draught, should be worked out and settled by the experts of the Department.

7. In pursuance of the above general lines of policy, it was decided that the following immediate steps should be taken :—

NORTHERN CIRCLE.

Saugor.—Acquisition of the site already selected by the Deputy Commissioner and Deputy Director of Agriculture on the Rahatgarh Road should be proceeded with. The Deputy Director should consult the Superintending Engineer, Circle II, as to whether he can undertake the buildings, the estimate for which excludes fencing. The Director of Agriculture should consult the Director of Agriculture, Bombay, on the subject of borrowing an expert for sinking the well.

Seoni.—The land already chosen for the farm is in the possession of *raiya*s *sarkar*, who are mostly men who sublet. Steps should now be taken to obtain possession from them, but the sub-tenants who are in cultivating possession may be allowed to continue until the farm is started. Work should be commenced in 1918-19 and the buildings provided for in the Public Works Department budget of that year.

Damoh.—The present farm of 48 acres is too small, and additional land up to a total of approximately 150 acres should be acquired as early as possible. As in Seoni, extra buildings required should be provided for in the 1918-19 budget.

Betul.—The recently established farm already covers about 150 acres. The Deputy Commissioner is eager to have it expanded, but the question should stand over until other districts have been provided for.

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Chhindwara.—A suitable site has been provisionally selected. It should now be acquired, but the farm should be the last to be actually started in the Northern Circle of those in the present programme so as not to over-burden the Deputy Director.

Jubbulpore.—Approximately an extra 100 acres should be acquired for the expansion of the Kheri area so as to bring it up to the standard size. Only departmentally constructed buildings are required. For these the Deputy Director should arrange.

The Deputy Director's proposals for a cattle farm are accepted, but buildings should be constructed departmentally and as cheaply as possible.

The proposal to have a farm at Sehora should stand over for the present.

SOUTHERN CIRCLE.

Drug.—A site has already been selected and acquisition proceedings for the portion of the land, which is not Government property, have been started. The establishment of the farm should be pressed on with, and the money provided in the budget for buildings and recurring expenses at Bilaspur should be reappropriated for the buildings here.

Bilaspur.—The proposal for a combined arable and cattle-breeding farm is agreed to. The site should be selected and acquired, but further work should be postponed until 1918-19.

Bilaghat.—The acquisition of fifty acres at Waraseoni is in progress and the Public Works Department are preparing plans and estimates for the buildings. The Director of Agriculture considers that a small extension of the area should be made. For this he should submit proposals.

Chanda.—The proposal to start a cattle-breeding farm at Sindewahi is agreed to, but the cost of buildings should be kept down. The Director of Agriculture should consider if he can have them constructed departmentally.

WESTERN CIRCLE.

Nimar.—No definite proposal for a district farm has been put forward. The Director of Agriculture should formulate and submit a scheme.

Berar.—A farm in the west of Berar, where *rabi* is important, is considered necessary. The Director of Agriculture should consult the Commissioner, Berar, and submit proposals.

ANNEXURE IV.

Area under cotton in the Nagpur District.

Year.	Acres.	Year.	Acres.
1894-95	126,923	1906-07	340,430
1895-96	108,895	1907-08	303,029
1896-97	150,244	1908-09	256,142
1897-98	125,193	1909-10	232,658
1898-99	137,640	1910-11	270,699
1899-1900	158,581	1911-12	294,246
1900-01	238,139	1912-13	316,468
1901-02	223,050	1913-14	345,084
1902-03	303,137	1914-15	348,983
1903-04	365,008	1915-16	234,764
1904-05	404,411	1916-17	309,189
1905-06	476,171		

Mr. H. FREDERICKSON, Manager, Bengal Nagpur Cotton Mills, Rajnandgaon, Central Provinces.

EXAMINED AT NAGPUR, NOVEMBER 14TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

325. (1) *Experience.*—I came out to this country in March 1897 and was sent straight up to Rajnandgaon to work at the Central Provinces mills, which the firm of Messrs. Shaw Wallace & Co. had just taken over from the late Raja Bahadur Balram Dass of Nandgaon.

326. *Efforts to promote the extension of cotton cultivation.*—In 1899, after we had extended the mills to five times the size they were when we bought them, I commenced making enquiries as to the possibility of increasing the area under cotton round about and also improving the quality.

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[Continued.]

(2) I found that cotton was almost universally grown mixed with the other crops such as *kodo* (*Paspalum scrobiculatum*) *tli* (*Sesamum indicum*) and *tur* (*Cajanus indicus*). The variety was, I believe, *gossypium neglectum* and the method of cultivation certainly did not belie its name, for to all intents and purposes, no care whatsoever was taken. Seed was thrown into the fields and whatever *kapas* came to maturity was picked and sold locally, generally to wandering petty merchants, who either bought the *kapas* outright or bartered salt for it.

(3) The rainfall in the Nandgaon State, I very soon found, was too heavy for cotton, whilst in the further north the crop was grown better. It seemed to thrive owing chiefly to the smaller rainfall, though also, to some extent, on account of the more undulating country giving better drainage.

(4) As a matter of fact in the days before the mill was started by the late Raja Bahadur and before railways came to the Central Provinces, I believe the area under cotton in the north-west of Chhattisgarh was quite considerable, and I therefore came to the conclusion that there was no reason why it should not once more be grown extensively.

(5) The first step I took was to consult the Agricultural Department, and in 1900, Mr. Joshi, Superintendent, Government Farm, Nagpur, accompanied me on a short tour through Khairagarh and Nandgaon. We selected plots and got the Raja of Khairagarh and the Superintendent of Nandgaon to distribute some seed as well as to run small experimental plots. I myself had an experimental field in Dhaba village where I grew half a dozen different kinds of cotton. All the seed was distributed by the mill company free of cost for about three years, when considering that we had done sufficient to show that cotton could be well grown in lines, and as a crop by itself, we started charging a small amount for the seed. As the area under cotton extended, I found that it was not always a good thing to charge a low price for seed, and in fact I came to the conclusion that what cost the people little was valued by them at no more than its cost price and much of the seed went to feed cattle.

(6) In about 1909 Mr. Clouston, Deputy Director of Agriculture, and I toured through the States of Nandgaon, Khairagarh, Chhuikhadan and Kawardha, as also the four or five Zamindaries which lie between Chhuikhadan and Khairagarh States. Meetings were held in each place where we stopped, and arrangements were made to continue the distribution of seed, as also to get the area extended, and I believe the number of acres under cotton did extend until the year 1907-8, which was exceptionally wet, so that the cotton crop was almost entirely ruined and people who grew cotton lost heavily thereby. As a matter of fact, I have noticed all along that a succession of dry years tended to extend the area under cotton, whilst a single exceptionally wet year reduced the area by about half. In order to benefit the actual cultivators by providing a nearer market for their produce and to prevent them from mortgaging their crops in advance to local middle-men, I started a ginning factory at Kawardha in the year 1906 and advised all cultivators through the Dewans of the States that we would pay very full prices to cultivators bringing in the produce of their own fields. After a time, however, owing to the wet season and very small holdings, I came to the conclusion that this company could not continue to run the factory at Kawardha any longer, and it was accordingly closed down.

(7) In 1912, I accompanied Messrs. Low and Clouston to Kawardha, and we then arranged with the Raja to allot a piece of land as an experimental farm which would be run by the Agricultural Department. This farm has been running ever since, and when Mr. Clouston and I visited it last in 1917, the Raja agreed to take the plot of about sixty acres over as it was and to run it as a State farm.

327. *General results of these efforts.*—As regards general results from all the help and instructions which have during the past seventeen years been given to cultivators in the States round about here, I think I can say that the quality of *kapas* produced has been improved, and I have, during the last five or six years, always been able to pay a higher price for *kapas* coming from Kawardha and thereabouts where seed had been distributed than for that which came from Phuljhar, Sarangarh and Kalahandi, east and south-east of Chhattisgarh.

(2) I believe that the reason why the cultivation of cotton originally became less popular was entirely due to the smaller demand for the lint owing to the importation of mill-made yarns, which gradually supplanted the hand spun article. A few extra wet seasons also spoilt cultivators' faith in this crop, so it may be also said that the not perfectly suitable climate also prevented the people going in largely for its cultivation.

(3) The conclusion I have come to, therefore, with regard to this part of Chhattisgarh at least, are that the quality of the crop can be improved by means of providing the cultivators with better seed and also that they should not be advised to sow cotton except in exceptionally well drained land, say north of the Khairagarh State.

328. (5) *Rotations and manures.*—Manure of course would do much good and the value of this as well as of a proper rotation of crops is being demonstrated on the Government Demonstration Farm at Kawardha. Personally I do not believe that the cultivators will manure their cotton fields for many years to come. The villages do not produce a sufficient supply of manure for all the fields under cultivation and the cultivators invariably prefer to manure crops producing food in preference to such as produce a non-edible product like cotton.

329. (7) *Conditions affecting increase in area.*—There is no long stapled cotton grown in Chhattisgarh except under experimental conditions, and so far my experience has gone to show that the longer stapled varieties require more attention and do not, under present differences as regards prices, pay the cultivators. There is no doubt about it and it has been proved over and over again on the demonstration farms about here that cotton even in a poor year pays better than many of the crops grown regularly by the Chhattisgarh villages. I refer particularly to *kodo*, which, as far as the profit per acre is concerned, would not seem to be worth growing at all except that it is a food crop and can be grown on poor land.

330. (8) *Uses of seed.*—Cotton seed is being more used now as a food for cattle and the people are, I believe, gradually beginning to see that it does pay to feed plough bullocks, so that the demand for seed goes gradually up, and the price has fully doubled since I have been in this part of the country.

(b) "Deshi" long staple cotton.

331. (10 and 11) *Experience and varieties.*—I have grown Hinghanghat, Tinnevely, *buri* and Cambodia during the last nineteen years and have come to conclusion that the first three varieties cannot be grown profitably in Chhattisgarh since the higher price obtained does not compensate the grower for the reduced crop harvested whilst the fibre of *buri* is not sufficiently strong to render it really useful for spinning.

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As regards Cambodia, from experiments I have seen in these States, I am rather inclined to think that this variety may with care be profitably cultivated. I know that, in Chhuikhadan State, some very good fields of *kapas* have resulted from sowing this variety and a profit has been made each year. I am myself growing ten acres of Cambodia at Sakri village close to Raipur.

332. (14) *Manures.*—As regards manures, fields cultivated by the departments of the States, such as the Jail Department, etc., are generally manured with cattle dung, and this and village refuse are the only forms of manure applied as a general rule to any crop. It is the practice usually to grow about eight lines of cotton and two of *tur*, which being a leguminous crop helps to keep up the supply of nitrogen in the soil. As regards manure there will, I believe, be great difficulty unless the Agricultural Department are prepared to supply some sort of suitable chemical manure at a cheap rate on the spot.

333. (15) *Conditions affecting increase in area.*—As I have stated before, when writing about short stapled cottons, I do not think that generally speaking Chhattisgarh, except the more northerly parts, is suitable for any kind of cotton, and it is only when prices are exceptionally high, that profits can be made in the Nandgaon State. Of course this difficulty about the heavy rainfall can be more or less eliminated by sowing cotton on well drained soils such as *bhata* (porous lateritic soil) always providing that cotton is available for irrigation after the rains stop and that manures in sufficient quantity can be obtained. As regards water, it is of course for the Irrigation Department to see whether they are prepared to give water at a reasonable rate for irrigation on such porous soil.

334. (17) *Prevention of mixing of different varieties.*—As a manufacturer of yarn and cloth, I would say that one of the great difficulties in India is to prevent the mixing of short and long stapled cotton together. This is not done so much, I believe, by the growers but by the middlemen who buy the cotton in small lots and cart it about with them from village to village until they have sufficient to make it worth their while going to the market. Here of course there is difficulty in getting growers to bring in their own produce, since they do not grow sufficient quantities of cotton for it to pay them to bring it in themselves, and the only way in which we check mixing is by always paying for *kapas* at the market rate for the lowest quality in the mixture, though this method as a matter of fact is not really satisfactory, since, in many cases, I have noticed that the only result is that the growers of staple cotton get no more for their produce than the men who grow ordinary short staple.

(2) No manufacturer will of course allow any mixing in his factories; and I do not think that ginning factories that simply gin *kapas* and hand over the resultant cotton and seed, to the owner, do mix cotton. It is done by smaller cotton sellers who buy *kapas* for themselves and sell the cotton.

335. (18) *Uses of seed and seed selection.*—It is usual for cultivators to keep a certain amount of good *kapas* by them until just before the rains break. They then hand-gin their *kapas*, reserve the seed for sowing and send the hand-ginned cotton to the market for sale.

(c) Exotic cotton.

336. (21) *Varieties.*—As I have mentioned before, I have tried both American and Egyptian cotton, Sea island, Georgian brown and Egyptian *Abassi*. None of the varieties tried were really successful, and I am inclined to think that these varieties are not suitable at any rate for this part of India.

337. *Experiments with tree cottons.*—In 1904, the Government of India and the British Cotton Growing Association made grants to the Long Staple Cotton Growing Syndicate, which was started by Messrs. Shaw Wallace & Co., with a view to push the cultivation of long stapled cotton in India. I was appointed to take charge of this work when it was started, but unfortunately within a couple of months, I was obliged to go home on a year's leave on account of malaria. When I came out again, land had been selected in various places in Bihar, in Krishnagar, Ranaghat, Jessore and the Central Provinces, and we had started growing different kinds of staple cottons, as also three main varieties of tree cottons, *Braziliense*, *Barbadense* and *Caravonica*. All the experiments proved a failure, the chief cause of the failure being in my opinion that all the land selected was more or less liable to water-logging.

(2) Having seen the results of all these experiments and having seen these tree cottons grown for many years—I have plants in my garden, which are twelve years old—I believe that tree cottons, especially the *Barbadense* variety, can be profitably grown in India, and I have expressed this belief in a short note, written for the Agricultural Gazette of the Central Provinces. The chief difficulties to be contended with are:—

- (1) That the stems of the plants are brittle especially after the plants have been grown for some years.
- (2) They survive the hot weather with difficulty, unless protected to some extent from the direct rays of the sun.

- (3) They are particularly subject to be attacked by stem borers.

(3) I believe that, provided wind breaks, such as are employed everywhere in the south of France to prevent damage from the "mistral" are employed, the bushes are grown under light shade, something after the fashion of coffee, and the plants at the same time have their stems whitewashed, then a very profitable crop can be harvested with little trouble year after year since the plants are of course perennials.

338. (28) *Importation of seed.*—I am not in favour of importing seed from other countries since it has been found over and over again that imported seed is extremely dangerous, in that, very often, new pests are imported with the seed.

II.—COMMERCIAL ASPECT.

339. (31) *Standardization of commercial names.*—The amount of cotton grown roundabout these mills is very small, and I am therefore obliged to import most of the cottons we require. Practically all our staple cotton comes from the province of Madras, since the staple varieties, which were formerly obtainable in the Central Provinces, have, in my opinion, much deteriorated in recent years and also owing to the qualities available becoming less each year. It is cheaper to bring Cambodia and other staple Madras qualities by sea to Calcutta and thence by rail to Rajnandgaon than to buy in the Central Provinces. I do not consider that it is necessary as far as mills are concerned to standardise the names, since we do not usually buy cotton by names but against samples.

340. *Methods of buying.*—I have had ginning factories in Amraoti, Chanda, Chhindwara, Kawardha and Nandgaon; and in places away from the mill, which I am unable to inspect often, employ *arattas* to pay for the *kapas* bought and brokers to bring in the carts to the factory. Where there is a cotton market,

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[Continued.]

we draw samples from the carts and settle allowances on account of quality before taking the carts from the markets. The arrangements seem to work quite satisfactorily.

III.—STATISTICAL.

341. (33) **Improvement of cotton forecast.**—The cotton forecast of the Central Provinces has recently been very accurate, and I believe the difference between the forecast and the actual has not been more than about five per cent.

342. (35) **Publication of Liverpool and Bombay prices.**—It is not, in my opinion, necessary to publish Liverpool and Bombay prices in up-country markets. Every big dealer knows them and others very soon get the information.

IV.—MANUFACTURE.

(a) Ginning and Pressing.

343. **General.**—All our gins are Platt Brothers' single Macarthy gins. I have tried three other makes, but found them not satisfactory, so that I soon threw them out. We used formerly to bale cotton at all our factories except at Chanda. We have now however only kept on Chhindwara and Nandgaon factories, and, as we find it cheaper to transport our cotton in Australian woolpacks, the baling presses are not in use. Occasionally I have bought Saw Ginned Dharwar, but the quality of this variety has deteriorated and I no longer buy it. If long stapled cottons were grown in these districts, I should not require to make any substantial alteration to the machines.

(b) Spinning and Weaving.

344. (43) **Counts spun.**—We spin here from 2½s to 28s and 32s.

345. (44) **Condition of cotton.**—Cotton reaches us in good condition excepting that of course the tops and bottoms of bales from which the gunny is often removed in transit are very dirty, and, in the rains, we calculate on losing thereby about one per cent of the cotton.

ANNEXURE.

Note by Mr. C. E. Low, I.C.S., Director of Agriculture, Central Provinces, on a proposal to introduce cotton in Chhattisgarh.

Introductory.—I have long been of opinion that cotton, probably long stapled, could be successfully grown in Western Chhattisgarh. Efforts have been made since the year 1900 by the Central Provinces Mills, Rajnandgaon, in conjunction with the State authorities, to induce cultivators to grow cotton; but with very varying success. A few results have been strikingly good: but most were lamentably bad. Good cultivation in most cases seems to give good results. Failure is mainly due to bad cultivation, for which this tract is notorious. Efforts were concentrated too much in the south-western areas near Nandgaon, where the rainfall is higher. The Agricultural Department was not at that time in a position to give more than advice and occasional help; it could not control: nor at the time, when the greatest efforts were being made, was its staff sufficiently well trained to be of real help.

We now have a well trained and rather more numerous staff: we know a good deal more about cotton growing than we did: and I think the time has come when we should attempt to consider Western Chhattisgarh seriously as a field for cotton growing. That the most promising area is largely comprised in Native States seems to me to be of no importance.

Tracts visited.—In company with Mr. Clouston, Deputy Director of Agriculture, Southern Circle, and Mr. Frederickson of the Central Provinces Mills, Rajnandgaon, I visited the states of Rajnandgaon, Chhuikhadan, Khairagarh, Kawardha and the Zemindaris of Gondai, Takurtola, Silhati and Lohara, between the 3rd and 7th December. I had intended to go on to Pandaria, but, in view of the fact that I already know the Zamindari well, and that I was pressed for time, I did not do so.

2. **Existing cotton crops.**—I saw several fields of *buri* and Berar *jari* cotton at Nandgaon, grown by the Dewan. The appearance and probable outturn were highly satisfactory, the crop was sown in lines and looked clean and well grown. I also saw two small fields of cotton at Chhuikhadan grown by the Dewan, one of *buri* and one of *jari*. The first was perhaps the best *buri* field I have ever seen: and the *jari* also was a good crop. I saw several fields of indigenous cotton near Kawardha: it was grown broadcast, mixed with *tur*, which was usually sown in lines. It was scanty and not free from weeds: the ground was hard and ill cultivated. The outturn was roughly estimated at about 150 pounds. Inter-cultivating would enormously improve this. I saw a very fine field of *buri* at Niwari near Kawardha. The crop was pure and yield probably extremely heavy. There was a very fairly good crop of *jari* grown beside it. This seemed not to be manured. The *buri* was grown on *genura* (adjoining village) land. The cultivator was a local *gontia*. Practically all the good looking cotton was moderately well manured.

3. **Cotton samples.**—I saw samples of cotton at various places. Nearly all of it similar in character, a mixture, with a lot of *malvensis*, but all very poor, small and damaged in some cases by insects. In one case, I saw a mixture of *buri*.

4. **Area and occurrence.**—The crop is most plentiful round Kawardha, where the area carries from 4,000 to 6,000 acres, according to the year: in this State it is concentrated in the Western jungle. The crop is also not infrequent in Gondai, Lohara and Chhuikhadan, especially in the outlying portion of the latter State called Bortara. In one *patwari's* circle here as much as ninety acres are reported.

The favourite fields for cotton are slopes of second class black soil called *ghurri* and *dorsa*: also in *genura* (adjoining village) fields, and on old village sites (*dih*). Near the hills to the west, this type of rolling poor black soil is predominant and could all grow cotton. Further east, the land is flatter. The areas where cotton might be grown are at present cropped with *kodo tur*, often in rotation with wheat. *Kodo tur* is a very poor crop; and cannot yield more than Rs. 15 an acre. The wheat is of poor variety (mostly *kathia*), and I doubt if it would yield more than Rs. 25 an acre.

5. **Previous distribution of seed.**—The Central Provinces Mills and the Agricultural Department have distributed *buri* and *jari* seed during twelve years past. The *jari* was not pure *roseum*, but the ordinary Berar *jari* containing all the ordinary mixed species with the exception of Upland Georgian. Pure *roseum* would give a higher yield than this *jari* and a very much higher one than the local mixture.

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6. **Prices and trade.**—The prices were said to be (December 7th) at Rajnandgaon, *buri* three and a half seers to the rupee and *jari* four and a half seers to the rupee. Further from the railway, prices varied, but tended to get lower the further one went. In many places, the prices for local cotton were as low as six or eight seers per rupee, and no better price was offered locally for Berar and *jari* or *roseum*. The local Marwaris buy the cotton and export most of it to Nandgaon. This makes it difficult for the Central Provinces Mills to help the cultivators by giving good prices, as the difference is mostly intercepted. The Central Provinces Mills have a gin at Kawardha, but it is not working at present.

7. **The rainfall.**—The rainfall decreases towards the north and west. I append a table—

Khalsa—	Inches.
Mungeli	45
Bemetara	44
Simga	43
Pandaria	46
Feudatories—	
Khairagarh	44
Kawardha	38
Chhuikhadan	40
Nandgaon	48

8. **Economic history of tract.**—The past history of the tract shows that it once grew a good deal of cotton especially round Kawardha: this was sown and woven locally and also exported by road through Jubbulpore to Mirzapur. At the time of the cotton famine, 72,922 acres of cotton were grown in Kawardha, Pandaria and West Bilaspur. The coming of the railway, and the great rise in the price of cereals, discouraged the growth of cotton. The price of this, forty years ago, is said to have been as much as eight seers per rupee, i.e., the price has in consequence of distance, small areas, bad trade connection and most of all bad seed, hardly risen at all, whereas the price of grain has multiplied tenfold and more. This is quite a sufficient cause for the decline.

9. **Difficulties to be expected in extending cotton growing.**—The difficulties are, firstly the bad local method of broadcasting. We might teach the cultivators to replace this by sowing with the *nari*, i.e., single tube drill, which they use for their wheat already: and we could then teach them to intercultivate with the *dhuandia* or small weed-hoe. Next, the seed is bad. We can give them good seed and take care for the first few years that they kept it pure. Lastly prices are low. We should have to arrange to collect the cotton, and send it to Rajnandgaon in bulk, or to the Kawardha gin, as soon as it is opened. This would ensure a good price.

There are undoubtedly serious obstacles to overcome. There is the apathy of the Chhattisgarhi. Even among our backward Central Provinces cultivators, he is altogether in a class by himself for backwardness and apathy. It has taken us six years' hard work to get 15,000 acres of rice transplanted in Chhattisgarh, instead of broadcasted. Similar difficulties may be expected in respect of cotton also.

The cattle are poor and small and the manure is inadequate. The latter difficulty is met even in Berar; it is a difficulty deep-seated in the rural economy of the country and can only be overcome by generations of laborious demonstration and administrative action. The poorness of the cattle we are already trying to deal with; but it will take many dozens of years to effect any great improvement.

10. **Forecast of possibilities.**—Allowing for all this, however, I am of opinion that a large area can be planted with cotton in this tract; which at its best will be as good as anywhere in the Central Provinces and at its worst will be to some extent inferior to the Berar crop, but still, far more paying than anything else the ground is capable of. In view of the rainfall and the somewhat retentive nature of the soil, I am of opinion it would be advisable to attempt to introduce *buri* here in the first instance. The fields I saw in this tract appear, when decently cultivated, to be superior to *jari*. It would be impossible, however, to be certain on this point, without experiment. Perhaps comparatively well manured and cultivated fields might grow *buri* and the poorer ones *roseum*.

The result of my tour is to bear out the idea I had already formed from the results of the work done by the Central Provinces Mills and the authorities of the various States. Some excellent results have been attained; but there has been no skilled or continuous supervision such as the Government Agricultural Department can provide. Given this, and the good will of the State authorities and of the Central Provinces Mills, and I see no reason why a success should not be achieved after some years' hard work. The Rajas of Khairagarh and Kawardha, the latter of whom I saw personally, are anxious for us to start work, and are ready to find land for us. The Diwan of Rajnandgaon is equally helpful and sympathetic. There are also large areas of *zamindari* land, mostly under the Court of wards. No fear need be entertained of the attitude of the local authorities at present; and it is for the Agricultural Department to see that these friendly relations are continued.

11. **Future programme.**—Our programme should certainly be as under: (i) We should acquire a farm of some fifty or sixty acres, to experiment on the best varieties and methods of cultivation, to serve as an object lesson to cultivators and as a centre of our demonstration work, and to produce seed for distribution.

(ii) We should have an overseer in charge, not only of the farm, but of demonstration work, and if possible an assistant to help him; and we should have a number of *kamlars* (skilled labourers) trained on the farm. Small groups of villages, five or six in each State, should be selected to start with, and approved agriculturists living in these villages encouraged to grow cotton. This area should be gradually extended. Arrangements should be made to keep the seed pure, and to help the cultivators to market their cotton on favourable terms.

12. **Site and management of Farm.**—The farm should be located in the tract most favourable for cotton growing and where most cotton is grown already, near a road, and at a place of general resort. Sites in the States of Chhuikhadan (Bortara chack), Nandgaon and Khairagarh (Khamaria chack) have been offered. These are well suited, but rather distant from the road. I prefer a site near Kawardha town, and the Raja to whom I explained our proposals in detail, is very ready to give us one. The site will be near a place of general resort, and will be distant by road some 52 miles from Tilda Station, 73 miles from Rajnandgaon, and 72 miles from Raipur. The whole area under consideration is a long way from the Bengal Nagpur Railway and no nearer site can be found: but the roads are quite practicable for motor car or motor cycle. If the Mandla-Bilaspur Railway line is built, it will pass within a few hundred yards of the probable site of

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the farm. It will be essential to place a thoroughly reliable man in charge as it will not be so easy to inspect this farm as our others. The supervision will rest with the Superintendent of Demonstration, Chhattisgarh, a competent but very hard worked officer; and the Deputy Director of Agriculture, Southern Circle, Mr. Clouston, to whom the two above epithets may be applied with even greater force.

13. *Probable date of starting.*—I could not possibly recommend the inception of the attempt to introduce cotton into Western Chhattisgarh, until a third Deputy Director of Agriculture arrives and relieves Mr. Clouston of the charge of the Berar-Nagpur-Wardha cotton area. When that has been accomplished, I think we should make a start, and I hope the result will be a useful addition to the area of land in India growing a long stapled cotton.

Mr. H. FREDERICKSON, called and examined.

346. (*President.*) I have considerable experience of cotton in the Central Provinces, having been here for the last twenty years. I am manager of the Bengal Nagpur Cotton Mills, Rajnandgaon. My experience of tree cottons chiefly in Bengal and Bihar did not prove satisfactory. The land was unsuitable and more or less water-logged. The cotton was a complete failure, and after three years it was decided to abandon it as in those parts of the country it was not a commercial proposition.

347. We have only had very small quantities of *roseum*. It has not been grown largely in the Chhattisgarh division. It is a good cotton of low staple, strong and rough and spins 10s. to 12s. I used to see a lot of Hinganghat *bani* when I first came out but, it gradually disappeared. We had a factory at Chanda to buy Hinganghat *bani kapas*, but the people mixed it so much that it was no good buying it and we gave the factory up completely. We spun it up to 32s. weft. It ran up to an inch and an eighth in staple. I know the cotton called *buri*. It proved to be weak; the staple was all right, about an inch in length, but it was a weak cotton. The ordinary Nagpur cotton known as *jari* is all right for low counts. We spin from 2½s. to 32s. For the higher counts we import cotton from Madras. We cannot get any cotton locally to spin high counts. Some cottons grown near Akola spin up to 20s. From the cotton that comes from the Nizam's territory we can frequently spin up to 30s. I have not had much experience of *roseum*.

348. I only took up cotton growing when I came out to India. As to the possibility of growing long staple cotton in the Central Provinces, I do not think the climate or the length of the growing season is entirely against it. Cambodia would grow quite well under irrigation. In my written evidence, I said that one of the great difficulties in India was to prevent the mixing of short and long stapled cottons together. I am not referring to any particular cotton but to cotton generally. I was really thinking of the local cottons in the Central Provinces, for example Hinganghat.

349. (*Mr. Wadia.*) I had a factory at Chanda for which I used to buy Hinganghat *kapas*, but the *bani* was constantly mixed with *jari*. I think the mixing was done by the middlemen. In Chhattisgarh, *kapas* is collected by men who go round with carts to the various villages. Instead of keeping the *kapas* separate they mix it. In Chanda and Hinganghat, the mixing is also done by the sellers of the ginned cotton. We used to buy all our staple cotton in Hinganghat when I first came out. Now we do not buy any at all from Central Provinces. The ginning factories gin cotton both for themselves and also on commission. As to whether the mixing is done by the ginners who buy their own *kapas* and sell the cotton afterwards, my opinion is that the ginners mix it.

350. I do not think that there is much damping now done by the ginners. I think that the practice is dying out. It used to be more prevalent formerly. I have seen damping machines in several factories I have been to. There were regular machines for damping, a sort of beater for the purpose of loosening the cotton and sprays for spraying the water on the cotton as it came through, ready for the press. Damping was done both in the ginning and pressing factories. We still get a certain amount of cotton damped. I think that some people still damp the cotton purposely but less frequently than was formerly the case. I think this damping could only be stopped by inspection. I know two factories where damping was until recently done by machinery. Any inspector could see at once what the machines were used for. I think that factory inspection would stop such damping. If it cannot be stopped without legislation, then legislation must be introduced. I think that open damping like that should be stopped. It would be very difficult to stop people who just leave the cotton to be damped by dew and then take it to the market or press it, but systematic damping can doubtless only be stopped by legislation. To prevent malpractices on the part of the officers inspecting the factories, they would have to be paid sufficiently well to make it worth their while to be above such dishonest practices. I do not think there is much mixing of *kapas* with cotton.

351. If long staple cotton only were grown in Chhattisgarh, the seed would have to be distributed from Government seed farms in order to keep up the standard. I am inclined to think myself that the staple of cotton grows weak owing to the want of selection of seed and that, unless fresh seed is given out every now and then, the cotton is bound to deteriorate. I do not think that it is necessary to have seed farms over the whole of the province. The great need is of course to have the same cotton grown over a large block and then there can be no mixing.

352. I have had experience of ginning and pressing pools. My firm, Messrs. Shaw Wallace and Company, has been a partner in these pools, but not recently. We have not now got a factory in a place where there is a pool. My experience of these combines is that there is no real combine. Supposing there was a ginning combine which nominally charged Rs. 4 for ginning, all you have to do is to go round to all the ginning factories and to ask each of them what they will charge for ginning and you invariably get a rebate. It is no combine at all. The share of the profits which used to go to the pool was one-fourth. I do not think that these pools can be in the interests of the cultivators. They must result in the cultivators' obtaining a smaller price than they otherwise would. In many cases there are more factories than there is work for in a normal season. Many factories do not work at all, but get a share in the pool without working. Some factories have been started, not with an idea of working, but simply to share in the profits of the pool. I think you will find factories that have never worked even in a bumper season.

353. I think it would be a good thing if ginning factories and presses were licensed by law. I would certainly make it a condition of these licenses that, if frequent damping and mixing were resorted to, the licensee would be liable to forfeiture of the license. I would not go so far as to suggest that there should be legislation to stop pool monopolies. Nor would I advocate that where there are more factories than are necessary for a particular district and a man starts a new factory simply to share in the pool and with no other object, a license should be refused to him. I think there have been cases in which all the factories

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do not join the pool: occasionally one or two factories stand out. If a factory stood out, it would spoil the pool.

354. (*Mr. Hodgkinson.*) I have not compared the Cambodia cotton grown in Raipur with Cambodia grown in Madras, but I should say that the quality is about the same. I use large quantities of Cambodia. In my opinion, it could be grown successfully in Raipur under irrigation. I have tried growing Hinganghat, Tinnevely and *buri* but without success. In the southern part of Chhattisgarh, I should say that the failure has been due only to excessive rainfall. The north western parts of the Central Provinces are as suitable as Berar.

355. Our machines would have to be altered for Cambodia only if no lower counts continued to be spun, but presumably the demand for lower counts would continue. At present I use something like five thousand of bales of staple cotton per year. We could use more if we could get it. We might use up to double, say eight or ten thousand bales. I think the majority of the mills would also increase their use of long stapled cotton in the same proportion. It would probably be eight to ten years before any quantity would be released for export, in view of the demand of the local mills.

356. (*Mr. Ashton.*) I should think a reasonable rate for irrigation water on the porous soil of Chhattisgarh for Cambodia cotton would be about Rs. 2 to Rs. 3 an acre. The land revenue there is very small. Under the present arrangement, the cultivators get water free in the first year. I think Re. 1-8 per acre is charged for it in the second year. I do not think that it will stand a rate of more than Rs. 2 to Rs. 3 per acre. The rate would have to be increased very gradually or otherwise the cultivators would be frightened of cotton. Of course, when they get used to cotton and if profits are high, they would be able to pay a higher rate. The main crop is rice the cultivators would rather grow rice than cotton because rice is a food crop. I understand that the canals and tanks have been more or less constructed for rice cultivation. All the southern part of the district is rice country. The canals have been largely constructed as protective works to guard against shortage of rainfall and consequent famines.

357. (*Mr. Henderson.*) I do not think that there would be any difficulty in acquiring *bhata* land in Chhattisgarh. I think that the average price would be about twenty years' rent. I believe that large areas could be acquired both in British territory and in Native States. The rent is next to nothing; it is from two to three annas to a rupee per acre per annum so that the purchase price would be from Rs. 4 to Rs. 20 per acre. I see no reason why large areas could not be acquired at this price. The *malguars* (holders of land in proprietary right) would not object, I imagine. I do not think that you would be able to obtain absolute proprietary rights. That is a difficult thing to get in the Central Provinces, I believe. What you would get would be occupancy right or tenant right.

358. (*Mr. Roberts.*) In the event of purchasing land, I do not think there would be much difficulty about labour. The people of Chhattisgarh are very indolent, but I think that they know on which side their bread is buttered and, if they see a profit, they might be induced to put more labour into their land. I get my labour for the mills locally. The labourers are largely the same type of people as the cultivators.

359. I have mentioned in my evidence that the *buri* which was grown some time ago was weak in staple. I did not use much of it in my factory. It was grown experimentally in small quantities. 10,000 lbs. was the most that we had in a year. My impression is that it got weaker each year, as the seed became acclimatised. I have had some experience of Upland Georgian and I do not think that it also gets weak. I mentioned in my written evidence that it would be dangerous to import exotic seeds on account of insect pests. I have not actually seen cases of this kind, but I have heard about various other products that have been grown from imported seeds which brought in insect pests.

360. It is more and more difficult to get staple cotton in this province. It is very difficult for the cultivators to get a proper price if they only grow long staple cotton in small quantities. A man cultivating a small area cannot afford to bring his cotton to the actual consumer himself and he sells it in small quantities. If a cotton were produced which combined high ginning percentage with better yield and were brought unmixed to a big market, the cultivators would get a proper price for it. In Amraoti, the buyers buy on ginning percentage and not so much on staple, which is all the same. If an improved cotton were brought in, it would have at first to be taken to a ginning factory attached to a mill, i.e., to a mill which had its own gins. We would give a better price for it.

361. I should like to say something about tree cottons. I do not believe that they cannot be grown. We tried them but we tried them on water-logged land. I believe that there are three difficulties. One is that the stems are very brittle because they are quick growing perennials and they must therefore be protected by wind breaks. Another is that they require shade and the third thing is that they are very apt to be attacked by stem-borers. They cannot be grown on water-logged land. I see no reason why they should not be grown commercially on well drained land. I think we ought to give them another trial. The length of staple is good. If you have them ten feet apart, it would mean 400 trees to an acre. My experience is that you can get up to two seers of *kapas* in weight per tree which would be 1,600 lbs. an acre. This would make an enormous difference in the cotton crop. Since the failure in 1904-1905, nobody has been very keen on trying them. The length of staple is one inch to one and one-eighth inch. I have tried three kinds, viz., *Barbadense*, *Braziliense* or kidney variety and *Caravonica*. The cotton has a fine silky fibre.

Rai Sahib BHAIYALAL DUBEY, L. Ag., Acting Deputy Director of Agriculture, Western Circle, Central Provinces.

EXAMINED AT AKOLA ON NOVEMBER 16TH, 1917.

Written statement

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

362. (1) *Experience.*—I have been stationed at Nagpur and Akola for about four and eleven years respectively. During the latter period by nature of my duties as a member of the Central Provinces Agricultural Department, I have been in continuous touch with cultivators of important cotton growing districts, viz., Nagpur, Wardha, Yeotmal, Amraoti, Akola, Buldana and Nimar.

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363. (2) **Varieties.**—The kind of cotton now grown in the above-mentioned districts is a variable mixture of yellow and white flowered plants commonly known as *jari*, *guarani*, *katil*, *kativilayati* or *hanri* in different parts. The mixture consists of as many as six distinct cottons, viz., Upland Georgian (*hirsutum*), *bani* (*indicum*) and four neglectums—*roseum*, *roseum cutchicum*, *malvensis* and *verum*. The first and the last two are considered inferior types from the monetary point of view, and are, therefore, being gradually eliminated.

(2) From experiments on Akola Farm from where improvements in cotton cultivation of these Provinces emanate, *roseum* proved to be the most paying and has therefore been recommended by the department which, to start with, arranged for its extensive trials with private land-owners in all the districts. Their experience has also been convincingly in its favour. A considerable area is now grown with it. Last year according to my estimate it was grown in about 700,000 acres.

(3) A yellow flowered type resembling a mixture of *malvensis* and *verum* is making a little headway for such lands as are badly infested with cotton wilt. It is known as *vishnuri*, *simbhri* or *shenderjana* in different localities. The variety is not grown because of its merit but because it is said to be immune to wilt disease. The Akola Farm has started trials to test the said immunity of this cotton and by next year we shall be able to form an opinion about it.

364. (3) **Size of holdings.**—The average size of holdings in the tract is about twenty acres, and fifty to sixty per cent. of the holding is put under cotton.

365. (4) **Yields and profits.**—The average yield of *jari* cotton is 280 lbs. of *kapas* (seed cotton) and the average net profits from it amount to Rs. 20 per acre. Experiments on Akola Farm show an average outturn of 438 lbs. of *jari* and 500 lbs. of *roseum kapas*. In other words there is an increase of fourteen per cent. in the outturn of the latter. Taking this as the basis, the net profits by growing *roseum* cotton are Rs. 30 per acre. The difference in net profits in favour of *roseum* is Rs. 10 (Rs. 30—Rs. 20). Half of this increase in the net profits is due to increased outturn per acre and the other half to the higher ginning percentage. The prices of the current season would raise the net profits on average yield to Rs. 39 and Rs. 54 for *jari* and *roseum* respectively. But reduced to the season's actual outturn (200 lbs. of *kapas* per acre), the profits would actually amount to about Rs. 23 for *jari* and Rs. 34 for *roseum*.

The following table compares the average profit per acre from different crops :—

Name of crop.	Net profit per acre.	Average outturn of kapas per acre.	Ginning percentage.
	Rs.	lbs.	
<i>Jari</i> cotton (<i>deshi</i> short staple)	20	240	34 per cent.
<i>Roseum</i> cotton (<i>deshi</i> short staple)	30	310	40 "
<i>Bani</i> (<i>deshi</i> long staple)	13	230	26 "
<i>Buri</i> (exotic)	18	222	34 "
Upland Georgian (exotic)	5	186	28 "
<i>Malvensis</i> (<i>deshi</i> short staple)	17	269	31 "
<i>Verum</i> (<i>deshi</i> short staple)	16	261	33 "
Wheat	14	..	..
<i>Juar</i>	15	..	..
Gram	10	..	..

366. (5) **Rotations and manures.**—Generally cotton is rotated with *juar* which is the staple food and fodder crop. People owning large holdings put a small part under wheat, gram, linseed and other minor crops. They recognise the value of rotation with leguminous and other crops by which cotton fields for the succeeding year are better prepared. But useful rotations generally are not adopted because they are less paying and specially the *rabi* crops do not yield satisfactorily on account of short rainfall. *Tur* (*Cajanus indicus*) is grown as a mixed crop with cotton in the proportion of one to two lines of *tur* to eight to twenty lines of cotton. *San* hemp is known to be a good rotation crop, but its cultivation is restricted only to limited areas in certain parts. Want of water for retting and of labour for extracting fibre are the complaints against it. Groundnut is a new introduction and can serve as the best and most paying rotation crop for cotton. It has been grown successfully on the Akola Farm and efforts are being made to extend its cultivation.

(2) Cattle dung mixed with house sweepings and ashes is the only manure in common use. Its value is appreciated almost throughout the cotton tract and its selling price is from eight annas to two rupees per cart load of ten maunds. Poudrette is a very good manure for cotton and can be available in considerable quantities near large towns, but caste prejudices come in the way of its being used to an appreciable extent. Folding sheep, when available, is practised in some places. Artificial manures have not yet been taken up

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and cattle urine, which is of the same manurial value as their solid excreta, is also neglected. The following table shows comparative merits of some useful manures for cotton tried on Akola Farm.

Name of manure.	Outturn of kapas per acre.
Cattle dung	532 lbs
Cattle urine	575 "
No manure	321 "
Cattle dung	396 "
Poudrette	493 "
Saltpetre	409 "
No manure	301 "
Cattle dung followed by top-dressing of nitrate of soda	650 "
Cattle dung followed by top-dressing of nitrate of saltpetre	636 "
No manure	317 "

367. (7) **Conditions effecting increase in area.**—Ordinarily the cotton area does not fluctuate much. With favourable season and high prices, people are encouraged to grow more cotton and there is a slight increase on this account. The nature of season at sowing time also determines the increase or decrease in cotton area. All suitable and available area is put under cotton and it is not likely that the increase can be considerable. It has perhaps reached the maximum. There is, however, a good scope for increase in quantity from the present area by improved seed, better rotation, better tillage and more manure.

368. (8) **Uses of seed and seed selection.**—The seed is fed to cattle and large quantities are exported. A very small quantity is used for extracting oil in the Akola Oil Mills. Some years ago a few cotton growers used to select the *kapas* for seed purposes by getting fluffy bolls picked separately from cotton fields, but now, to my knowledge, no selection is done by cultivators who draw their supply of seed either from one of the gineries or from their bankers who are supposed to purchase cotton of good quality and gin it for seed purposes. The good quality of cotton in their estimation is one giving a higher percentage of lint. Seed for sowing now generally is ginned in machine gins. Hand gins, though not in common use, are yet found in some parts of the Division and the seed so ginned is valued more than that secured from factories. Hand gins are not now in favour because of (i) scarcity of labour, (ii) slow work and (iii) the lint does not fetch as good a price.

(2) Seeing that no proper system of seed selection is practised and also with a view to propagate the seed which is worth pushing, the Department organized the system of private seed farms and it has proved to be a success. Plant to plant selection is followed every year on the Akola Farm and seed propagated from the most desirable plant is given from year to year for being sown in the seed farms varying in size from ten to fifty acres. The private owner carefully cultivates the crop under departmental supervision and stores the produce and gins the seed separately. This seed he distributes to his neighbours from where it extends further. Presently *roseum* being the most paying cotton is worked with on these farms. If we happen to find a better cotton in future, the agency of these seed farms will be very useful in spreading its cultivation. What we shall have to do will be to give in the first year for trial a small quantity of seed to the owner of the seed farm who will grow it on a small area and test for himself its comparative value. If found superior, he will naturally grow his whole area with it and the seed will thus spread.

369. **Agricultural Seed Unions.**—After some years' experience, it was found that to secure large quantities of *roseum* seed for distribution, seed farms were not enough. Agricultural Co-operative Unions were then thought of. The members of these Unions promised to produce and distribute pure seed. The Union runs a central farm for which the selected seed is annually supplied from the Akola Farm. The seed produced on the Central Farm is grown on the branch farms of the Unions and that from the latter is distributed to cultivators. By this system of working, the selected seed coming from a known stock of the Akola Farm reaches the cultivator every seventh year. Unions sell the seed at a profit (amounting to about Rs. 6 per acre) and the members by ginning their produce and selling the lint direct in the market, save a considerable amount of money which would otherwise go to the middlemen. The other forms of co-operation for agricultural improvements can in future be worked well through these Unions.

370. (9) **General economic conditions.**—The cotton tract is considered to be the richest in the Central Provinces and its prosperity is attributed to the cotton crop which during the last 25 years has received particular importance on account of better prices, favourable climatic conditions and better facilities of communication and marketing the produce. Cotton markets have been of immense help in encouraging people to put more area under this crop. An average holder has however a burden of indebtedness from which he can free himself only by being more industrious and better educated to conduct his own affairs. Co-operative societies can do much good in this direction. They provide money at cheaper rates of interest and help to educate members for being better business men. Primary education followed by technical training is sure to improve the economic condition. Labouring classes in the cotton tract earn high wages and are on the whole well off.

(b) "*Deshi*" long staple cotton.

371. (11) **Varieties.**—In fact, no *deshi* long staple cotton is grown in the important cotton districts of the Central Provinces. *Bani*, known as the Hinganghat cotton, used to be grown three or four decades ago,

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[Continued.]

but the introduction of the hardier type known as *jari* has altogether replaced it by this time. Even up to ten years ago, we could trace *bani* in the southern parts of Berar growing pure in some fields, while in others it was found mixed with *jari* in large proportion. The climate of the southern plateau of Berar is more favourable for the growth of *deshi* long staple cotton (*bani*), but even there its yield is less than that of *jari*. The parts nearer the railway line took up the hardier type early because the seed was available close to them. The cause of the late introduction of the hardier type in the southern parts is attributed to their remoteness and the difficulty of transport and consequently cultivators there were not in closer touch with this new seed. As we go still further south, e.g., the Nizam's Dominions, we come across pure *bani*. The *bani* cotton coming to the Akola bazaar is known as *dhanki*, but its reputation has much suffered during recent years.

372. (12) **Conditions effecting increase in area.**—*Roseum* is more paying than *jari* and much more so than *bani*. The last being the only *deshi* long staple cotton is not being pushed. Had it been even worth pushing, the length of ginning season and climatic conditions would not help much. Useful rotations can certainly be of some help, but the present crops suitable for the purpose are less paying and they therefore cannot replace considerably cotton where it is grown from year to year. So far there has been no project for irrigation works in Berar, nor there is likelihood of any in the near future, but if it be possible to have any such project for canal irrigation in some part of Berar, I am sure it will be very popular. It will surely not help the cultivation of *bani*, but the exotic cottons like *Cambodia* and *buri*, I think, can be grown successfully under irrigation, provided that the land is richly manured. *Bani* has small bolls and the *kapas* cannot be picked out so easily and consequently labourers do not prefer to do its picking by contract which is the prevalent economic practice.

(c) *Exotic cotton.*

373. (20) **Varieties.**—The attempts made in the past towards the introduction of exotic cotton have not met with any success. In 1908, the seed of *buri* cotton, a type of *Upland Georgian* which was acclimatized in Bihar, was tried on the Akola Farm and seemed to be a promising stapled variety for introduction in these parts. Extensive trials were made in all the districts and their net result was that it could not compete with *roseum*. Though later, it is superior to *Upland Georgian*, inasmuch as its plant is hardier and more prolific. The ginning percentage is also higher. Both the varieties are immune to wilt. They suffer from leaf blight in the months of September and October when most of the leaves turn reddish brown and fall off. The young bolls, buds and flowers also fall down. If *buri* cotton is favoured with late rains, fresh leaves, flowers and buds appear by the end of November with the advent of cold, provided that the soil is heavy, retentive of moisture and richly manured. This late crop in favourable seasons helped with cold weather showers may give pickings up to April, and I believe the outturn will be quite satisfactory under the conditions mentioned above, but the individual plots in which these conditions are obtainable will stand by themselves exposed to ravages of stray cattle after the local cotton is harvested.

374. (27) **Prevention of mixing of different varieties.**—The owners of seed farms and members of Unions grow only one type in their whole cotton area from which they weed out alien plants, if any, at the time of flowering. The cotton picked is stored and ginned carefully either in small ginning plants set up at the recommendation and with the help of the Department or in ginning factories which are carefully cleaned of foreign seed before ginning the Union or seed farm cotton. The former is however a more satisfactory arrangement. The extension of this system will prevent mixture creeping in fields. Encouragement in the co-operative sale of produce only to selected and fair dealers would, in my opinion, prevent the mixture in the factories.

375. (28) **Importation of seed.**—Acclimatized selected seed is better than the fresh imported seed because the latter does not at all do well for the first three or four years and also because of the uncertainty of the type we may get from year to year.

376. **Recommendations in regard to research.**—In my opinion, there is yet some scope for research work in exotic and *deshi* long staple cotton :—

- (i) A suitable type may be secured by seed selection or by hybridization.
- (ii) Suitable manure or mixture of manures may prove helpful.
- (iii) About the most suitable and economic cultivation for exotics much is not yet known.

Large areas in the northern districts of the Central Provinces may be found suited to grow the exotic like *buri* with improved methods of cultivation and manuring.

III.—STATISTICAL.

377. (33) **Improvement of cotton forecast.**—Allowing for the difficulties in forecasting the yield of this crop, the cotton forecasts published in these provinces are fairly accurate since the Agriculture and Land Record Departments co-operate to frame the forecast.

V.—GENERAL.

378. (46) **Attitude of buyers to improved cottons.**—Regarding the premium on the prices of long staple cottons, my own information is that no buyer has yet come forward to offer premium to encourage the growth of stapled cotton. When the Department tried to push *buri* in the first year, it got the premium value of fifty per cent. more than that of local cotton. After three years, when the area under this cotton extended to 6,000 acres it could secure only twenty per cent. more chiefly because its staple had gone weaker and then it was less paying than either *jari* or *roseum*. The people were thus discouraged to grow and now have given it up entirely.

379. (49) **Effect of tenure of land.**—The tenure of land is not at all obstructive to cotton cultivation in Berar where the tenant is in fact a proprietor of the holding. He can thus safely spend on the improvement of his holding. He has sufficient credit to raise money, if necessary, on the security of his land. In the Central Provinces districts, the conditions are quite different. The ordinary and occupancy tenants there have not the same privileges of dealing with their holdings as in Berar.

Rai Sahib BHAIYALAL DUBEY called and examined.

380. (*Mr. Roberts.*) In my written statement, I have given the net profits per acre of the various types of cotton. This calculation is arrived at by taking the gross outturn and deducting the cost of cultivation.

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[Continued.]

The cost of cultivation is uniform throughout. It is the same in the case of *jari*, *buri* and *roseum*. I have given the outturn figures on which it is based in the third column of the statement. The average outturn of *jari* is for the last five years and represents cultivators' average. The figures for other types are in relation to this average. *Buri* yields less *kapas* than *bani*.

381. The figures in the statement in paragraph 366 are the results of ten years' tests on comparative plots. The experiments with manure have all been made on *roseum*. I have made no experiments to know the effect of manures on American types or of different manures on different types. We have applied poudrette and cow dung to the non-experimental fields and there we know that the effect was good. I do not think that there would be any difference in the effect on the American or on the *deshi* types, if the dose of manure is heavy. But the American types could not be grown on unmanured plots. These comparative tests have all been on one-tenth acre plots which were manured at the rate of forty pounds of nitrogen per acre. I do not think that *buri* could be grown profitably without manure; other *deshi* types might be. In ordinary conditions, *buri* could not compete with *deshi*. If manure is applied, *buri* has got a higher potential yielding power.

382. I have stated in my written evidence that if irrigation is possible, it would be feasible to grow exotic cottons like *Cambodia* and *buri*. I have also mentioned other conditions. If *buri* gets late rain and three or four showers of rain in the cold season, then it will give a good outturn provided it is helped with manure. If there are no cold season showers, there will be no late pickings. The flowers of *buri* are knocked off by rain in August but with the advent of the cold season, the flowers come out again in the beginning of December. In order that the crop may prove successful, there should be some moisture in the soil, which can be supplied by winter rain.

383. It is the case that in ordinary mixed *jari*, there is a proportion of Upland Georgian grown. It is sometimes as high as twenty to thirty per cent. but this is now found only in remote parts. Ordinarily you see from ten to thirteen per cent. in the fields. *Buri* is much hardier and more prolific than Upland Georgian. Upland Georgian still exists as mixture in *deshi* cotton. A careful cultivator prefers to eliminate Upland Georgian at the time of weeding. The cultivators do not like this type and when any attempt is made to eliminate undesirable types, Upland Georgian will be eliminated first and altogether. The seed is ginned in factories and a lot of mixture goes on in the factories. The area under cotton in Berar is about thirty lakhs of acres. It is very difficult to say what is the highest area of American cotton that we have had in the Central Provinces because it has not been grown in a pure state. I do not know if there is any area in which it is grown pure except one village in the Yeotmal district which has got some wilt-infested land which grows Upland Georgian. It is about fifty to sixty acres in extent. We grew up to 6,000 acres of *buri* in 1911-12. Apart from the question of ginning percentage, I think I can distinguish Upland Georgian from *buri* but the ordinary cultivator would not be able to do so. The plant of *buri* shows more vigour than that of Upland Georgian. I have had something to do with selection work on cotton. I have done selection work on American cotton. Ginning percentage, vigour, hardiness, length and strength of staple are the points to which attention is paid.

384. Both Upland Georgian and *buri* are immune from wilt. About two to three per cent. of the area under cotton is affected by wilt. In some places the percentage is higher. In the northern parts of Berar, it is worse than in the southern parts. It is especially prevalent in rich and heavy soils. It has also been attributed to heavy manuring.

385. Whether in the northern part of Berar, there are still good prospects for staple cotton, has yet to be seen. In the north of the Central Provinces, they have heavy soils and heavier rainfall so the prospects of American cotton there seem more favourable. I am referring to the black soil in the north of the Central Provinces which is suited for growing wheat. I mean the heavy soils of the Hoshangabad, Narsinghpur, Damoh, and Saugor districts. Wilt is not going to be a decisive factor at present at any rate, for the introduction of *buri* cotton. I have not got sufficient experience regarding other factors. In villages where wilt already exists, it is a serious question. I know of some villages where the people are in fact very much disappointed with cotton on account of wilt and the first effect will be the reduction of the area under cotton. Of course the cultivators will try some other varieties, for instance in Yeotmal they have sown Upland Georgian in fifty acres, in a village called Moha where the land suffers very much from wilt. In other cases cultivators are trying another variety called *vishnuri*. It appears to be a mixture of *verum* and *malvense* but our experience is that it is not entirely wilt resistant. It is apparent from the trend of my evidence that even in the Moha village of the Yeotmal District one could put out an American type which would be much better than the Upland Georgian. *Buri* is a much better type than Upland Georgian. *Buri* seed was given out to that village in 1911-12 and perhaps it is grown mixed with Upland Georgian there now. *Buri* and Upland Georgian are entirely immune to wilt. I have never seen wilt attacking them. I have mentioned in my written evidence that the most suitable and economic conditions under which exotics can be grown are not exactly known. We have got waterlogged areas. We know that *buri* stands waterlogging better than *roseum*. *Buri* might do better than *roseum* in patches here and there but there are no continuous tracts in which it would do so.

386. As to the possibility of improved *deshi*, I think that *bani* is out of the question on account of its lower ginning percentage. We have a cross of *bani* with *deshi* Lahore which seems to be promising. Some times we get good reports about its fibre and sometimes it is said to be irregular. So we have not yet made up our minds about it. It gives about 35 per cent. of lint. It is pure so far as the leaf characters and the flowers are concerned.

387. The selection work I do is carried out in the way I will describe. We select from one line three to four plants, the most vigorous of all and those which bear the greatest number of bolls. Originally when we started, we selected eight or ten plants from a big field. The seed of each of these plants was sown in a single line. The total outturn of each line was compared. We also counted the number of plants, worked out the percentage of yield for each plant of the line and the line which showed the best results was retained and the rest rejected. From that line again, we selected two or three plants and the seed of those plants was again sown in lines the following year. The seed from the best of these lines would be sown in a small plot and the seed from that plot in an increased plot until we got sufficient seed for the whole farm out of the best of the plants originally selected. The system of selection therefore is that three plants are selected from a line and the seed from them is sown in another line the following year. This goes on until in the fifth year the whole farm would be sown with that seed. In the sixth year, seed from the farm would be supplied to the Central Union Farm which would supply it to the branch farm

the following year. From the branch farms it goes to the cultivators. It thus takes eight years for seed from our original selection to reach the cultivator.

388. (Mr. Henderson.) I do not know if, in the opinion of the cultivators, the quality of *bani* is going down every year, but it is certain that they do not like to grow it. At one time Hinganghat *bani* was famous. I cannot give definite figures as to what the yield of *bani* used to be. I heard the opinion expressed yesterday that, in old days, the yield of *jari* was 200 lbs. and of *bani* 127 lbs. per acre. In the old days when Hinganghat *bani* was famous, in the parts in which *bani* was grown, *jari* was not known. *Jari* was grown at that time in Berar but from the description the people give of it, we know that this *jari* was different from and superior to the ordinary mixture now commonly known as *jari*. The mixture in Berar is known as *kati vilayati* and it must have come from Khandesh and gradually made its way towards Hinganghat. We find *bani* still grown in the Nizam's dominion and the chief reason for this is that the people there have not yet either been able to secure the seed of *roseum* or of *kati vilayati* or do not know about it. I came to Berar in 1906. At that time, the *bani* that used to come in to the Akola bazaar from the Nizam's dominions was pure *bani*. Now we find all kinds of mixture though there is a high percentage of *bani* in it but the pure *bani* carts that we get now are very few; it is only from Dhanki and other parts in the Nizam's dominion that we get pure *bani*. They grow *bani* in the Nizam's dominion only because they cannot get any other seed. The people who come to sell their *kapas* here, see the local or *kati vilayati kapas* in the market and they take away some seed from here and gradually it is spreading there too. I think the *bani* from the Nizam's territories is the same as the old *bani*. As to whether it is as good as Broach, I have not much experience of Broach cotton but the *bani* at present is as good as it used to be, as the old men say that it is giving the same outturn as it gave then.

389. The figures in my written statement relate to net profit per acre over ten years but of late the price of *buri* has gone up. It went up last year. In view of the price of staple cotton, it is quite possible that the price of *buri* will go even higher which might give a much more favourable aspect to *buri* cultivation. The price per maund of *buri kapas* to enable it to compete with *roseum* would have to be about Rs. 13 as compared with *deshi* at Rs. 8 per maund. At the present price of Rs. 16 per maund for *deshi kapas*, *buri* would have to be Rs. 24 per maund. The basis of the calculation in my written evidence is this: from our reports, it can be found that certain cottons were selling at certain prices; for instance, in 1913-14, *roseum kapas* was sold at Rs. 65 per *khandi* of 560 lbs. *Jari* was sold at Rs. 103 per *bhoja* of 345 lbs. of lint. *Bani* was sold at Rs. 125 per *bhoja*, *malensis* at Rs. 107, *verum* at Rs. 107, *roseum* at Rs. 105 and *buri* at Rs. 133. We took the average of nine years.

390. As to the number of centres in which we had comparative trials of *bani*, *roseum* and *buri*, we have not tried *bani* since 1904-05 because in 1904 and 1905, we had distributed large quantities of *bani* seed and without any exception, the results were unsuccessful. *Buri* trials were started in 1908. Tests were made on the central farm. There were only three or four seed farms originally. Seed was given out to five or six seed farms. There were only one experimental plot and some non-experimental areas in which *buri* was grown. The tests were carried out for two years. After the second year, seed was given out to the seed farms and the results were compared. It might have been better if more exhaustive tests had been carried out. I cannot definitely say whether *roseum* would be the best type for the Nizam's dominions.

391. Most of the cotton in Berar is grown without manure. I have gone into the question of leguminous crops to take the place of manures. I would recommend small Japan groundnut as the most suitable leguminous crop for rotation with cotton. I have not tried experiments with other leguminous crops such as *matki*. *Matki* is an inferior crop and grown only on very light soils. The limiting factor in Berar is largely one of manure. The difficulty of introducing rotations of leguminous fodder crops is that those crops would not pay. We made some trials with Raipur local groundnut but we found that there was difficulty in regard to labour for lifting the crop. We tried soy bean for fodder. We did not feed the cattle on the ground. We collected the crop and turned it into *bhuwa* (fodder). I do not think there is any leguminous crop except groundnut which could be used as a suitable rotation with cotton. Other crops are not sufficiently paying.

392. Last year we got very little *buri* and that was inferior. This year *buri* has yielded very well and the quality of the cotton is good. In 1911-12, we had six thousand acres of *buri*. For the *kapas* the cultivator would have got only the same price as the local cotton. We therefore made special arrangements to collect the *kapas* at one place; it was ginned separately and the lint was sent to the Empress Mills, Nagpur.

393. I have had some experience with American types. In Mr. Mollison's time, we tried various types of Upland Georgian. Some thirteen to fourteen types were tried. *Buri* seemed to be the best. I have had no experience of Dharwar American. As to Punjab American, I do not know whether the seed came from the Punjab, but we got some seed from Kabul eight years ago. It might have come through the Punjab Government.

394. (Mr. Wadia.) If the price of *buri* went up to Rs. 160 per *bhoja* of 345 pounds, I still do not think it would pay the ordinary cultivator to grow it but those who were enthusiastic about it might grow it. The yield of *buri* on unmanured lands is only about 120 lbs. per acre. Rich lands might yield up to 500 lbs. per acre. The figures in my written evidence are for fair land. *Buri* will not grow on light soils. The cultivators of heavier lands might take to it if the prices went up but the cultivators of light land will not grow it. When the premium on *buri* went up to fifty per cent., the area went up to 6,000 acres but it fell again when the premium dropped to twenty per cent. At present, lint of *jari* (local cotton) is being sold at Rs. 440 per *khandi* of 784 pounds. The Nizam's State *bani* grown in Parbhani and its neighbourhood is fetching Rs. 590, and there is therefore a difference of Rs. 150 per *khandi*. *Buri* cotton lint will fetch about the same price as Parbhani *bani*. If prices were favourable, there would be a considerable area under *buri* but all cultivators would not take it up. Large quantities of *bani* and *buri* could be grown in Hinganghat if prices were still more favourable.

395. *Roseum* and other varieties of *neglectums* as well as *bani* are liable to wilt whereas *buri* and Upland Georgian are immune. *Buri* and Upland Georgian are however liable to leaf blight, which does not attack the *neglectums*.

396. The growing season for local cotton lasts from July to October. We sow from the middle of June to the first week in July. It is a four months crop. The picking begins at the end of October and goes on to the middle of December but if the rains are favourable, it sometimes continues up to January. The shortness of the growing season is one of the difficulties in the way of long staple cotton. We do not get frosts. The lowest temperature in December and January would be about sixty degrees but sometimes

it is less. By shortness of growing season, I mean that there is no sufficient moisture in the soil in December and January.

397. The most ordinary rotation is cotton after *juar*. Cotton after wheat, gram or any other *rabi* crop is better than after *juar*. Cotton after wheat is not a common rotation. On account of short rainfall, wheat does not pay the cultivator. *Juar* crop is taken after cotton. *Juar* is sown in July and then the field is put under cotton the next year. Both *juar* and cotton occupy the field for one complete year.

Rai Sahib GANESHDAS KUNDANMAL of Amraoti.

EXAMINED AT AKOLA, NOVEMBER 16TH, 1917.

Written statement (Translation).

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short-staple cotton.

398. (1) Experience.—I am a resident of the Amraoti District. I am in actual touch with cotton cultivation.

399. (2) Varieties.—There are two varieties, one is *katel* and the other *vilayati*, or *tapri*.

400. Area under cotton.—The Amraoti District contains about sixteen lakhs of acres of land fit for cotton cultivation, out of which about nine lakhs of acres are under cotton every year.

401. (4) Yields and profits.—The average yield per acre is 240 lbs. and the profits per acre, after deducting expenses of cultivation and rent, are eighty lbs. of cotton.

402. (5) Rotations and manures.—The rotation of crops in *kharif* land is *juar* and cotton, alternately, and in *rabi* land, wheat, or gram or linseed and cotton. All fields are not manured, but whenever manure is applied, it generally consists of cow-dung.

403. (6) Comparative returns.—Long-staple cotton requires a greater amount of rain, and as we have got less rain during recent years, this crop does not yield a good return. Hence short-staple cotton is generally sown. Another reason is that the short-staple cotton yields more than the long-staple cotton.

404. (7) Conditions affecting increase in area.—The area under short-staple cotton in the Amraoti District does not fluctuate largely. The people are convinced that *deshi* short-staple cotton yields more return and hence this variety is likely to be sown in greater quantities. But if the rate of cotton ceases to maintain the present standard, it is possible less cotton might be sown and any crop that would fetch a good price would be sown instead.

405. (8) Uses of seed and seed selection.—The seed is generally used for feeding cattle, and a quantity of it is exported for the purpose of extracting oil from it. Generally, no seed selection is practised on a large scale, but some cultivators remove seeds of the *tapri* variety and others weed out the plants. Some set aside a quantity of selected cotton for seed purposes and, after taking out the seeds, sow them. It is only rarely that hand-ginned seed is sown, but people generally use machine-ginned seeds.

406. (9) General.—I think that if Government increases the facilities for irrigation, and the high price of cotton is maintained in future, then, probably, a greater quantity of cotton might be produced.

(b) "Deshi" long-staple cotton.

407. (11) Varieties.—Long-staple cotton is generally never sown in the Amraoti District. Formerly, a variety of long-staple cotton called *bani* used to be sown, but it is no longer used, owing to want of sufficient rain in recent years. There is no other *deshi* variety of long-staple cotton. More remarks on this point are unnecessary.

(c) Exotic cotton.

408. (21) Varieties.—*Roseum* and *buri* are the two varieties sown in the district. Only a very small quantity of these varieties is grown. The quantity of exotic cotton sown in the district is about one per cent. of the total quantity grown there.

409. (23) Comparative returns.—If there be more rain, the *roseum* variety does not yield a good return. If the rain be moderate, the average yield per acre is about 280 lbs. The *buri* variety is rarely sown, and its yield is less than that of *roseum*, as it does not get sufficient rain. Its yield depends on the amount of rain. Hence it is difficult to say what the yield per acre would be: about one-third of the total yield represents the profit of the cultivator. The proportion of this variety to *deshi* short-staple cotton is less than one per cent.

410. (25) Conditions affecting increase in area.—The increase in the growth of *roseum* will depend upon the facilities afforded to the cultivator to obtain select seed from Government farms. Seed is not properly selected on the seed farms and by seed unions, because the cultivators do not take proper care in selection and consequently they get a mixed crop. People cannot trust in the quality of the seeds, and the price also the *roseum* seed is also higher. Hence this seed does not command a good sale. If we want to grow more *roseum*, its seed must be sold at the rate at which *deshi* seed is sold in the market, and it must be supplied from the Government farms.

411. (26) Suitability of existing varieties.—The *roseum* variety yields a good crop in this district. The question whether other varieties can be grown with satisfactory results cannot be answered at present. An experiment should first be made on the Government farms and when we are convinced that a particular variety would yield excellent results, then its use might be extended.

412. (27) Prevention of mixing of different varieties.—It would be hardly necessary to weed out the plants in the fields if Government officers give seed, ginned under their own supervision from cotton grown on Government farms as well as cotton grown on private fields where the *roseum* variety alone is allowed to stand after weeding out the *deshi* short or long staple kind, under the supervision of Government officers.

413. (28) Importation of seed.—In my opinion, it would be better if the seed is first selected under the direct supervision of the Agricultural Department and then supplied to cultivators.

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Rai Sahib GANESHDAS KUNDANMALL.

(Continued.)

II.—COMMERCIAL ASPECT.

414. (30) **Local trade customs.**—It is not generally necessary to have an agent or make an advance or to enter into an agreement that the cotton will be purchased at a certain rate in regard to the marketing of the cotton crop. In a few places, an advance is given and at that time an agreement is made that the cotton will be purchased after so many days and at such and such a rate. This custom prevails here and there in villages, but it is lessening day by day.

415. (31) **Standardization of commercial names.**—The five grades of cotton are superfine, fine, pakka, fully good, and good, and they all come from this district. These names alone are convenient. There appears to be no necessity to alter them. These names are in vogue in almost all cotton-producing provinces, and it does not appear necessary to alter them.

416. (32) **Buying agencies.**—The existing system of buying through brokers and agents appears to be satisfactory. But the appointment of these brokers and agents rests in the hands of the cotton market committee. It appears necessary to make a little change in it and it is as follows. At present any person who likes can become a broker or an agent by paying a fee. Because of this all brokers and agents cannot be said to be capable and reliable, with the result that sometimes the merchant and sometimes the seller suffers loss. Therefore, before issuing licenses to these persons, their fitness for the work should be determined by a committee consisting of some merchants and some members of the cotton market committee, and those who are approved by it should receive licenses. This will suit the convenience of both merchants and sellers much better.

III.—STATISTICAL.

417. (33) **Improvement of cotton forecast.**—The estimates based on the cotton forecasts published in our province are generally correct, and there appears to be no necessity to make any improvement in them.

418. (34) **Improvement of other statistical information.**—In my opinion, the information available at present is sufficient.

419. (35) **Publication of Liverpool and Bombay prices.**—In my opinion, the daily publication of Liverpool and Bombay cotton prices is suitable.

IV.—MANUFACTURE.

(a) Ginning and Pressing.

420. (36) **Type and number of gins and presses.**—There are 48 gins, Platt Brothers' type and one press, type Fawcett Preston and Company, in my factory.

421. (37) **Size of bale.**—The size of the bale produced in my factory is $4\frac{1}{2}' \times 1\frac{1}{2}' \times 1\frac{1}{4}'$.

422. (40) **Factory labour.**—Difficulty is sometimes experienced in getting factory labour.

423. (41) **Condition of cotton.**—Most of the cotton reaches me in good condition, because such cotton fetches a higher price, and therefore the cultivators take precautions in bringing it. Only in unavoidable circumstances, does the cotton not reach me in a good condition and there is no remedy for it.

(b) Spinning and Weaving.

424. (45) **Effect of replacement of short staple cotton by long staple.**—There will be no effect on the cotton market. The condition which prevails in the market when short-staple cotton is received will also continue if long-staple cotton is received.

VI.—IRRIGATION.

425. (71) **Cropping and causes affecting it.**—Out of 100 acres, sixty are devoted to cotton, thirty-two to *juar* and ten to other miscellaneous *rabi* crops. If there be ample water, the sowing of *rabi* crops will increase to twenty per cent. There will be no particular change in crops if a necessity for fodder is felt. First *karbi* will be sown for fodder and the sowing of *juar* will increase ten per cent. The crops sown in rotation will be *juar* and cotton.

426. (73) **Deshi versus American cotton.**—In my opinion, cultivators prefer the country cotton to American cotton, because the American cotton needs more rain, and, if there is not sufficient rain, the crop fails. Therefore they do not like American cotton.

Rai Sahib GANESHDAS KUNDANMAL called and examined.

Translation.

427. (Mr. Wadia.) I am a ginner as well as a cultivator. I cultivate my own land. I have about five to six thousand acres of land. I cultivate about five hundred acres myself, letting out the rest to tenants. I have a cotton gin at Amraoti with forty-eight gins. I have also a press. Out of the five hundred acres of land that I actually cultivate, three hundred acres are under cotton.

428. (Mr. Roberts.) I am connected with a Seed Union. My brother is the chief man in the Union. I look after the gins and the cotton trade is my business. My brother looks after the Union which is in a village twenty-five miles from Amraoti. I can give evidence in regard to cotton, but I do not know much about the working of the Unions.

429. My experience of *buri* is that it does not yield as much as *roseum* on any class of soil in a dry year. I have grown it myself on seven or eight acres for two years and then I gave it up. The reason why there is a large proportion of Upland cotton in the *jari* type is that the seed is not selected and that is the reason for its existence. The ordinary seed the *zamindars* use is a mixture. A system of seed farms will ultimately eliminate Upland from the local mixture. I think that if the present number of Seed Unions continues to work it would take ten years, before there was nothing but *roseum*, but it would take less than this if the number of the Unions is increased. If the department introduced a cotton which was rougher than *roseum*, but yielded more, cultivators would take to it. It would not fetch the same price unless it had as high a ginning percentage. The price depends on the ginning percentage. The lint of longer staple cotton gets a better price but if the *kapas* is sold in the bazaar, the *kapas* giving the higher ginning percentage gets the higher value. My experience is that Rs. 4 more is paid per *bhoja* of 340 lbs. of *roseum* lint than for the ordinary *jari*.

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430. (Mr. Henderson.) We get a certain mixture of Upland Georgian. Seed is preferred which has no mixture of Upland Georgian. In one year out of ten, Upland Georgian might do better than *roseum*. Upland Georgian deteriorates and is affected by leaf blight. *Roseum* is not affected by leaf blight. *Deshi* cotton is attacked by wilt but in spite of wilt it does better than Upland Georgian. Upland Georgian is not sown as a protective measure. It is not mixed as a measure of protection but it is in the seed. It has continued for so long a time simply for the reason that the cultivators have not selected their seed.

431. (Mr. Wadia.) My ginning factory is at Amraoti. I do not keep *jari* and *roseum* separate. They are mixed together. I do not water my cotton. Four or five years ago I used to damp my cotton but for the last five years I have not damped it. Before that everybody did it. I used to damp it then but I stopped it because it did not pay. The cotton got caked and when it arrived in Bombay an allowance of Rs. 10 per *khandi* was made. If the cotton was sold quickly, no rebate was made as the damping was not discovered. There is no damping done now in Amraoti. I am not sure about other places but I have heard that no damping is done now.

432. If I kept my *roseum* separate and sold it separately, then it would get a higher price than *jari* in Bombay. If I could secure sufficient *roseum* to make up one hundred bales, it would fetch a better price. The class of *jari* is improved by a mixture of *roseum* and the mixture is sold as *Oomras* according to class. *Roseum* by itself would be superfine and the mixture would be sold as fine. I know of no combines either for ginning or pressing at Amraoti.

433. (President.) I consider that in order to ensure better seed, it must necessarily be supplied by Government farms. Seed cannot be satisfactorily produced by seed farms or Unions. All men are not honest in the Unions. It is likely that Union members may mix other cotton seed with *roseum* and sell the seed as pure. Out of six people, one or two might do that. I believe in Government farms and think they are better than Seed Unions.

434. As to cotton markets, I am of opinion that licenses should not be issued to unreliable persons. There are some rules to that effect but they are not observed. A man simply has to pay a fee of Rs. 60 and he gets his license. The fee is Rs. 40 for an *aralya* and Rs. 20 for brokerage, Rs. 60 in all. When a man pays that amount, he is given a license without any enquiries irrespective of his qualifications. I should lay it down as a qualification that he should be a man of position, an honest man who would pay the cultivator the proper price. If such a rule were enforced, ten out of seventy-five would go out as dishonest. Even if the fee were increased, it would not necessarily follow that you would get honest men.

435. I submit my ginning press returns direct to the Director of Agriculture. I think that these returns should be made general and compulsory.

Rao Sahib BALWANTRAO RAMCHANDRA LANDGE, Izardar, Sonvadhona, Yeotmal.

EXAMINED AT AKOLA, NOVEMBER 16TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

436. (1) **Experience.**—I have been stationed in two cotton growing districts since my childhood. I was living in the Amraoti district up to 1895, i.e., about 34 years. Since then, I have been living in the Yeotmal district, i.e., about 22 years. Not only have I been in actual touch with cotton cultivators but I have been cultivating cotton myself.

437. (2) **Varieties.**—Mixed *jari*, consisting of *roseum*, *malvense cutchicum*, *verum*, *ghogli* or Upland Georgian, etc., are grown in both the Amraoti and Yeotmal districts.

438. (3) **Size of holdings.**—The average size of the cotton growing holdings is about 25 acres, of which in the majority of cases, more than half is under cotton.

439. (4) **Yields and profits.**—The average yield per acre is about 200 lbs. and the average profit is about Rs. 10 per acre. This also varies according to the rainfall and weeding expenses.

440. (5) **Rotations and manures.**—In a newly broken soil, *til* is first sown and next to it cotton and *tur*. The general rotation is that cotton is followed by *juar* and other cereals and then cotton again. But the tendency is sometimes to grow cotton successively two years. The manure generally used is farmyard manure. In very few cases that can be counted on the fingers of a hand, they use nitrate of soda.

441. (6) **Comparative returns.**—Since about ten years, attempts are being made to do away with the mixed varieties of *deshi* short staple cotton and introduce only one of them, namely, *roseum*. This alone compares favourably with the other varieties. The yield per acre is better and much more so the lint.

(2) The *deshi* long staples are *bani* and Broach. The former is more delicate than the other varieties of *jari*, and yields much less per acre and the percentage of lint is far less. As for Broach it is a very late variety and is found not at all profitable. I had some experience of three exotic varieties, namely, Upland, *buri* and Egyptian. In the case of *buri*, the average yield may come up to that of *roseum* in very favoured localities but the percentage of lint is about six per cent. less. As for Egyptian and Upland, both yield less and the percentage of lint also is less. Egyptian grows under special circumstances of irrigation. But all the three varieties are susceptible to leaf blight, frost and severe cold. But they are free from wilt which is not the case with *roseum*.

442. (7) **Conditions affecting increase in area.**—The fluctuation in the area under *deshi* short staple is not much. But if there is any, it is due to the fluctuations in the prices. There is very little possibility of an increase of area under *deshi* short staple cotton unless prices go very high. The only factor that would limit that increase is a long staple substitute that would give an equal yield but in case no such variety is found out, the difference in prices must compensate for the loss in yield.

443. (8) **Uses of seed and seed selection.**—Cotton seed is used for feeding the cattle and sowing. The surplus which is a very big one is exported mainly, as I understand, for extracting oil. If at all any selection is practised, it is on the principle of introducing a particular variety only. Generally machine ginned seed that is not crushed much is selected for sowing. It is only in very few exceptional cases that they select hand ginned seed.

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(Continued.)

444. (9) **General economic conditions.**—All long stapled cottons tried up to this time seem to be late varieties, while *roscum* which is most profitable of all the mixed varieties of *deshi jari* is an early one. Rainfall in the country being uncertain, early varieties are preferred most. Besides in introducing long stapled varieties the dates of payment of Government money will have to be changed. The present dates suit only in cases of early varieties. As far as my knowledge goes, the present system of purchasing cotton or lint is defective. No distinction seems to have been made with reference to quality of lint but to quantity only.

(b) "*Deshi*" long staple cotton.

445. (11) **Varieties.**—For the present no specific variety of long staple cotton is grown in the districts with which I am acquainted. There are, however, some fields and those too very few where Upland Georgian seems to have been sown as the next best because *roscum* is found to be impossible to grow on account of the soil being extremely affected with wilt.

446. (13) **Yields and profits and comparative returns.**—As I have had very little experience of different varieties of exotic cottons, I am not able to give their average yield and profits but they don't compare favourably with the *deshi* short staple cotton except *buri* of which the yield may come up to that of *roscum* in very favoured localities, but the percentage of lint is about six per cent. less. The yield of the *deshi* long staple cotton is much better than that of Broach *deshi* long staple variety in this part of the country but is in no way better than *buri*, another exotic long staple variety. It compares favourably with other *deshi* crops of cereals in favoured localities unless heavily damaged by rain as this year or the prices go very low as three years ago.

447. (14) **Rotations and manures.**—For the present cotton is sown after cereals. Farmyard manure is the principal manure used at present. It is only those cultivators that are in close touch with Government farms who use nitrate of soda. But that is found impracticable on account of the prices having gone very high on account of war.

448. (15) **Conditions affecting increase in area.**—I do not think, under any circumstances, that the *deshi* long staple cotton *bani* will become popular.

449. (16) **Suitability of existing varieties.**—As far as my knowledge goes, I can say that nothing is being done in the direction of pushing the *deshi* long staple cotton.

450. (17) **Prevention of mixing of different varieties.**—I need recommend no measures to prevent the mixing of *deshi* long staple cotton with (i) *deshi* short staple cotton, (ii) exotic cotton, as there is very little *deshi* long staple cotton in existence. If there is any it can be prevented by opening seed farms but it will have the effect of altogether doing away with that variety and bring *roscum* or *deshi* short staple to greater prominence. It is very difficult to separate mixed varieties in the factories. They can be separately ginned only when they are brought separate and that too in small ginning factories.

451. (18) **Uses of seed and seed selection.**—The seed in mixed quantities is used for feeding the cattle or sowing in fields. The surplus is exported. No selection of seed is practised in the case of *deshi* long staple cotton.

452. **General.**—About twenty years ago when I personally began to look after my farm, *deshi* long staple cotton seed in greater quantities mixed with other varieties was sown. But the mixture when sold raw brought less price than the cotton with less mixture of *deshi* long staple and when it was ginned, the percentage of lint was very much less, so that I had to give up that variety and take to another one. I therefore think that regeneration of *deshi* long staple is an impossibility.

(c) *Exotic cotton.*

453. (21) **Varieties.**—No exotic cottons are grown in the district with which I am acquainted except on the Akola agricultural farm.

454. (23) **Comparative returns.**—The only exotic cotton I can say something about is *buri*. It is not so paying as the *deshi* short staple cotton *roscum*, but it compares favourably well with *deshi* long staple cotton *bani*. Under specially favoured circumstances and localities it compares favourably well with other *deshi* crops, *juar*, wheat, etc.

455. (25) **Conditions affecting increase in area.**—The increase in the area of exotic cotton *buri* can only be effected under irrigation as the rainfall is rather uncertain. The ginning season is sufficiently long till the middle of June. The climatic circumstances in the two districts must remain the same. It can compete with food crops under special circumstances only. As *buri* is not wilt affected, I don't think the principle of rotation of crops will have to be strictly followed as in the case of *roscum*. The difficulty of labour supply is the same in the case of *buri* as *roscum*. No effort is being made to push the cause of the exotic varieties of cotton.

456. (27) **Prevention of mixing of different varieties.**—If the exotic variety *buri* has to be pushed on, the mixing of cotton in the fields can be prevented by opening seed farms. If this variety is kept quite free from mixture in fields, it can only be kept pure in factories by getting the cotton ginned in small factories only.

457. (28) **Importation of seed.**—Seed of exotic cotton will have to be imported from America or Egypt till the quantity is sufficient and till the variety is acclimatised. After that selection of seed will, I think, be quite enough to serve the purpose of producing long staple cotton in India.

458. **General.**—Rainfall in the two districts being uncertain irrigation is, I think, a necessary item for the production of long staple variety. But as irrigation is a very difficult question to be solved at present, trial may be given to the long staple cotton *buri* at least in good soil richly manured and in order to induce people to take to *buri* sowing again, good temptations by way of special concessions, prizes and bonuses will have to be kept in their way. The dates for the payment of Government money will have to be fixed later. The system of purchases will have to be changed. At present not only there is no inducement to keep varieties separate but there is a temptation to get varieties of lint at least mixed up.

(2) I think the present organization of the Agricultural Department in handling cotton as far as production and purity goes is good. The only suggestion to be made is the increase of establishment and selection of proper men for inducing people to go out of their old beaten track and take to new methods by showing them the defects.

II.—COMMERCIAL ASPECT.

459. (30) **Local trade customs.**—I am acquainted with the local trade custom in regard to the marketing of the cotton crop in the Yeotmal cotton market only. But the same custom prevails in all the cotton

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markets in Berar, as far as the routine is concerned. If there is any difference at all, it is with regard to minor items which may well be neglected at present. The cultivators of different places take their ginned and unginned cotton carts to cotton markets according to their conveniences. There the brokers or *aratyas* take samples of cotton (ginned or unginned) to different buyers or traders. One general rate is declared and the bargain is struck. No attention is paid to the quality of the stuff of individuals. After weighment by weigh bridges, the carts are taken to the places where they are to be emptied and there lots of hitches arise. There either the rate is cut down or some weighment is declared short by one maund or two maunds as the case may be or sometimes both. Then the empty carts are weighed. After accounting is done the cartmen leave for their respective places blaming all the while the brokers, the *aratyas* and finally their own lot or *kismet*.

(2) Sometimes when the body of brokers is very strong, they themselves buy the stuff though it is quite against the rules. Existence of cotton markets for handling cotton after production is also to be taken as one of the best organizations. But lots of changes will have to be made in the rules by way of giving better power to the cotton market committees to enable them to handle properly middlemen, buyers, brokers, *aratyas* and weighmen for any malpractices that may be brought to their notice. For the present the class of buying agency is interested only in buying and selling as much stuff as could possibly be had. They do not at all concern themselves with the production of improved varieties. So the best way, in my opinion, is to establish responsible agencies who will look to improved production and purity up to the time the commodity goes finally into the hands of mill-owners, as is done at present by the Agricultural Department in the case of purity of cotton seed.

(3) The present system of ginning cotton in big ginning factories is not in any way suited for keeping the purity of seed for the production of a pure variety of cotton next year. It will do well when the desirable variety of cotton is produced in large quantities and taken to the factories in a pure state. For the present, the system of establishing small factories introduced by the Agricultural Department will serve the desired object in the best possible way.

(4) In the case of *aratyas* they are allowed to buy by rules but both *aratyas* and brokers receive *arat* and brokerage from the cultivators and instead of fighting for their masters from whom they receive their remuneration they serve their own interests at their (masters') cost. This ought anyhow to be remedied by making necessary changes in the rules.

(5) The system of advances to cultivators, forward sales or contracts by them should, as far as possible, be discouraged. They are quite ignorant of the current Bombay rates and being needy accept money on any terms which sometimes are not even understood by them.

460. (31) **Standardization of commercial names.**—I am acquainted with only the following commercial names of cotton:—

- (1) *Oomras* coming from Amraoti.
- (2) Akola " " Akola.
- (3) Broach " " Broach.
- (4) *Kumpla* " " Dharwar side.

I do not think that the names are very suitable. All the varieties of cotton should be given their current names with the names of places from which they come prefixed to them.

461. (32) **Buying agencies.**—In the case of finding out the best form of buying agency the system of co-operation resorted to at present by the Agricultural Department may, in my opinion, be followed.

III.—STATISTICAL.

462. (35) **Publication of Liverpool and Bombay prices.**—I think the daily publication of Liverpool and Bombay cotton prices at up-country markets through the agencies of the market will be of much use.

IV.—MANUFACTURE.

463. (36) **Type and number of gins.**—I use Platt and Dobson gins in my factory. I have got only eight gins.

464. (40) **Factory labour.**—My factory being small, I have not experienced any difficulty in obtaining factory labour.

465. (41) **Condition of cotton.**—After untimely rain in the busy season, I get sometimes wet cotton which is found very difficult to be ginned. The only remedy for this in the hands of the factory owner is to allow it to be exposed to the sun until the stuff gets quite dry or another remedy is that the purchaser of the wet ginned stuff should punish the man amply by making excessive deductions.

466. (45) **Effect of replacement of short-staple cotton by long staple.**—I do not think any substantial alteration would be necessary in the present machinery of the ginning factories even if the present short staple cotton was replaced in large quantities by long staple. I have had some experience of the ginning of *buri* cotton and I think there is no difference in ginning *buri* and *roscum*.

V.—GENERAL.

467. (46) **Attitude of buyers to improved cottons.**—I am not acquainted with any cases of buyers in the past having been prepared to encourage the growth of improved cottons by offering a premium for them. When the Agricultural Department found out the improved varieties of *roscum* and *buri*, they supplied the seed farm people at various places with the seed, the prices of which were recovered in the busy season. About three years ago Mr. Hirjibhoy, agent to Nagpur Empress Mills, brought some Broach seed and sold it in Yeotmal to different cultivators.

468. (49) **Effect of tenure of land.**—The tenure on which land is held in the tracts of which I have got some experience does not in any way affect the extension of cultivation of cotton but it affects the improved production of cotton. The question of manuring each and every portion of a holding actually under cotton is not possible. Keeping sufficient cattle for manure also is not possible. Making provision for grazing for so many cattle is also a very difficult question for Government to solve. Looking to these things, I think the present holdings are quite insufficient. These holdings should be more extensive. Besides these small holdings are liable to be divided to infinity. This should be remedied if possible.

N.B.—For the oral evidence of this witness see pages 78 and 79 below.

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Rao Sahib V. C. KULKARNI.

Rao Sahib V. C. KULKARNI of Gaigaon.

EXAMINED AT AKOLA, NOVEMBER 16TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

469. (1) **Experience.**—I am a resident of Gaigaon of the Akola district in Berar, my principal occupation being agriculture. I have been in touch with cotton cultivators for the last twelve years.

470. (2) **Varieties.**—In this district, cultivators do not generally grow a pure variety of cotton; a mixture of all the following varieties is grown and is commonly called 'gaorani' or 'jari.' (1) *Roseum*; (2) *cutchicum*; (3) *malvense*; (4) *verum*; (5) *bani* and (6) *buri*. From the last seven or eight years some cultivators are growing pure and selected seed of *roseum*, and it is found to be more profitable both in yield and lint than the mixed variety mentioned above.

471. (3) **Size of holdings.**—The area in possession of landholders in this district varies from about five to 1,500 acres but generally it may be said that the average size of holdings may be from 20 to 25 acres. Formerly when the rains were excessive, *rabi* crop could be grown successfully. Cultivators used to make three equal divisions of their holdings under (1) cotton, (2) *juar*, (3) *rabi* crops. But for the last fifteen years, the last crop is gradually discouraged and the first has taken its place. At present nearly two-thirds of their holdings are under cotton and the remaining under other crops. The reason for increase in cotton is chiefly due to gradual rise in prices and shortage of rainfall.

472. (4) **Yields and profits.**—The average yields and profits per acre from *deshi* short staple cotton can be estimated at about Rs. 35 and 20, respectively.

473. (5) **Rotations and manures.**—The general system of rotation is cotton after *juar* or rarely wheat and again cotton. But many cultivators are nowadays inclined to sow cotton successively for four to five years. Generally manure is not applied to all the area as it is not available in large quantities. Very few who can afford to give manure use only cattle dung, accumulated from their farmyards. Another system of manuring land is that of sowing leguminous crops which leaves manurial properties in the soil to thrive the cotton crop for next year.

474. (6) **Comparative returns.**—The reply to these questions is separately given in a tabulated form annexed hereto.

475. (7) **Conditions affecting increase in area.**—Fluctuation of the area under cotton chiefly depends on its rate and character of season in previous years. For instance, if the outturn of cotton owing to excessive rainfall or other unsuitable climatic conditions is found much less than that of the ordinary season, the growers are naturally inclined to reduce the area to some extent next year. I do not think there is any scope now for the increase of short staple cotton as there is no room for the reduction in the area under other crops. It has reached the maximum. It can neither be decreased unless long staple cotton or other crops pay at least an equal return to the growers.

476. (8) **Uses of seed and seed selection.**—Cotton seed is generally used for feeding both working and milch cattle. The rest is exported to foreign countries. A small quantity is also used for extracting oil. No seed selection is made for *jari* cotton. Cotton buyers sort out from the lot such carts of *kapas* which they judge to be better and gin it separately and sell the seed for seed purposes. Those who grow pure variety of *roseum* get their seed supply from seed farms or unions which have been started to help to extend the cultivation of this variety and are supplied with selected seed from the Government farm, Akola, every year.

477. (9) **General economic conditions.**—The general state of cultivators is not very satisfactory. They being illiterate are in the habit of being extravagant and thus are often over-run with debts carrying exorbitant rates of interest. The result is in spite of all his efforts to produce a good crop with improved methods the cultivator finds himself in much difficulty to repay even the interest from his net profits leaving the principal debt as it is. He has again to approach the *sahukars* and ask them for fresh loans required for next year's cultivation. At this time the cultivators being already under debt are required to submit to the conditions imposed by the money lender as they have no other source of meeting their requirements. At times the *sahukar* enter into a contract and purchases all his future produce in advance at a fixed rate. Sometimes the cultivator is obliged to sell his produce even at a fallen rate under the pressure of *sahukars* to repay his debts. Being short of money from the beginning, he cannot wait up to ginning to get the full advantage of lint and seed of his cotton. Being in touch with the district work of the co-operative credit societies and agricultural unions for the last seven years, I have come to the conclusion that the credit societies are no doubt very useful to help the cultivators to a considerable extent. But unless all sorts of the dealings with local *sahukars* are stopped and their evil influence eliminated, credit facilities alone will not do as much good as is expected of them. The *sahukars* are sure to recoup their loss by monopolising the purchase of produce and supplying other requirements. It is needless to say how the cultivators are further deceived in weighments and other matters when they have to deal in selling their produce. It is not that the cultivator does not know all these hardships but he is incapable of preventing them. To avoid this trouble of sale, it is necessary in my opinion that a check society be organised, at each market place to safeguard the interests of the cultivator. The duties of the society should be to see that the right quality gets the right value with proper weighments. These societies should also undertake to serve as middlemen on a small amount of commission to sell the cotton or lint or any other crops, namely, *juar*, wheat, gram, etc., of those who would like to sell it through the society.

(2) The Central Bank should undertake to organise and control such societies and to finance them when necessary. It is true that in the beginning, the existence of such a society may not be liked by the present middlemen, who may create numerous obstacles to hamper the society's work and do their best to see that the movement is a failure. But where the members of this society have themselves got some business knowledge, these troubles imposed in course of time surely disappear, as a result of the tact and patience exercised by them.

(3) In order to give the maximum profits from ginning to the cultivator, it is also necessary to have small ginning plants run by oil engines established at principal centres in every *taluk* within their easy

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[Continued.]

reach. At present, petty cultivators (whose number is not inconsiderable) owning a cartload or two of *kapas* do not get access to the factories and are in one way obliged to sell their cotton unginned and thus lose a portion of the return of their honest labour.

(b) "Deshi" long staple cotton.

478. (11) **Varieties.**—No pure variety of any long staple cotton is grown in this district now, though a small percentage of *malvense*, *verum* and *bani* types are found in the mixture presently grown. Formerly, a few people in the southern part of the district used to sow *bani* cotton, the staple of which was very fine and long. But it being late and very poor both in yield and lint percentage did not pay them as much as they could get from the short staple mixture. Besides it did not suit the character of rainfall in this part which is wanting in later rains. Generally long staple cottons require cool climate. No doubt they could get about 25 per cent. higher prices for this cotton than *jari* but owing to the adverse circumstances of poor yield and low percentage it did not cover the loss. They therefore gave up the cultivation of this long staple variety.

(c) Exotic cotton.

479. (21) **Varieties.**—I tried the American variety of cotton named *buri* in the year 1910-11, but to my disappointment it proved to be a failure. I found that it suffers from red disease at the end of the rains and its growth is stunted. I do not think it would be of any advantage to import the seed of these cottons every year as it must be accustomed to our climate and nature of the rainy season. Efforts to introduce *deshi* or exotic long staple cotton cannot in my opinion be successful unless they prove to be equally good in paying the return though not better in yield than the indigenous short staple varieties. It is but natural for any cultivator to expect the maximum return for his minimum labour.

N.B.—For the oral evidence of this witness see pages 78 and 79 below.

Central Provinces.]

Rao Sahib V. C. KULKARNI.

[Continued.]

ANNEXURE.
COMPARATIVE RETURNS OF DIFFERENT VARIETIES OF COTTON.
(Vide paragraph 474 above.)
Deshi short staple cotton.

Name of variety.	Output per acre.	Lint per cent.	Quantity of lint.	Quantity of seed.	Value of lint per 280 lbs.	Value of seed (bazaar).	TOTAL.			Cost of cultivation.	Net profit.	Higher price obtained by sale of seed for sowing.	Net profit per acre taking higher value of seed into consideration.	Value of <i>kapas</i> if sold as <i>kapas</i> .	Rs.	Net profit per acre <i>kapas</i> is sold.
							Rs. A. P.	Rs. A. P.	Rs. A. P.							
<i>Deshi long staple cotton.</i>																
<i>Jari</i>	230	34	78	152	31	3 12 0	34 12 0	15	19 12 0	5 0 0	21	33	18	23		
<i>Roseum</i>	260	39	101	159	40	4 0 0	44 0 0	15	29 0 0	10 0 0	35	38				
<i>Exotic cotton.</i>																
<i>Bani</i>	180	25	45	135	22 8 0	4 0 0	26 8 0	15	11 8 0	..	..	25	10			
<i>Buri</i>	50	34	17	33	8 8 0	1 0 0	9 8 0	15	5 8 0 (Loss).	..	..	..	..			

Central Provinces.]

Mr. B. M. PANDIT.

Mr. B. M. PANDIT, of Murtizapur, Akola District.

EXAMINED AT AKOLA, NOVEMBER 16TH, 1917.

Written statement.

1.—AGRICULTURAL EXPERIENCE.**(a) "Deshi" short staple cotton.**

480. (1) **Experience.**—I am stationed in the Akola District of the Central Provinces. I am a permanent resident of Murtizapur, a *taluk* town in Akola District. I have got cultivation of my own and am also in touch with other cultivators in this district.

481. (2) **Varieties.**—Generally in this district, the cultivators grow a mixture of the following types of cotton. (1) *roseum*, (2) *cutchicum*, (3) *malvense*, (4) *verum*, (5) *buri* and it is commonly called *jari* or *gaorani*. Nowadays some of the cultivators are growing only the first variety called *roseum*.

482. (3) **Size of holdings.**—On an average, an ordinary cultivator holds about twenty to thirty acres of land though there are some big landholders owning 100 acres and above. In previous years, when rainfall was well distributed throughout the season and the rate of cotton was not so high, cultivators used to divide their holdings into three equal parts and sow therein cotton, *juar* and any other *rabi* crop in rotation. Now nearly two-thirds are sown with cotton and only one-third with remaining crops, mostly *khari*.

483. (4) **Yields and profits.**—On an average, the cultivator gets from *gaorani* cotton about 250 lbs. per acre which yields him a net profit of Rs. 6 to 7 per acre while those who grow the pure type of *roseum* generally get an yield of 280 lbs. per acre which give a net profit of Rs. 8 to 10 per acre. These figures are for unginned cotton (*kapas*).

484. (5) **Rotations and manures.**—Generally no manure is applied by a majority of cultivators. The few who can afford to apply it make use of only farmyard manure. As for rotation some are in the habit of growing *rabi* crops in rich lands which naturally serve the functions of manure for the next year's crop. But the general system of rotation is cotton after *juar* and again cotton. Some cultivators grow cotton successively.

485. (6) **Comparative returns.**—The comparison of the returns of the different varieties of *deshi* short stapled cotton with (a) *deshi* long stapled cotton, (b) other *deshi* crops, (c) exotic cotton, is shown in the statement appended.

Besides the crops mentioned in his statement there are *til*, *mung*, *tur*, etc., among other *deshi* crops but as they are not grown independently, the figures are not available.

486. (7) **Conditions affecting increase in area.**—The area under short stapled cotton sometimes fluctuates according to the price of cotton in previous seasons, also it depends upon the break of monsoons. In my opinion, there is no possibility of an increase in the area under short stapled varieties as it has already reached the maximum and it cannot be decreased unless the cultivator finds that he gets at least an equal return from long stapled variety.

487. (8) **Uses of seed and seed selection.**—The seed is generally used for feeding cattle and for sowing. Some seed is exported to foreign countries, also a small quantity is being used nowadays for extracting oil. Generally the cultivators excepting those who grow *roseum* get their seed supply from cotton buyers who take no special precautions for selection of seed except that the quantity of *kapas* which they think superior by feel of hand is separately ginned and seed sold for sowing purposes. But nowadays the practice has been introduced to supply pure and selected seed through the agencies of seed farms and unions specially organized for the purpose. The system of the seed selection is as follows: Every year seed is produced on Government farm by the selection of plants and it is distributed to the owners of seed farms and central farms of agricultural seed unions, who grow it pure under the supervision of the department and seed produced in this way is sold to ordinary cultivators in the neighbourhood. No doubt seed produced by hand gins is generally preferred to machine gins. But owing to high wages and loss of a small quantity of lint which goes with the seed and to some extent low price offered in the market for the lint so produced, the former becomes costly and now almost all the cultivators sow seed ginned in factories.

488. (9) **General economic conditions.**—The majority of cultivators are over-run with debts owing to their being harassed by the money-lenders at the time of emergency. For securing money to enable him to give a proper cultivation to his crop, the cultivator has to submit, though unwillingly, to the sweet will of his creditor who, at times, imposes heavy conditions upon him such as of high interest or of binding him to sell his produce to the creditor. Again, the cultivator is pressed to repay his debts at a time when the rates are not favourable to him and he has to sell his *kapas* at that time though not without a loss; he is not even given an opportunity to wait till his *kapas* is ginned and hence the major portion of the profit goes to others dealing in cotton rather than to himself.

(b) "Deshi" long stapled cotton.

489. (10) **Varieties.**—No pure varieties of these types are grown in this district though *malvense* and *verum* are mixed in a very small proportion with the *gaorani* as stated above. In the past, about twenty years ago, people used to grow a long stapled variety called *bani* but owing to lower return of both *kapas* and lint than the short stapled varieties the cultivator does not get as much money return as he gets from the latter varieties, though at times the rate for the former was higher. Besides, experience for the past ten years showed that the rainfall for the latter period of the season was successively uncertain, which is very essential to all long stapled varieties, which are necessarily late.

(c) Exotic cotton.

490. (28) **Importation of seed.**—My experience in trying *buri* cotton showed that this type did not suit the conditions in our district. If any attempt is at all made in the introduction of other exotic cottons, I am of opinion that importing the seed every year would do no good, it must be accustomed to resist the local climatic conditions before it is generally introduced.

Central Provinces.]

Mr. B. M. PANDIT.

[Continued.

II.—COMMERCIAL ASPECT.

491. *Suggestions for improvement of system of handling cotton.*—In my opinion, the present system of handling cotton is defective. In the first place, much more care should be taken in picking which would prevent the dirty appearance. Then the general class of cultivators being ignorant is much more deceived when the crop is brought to the market. The cultivator has no direct approach to the buyer without the medium of brokers and *aratyas* who do not take as much precaution as is necessary to safeguard the interest of the seller. Again according to the present arrangement of the ginning factories, a small cultivator cannot get advantage of ginning which can be removed, in my opinion, by scattering small ginning plants within their easy reach or by dividing large factories into small compartments of four to six gins: this will help considerably to grow pure types of varieties also. No proper attention is at present given by factory owners to cotton seed, the flooring beneath the gins is neither paved nor cemented and the consequence is that the seed which falls down is mixed with soil and dirt. Not being a mechanical man I cannot say definitely, but I think that the fitting of the gin should be such as may not allow the seed to remain in them while dropping. The establishment of seed farms will no doubt do much good in supplying pure and selected seed to cultivators, under the supervision of the expert staff on a larger scale who would also assist the cultivator in marketing their produce. According to the present demand, I think that at least one man should be posted to each taluk or a market place, to safeguard the interest of the cultivators. I do not think that any more improvement is necessary in the regulation of buying agencies and ginning factories except imposing some restrictions upon the brokers and *aratyas*, if they are at all considered to be necessary, with regard to paying more attention to the interest of the seller.

492. (30) *Local trade customs.*—With regard to the marketing of the cotton crop the cultivator takes his *kapas* to the nearest market in cart load where the broker or *aratya* settles the rate with the buyers in consultation with the seller and in this way the *kapas* is sold. At times the buyer advances money to the cultivator at the time of interculture of his crop on a promise that the *kapas* will be sold to him only, or by entering into a contract of a fixed rate.

493. (31) *Standardization of commercial names.*—At present the *kapas* is distinguished into two principal divisions named after the tract from which it comes, viz., *deshpatti* (a tract of superior black soil), *khadas patti* (a tract of inferior soil). It is further distinguished as under (1) *lal patti* (not damaged by rains) (2) *kali patti* (spoiled by rains) (3) *tardar* (long stapled whether it may be pure or mixed, (4) *jada-mal* (rough short stapled containing more lint) (5) *zoda* (last pickings of all sorts). So far as our tract is concerned, these names seem to be suitable.

494. (32) *Buying agencies.*—I do not think that the present form of buying agency requires any change.

N.B.—For the oral evidence of this witness see pages 77 and 78 below.

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Mr. B. M. PANDIT.

[Continued.

ANNEXURE.
COMPARATIVE RETURNS OF COTTON AND OTHER CROPS.
(Vide paragraph 485 above.)

Deshi SHORT STAPLED COTTON.				Deshi LONG STAPLED COTTON.		OTHER Deshi CROPS.		EXOTIC COTTON.	
Name of variety.	Approximate yield per acre in lbs.	Value of <i>kapas</i> .	Value of lint when ginned.	Value of seed when sold for seed purposes.	Name of variety.	Approximate yield per acre and its value.	Name of crop.	Approximate yield per acre.	REMARKS.
Jari	Rs. 250	Rs. 30	Rs. 28	6	Bani	I have never grown or seen this type of cotton but I have heard in past from some old cultivators that the yield of it was much less than <i>Jari</i> and its lint percentage was 26 or 27.	Juar	Rs. 18	I had grown this variety only for one year, i.e., in 1911-1912 when I found that the leaves were affected with red blight and the crop was totally damaged in the winter, hence no figures are available.
Roseum	280	35	37	12			Wheat	27	
				If the seed is sold for feeding purposes it will bring only Rs. 4-8 in both the varieties.			Gram	10	
							Groundnut	31	
						Besides the above quantity of grain all these crops supply fodder which is never weighed nor measured, hence no figures are available.			

Conference of representatives of Seed Unions in Berar.

At a conference of representatives of Seed Unions in Berar held at Akola on the 16th November 1917, the following were present :—

Rao Sahib B. RAMCHANDRA LANDGE, Izaradar, Sonvadhona, Yeotmal; Rao Sahib V. C. KULKARNI of Gaigaon; Mr. B. M. PANDIT of Murtizapur, Amraoti; Mr. HIR LAL of Kokarda, Darijapur, Amraoti; Maulvi GHULAM AHMAD of Pimpalgaon Raja, Amraoti.

Mr. Landge gave the following evidence on his own behalf and that of the other representatives of the Seed Unions.

495. (Mr. Roberts.) The Central Farm of a Seed Union belongs to one member only. The area of the Central Farm with which I am connected is 100 acres, all under cotton. There are more than 35 branch farms in my Union. Each branch farm has about twenty acres. Some are as big as thirty acres. As the cotton is picked, the *kapas* is kept by the member himself at his own place until it is brought to the ginning factory, which belongs to one member, who in the case of my Seed Union is myself. Near the ginning factory is a storehouse in which cotton seed is kept. The members of a Seed Union may be classified in three classes :—

- (1) Those who prefer to gin their own cotton, take away the lint and keep the seed at the Union storehouse.
- (2) Those who sell the *kapas* but keep the seed for themselves buying it back at the market rate. Their *kapas* is ginned at the Union ginnery.
- (3) Those who sell both their cotton and cotton seed to any one willing to buy it.

The members of the Union, who have branch farms, are allowed to sell their seed to people outside the Union. The Central Farm seed and the Branch Farm seed are kept separate. The Central Farm seed is distributed among the members of the Union first at the rates dictated by the Agricultural Department. We mostly take these rates. The rate last year was about Rs. 35 per *khandi* of 560 lbs. The year before last it was Rs. 28. Last year for the best seed the rate was Rs. 40 and for the second quality of seed the rate was Rs. 35 per *khandi* of 560 lbs. of seed. The price of seed in the bazaar varied from Rs. 14 to Rs. 20 per *khandi*. Last year at the end of the season it was Rs. 16. You may, therefore, say that we are charging 2½ times the price of the seed in the bazaar. We charge at the same price as that at which we get our own seed. The branch farms get the central farm seed at that rate only. The branch farms get the same rate for their own seed as they pay themselves. The seed from these branch farms goes to the cultivators outside the Union. There is no difficulty in disposing of it. There is always a great demand for seed, at least for the seed of my Union. People come to my place and take away the seed. Some portion of the seed is sold through the Tahsildars. About half of my seed is distributed through the revenue agencies. Before selling we convene a meeting of the Taluk Association at which the Deputy Director or the Superintendent of the Farm is present and the whole arrangement is made with the Tahsildar. Everything is settled and we send our seed accordingly. We send about half of our seed and the rest we sell at our own place where people come for it. The branch farm seed is sold to cultivators outside the Union, and we lose the seed of it altogether. The branch farms get fresh seed from the central farm seed store and the central farms get restocked from Akola. The central farm supervises the branch farms carefully. Last year we could not get any fresh seed from Akola and had to use our own seed. That was on account of the failure of the crop. Even if we buy seed from outside, we do not allow it to be mixed with our seed. Branch farms uproot other varieties than those grown from our seed but outsiders do not do so. The Unions employ a man to do this roguing to take away the impurities. He is called a *kamdar*. He is a servant of the Union. In my Union, he gets a pay of Rs. 12 per mensem. He works all the year round on cotton. When the cotton is being brought to the ginning factory, he supervises the ginning; he does not allow any mixture to be made. Whenever he notices mixed cotton being ginned, he has to stop the ginning, get the gin cleaned out to his satisfaction before any more cotton is ginned. In the rains he has to look after the farms to find out whether there is any yellow flowered cotton. From February to June, he helps in the distribution or sale of seed. March is the only month when his work is a little slack. We keep the ordinary registers, such as list of members, cash books and ledgers, books, showing the amount of cotton bought in, payments due, etc. We are required to send returns to the Agricultural Department. The Agricultural Assistant comes and inspects. The Union has no capital. There is no necessity for it. We take subscriptions from the members to meet the pay of the *kamdar* or to defray any other expenses. There is no need of capital. The ginning factory is mine. The Union does not actually buy any seed or cotton. It simply holds them for the members. I charge simply a ginning rate, of two annas less per *bhoja* of 10 maunds of ginned cotton, i.e., 280 lbs. than the ordinary rate. When the ordinary rate is Rs. 4-12, I charge Rs. 4-10, not only to the members of the Union but to everyone. My factory is out of the way, so it is necessary for me to make some concession. The rate at Yeotmal this year has been enhanced beyond Rs. 4-12. I have not enhanced my rate but may do so.

496. When people sell their pure *roseum kapas*, the extra price that they get depends on the quality. If it is from a good field, they get sometimes three or four rupees more per *khandi* of 560 lbs. If the quality is not good or the percentage of lint is less, the price is less. The maximum premium for *roseum* is something like Rs. 3 to 4 per *khandi* of 560 lbs. If the cotton has to be taken to Yeotmal, that costs Rs. 2 more. The average extra price for *roseum* over *jari* therefore is Rs. 2 per *khandi*. I do not deal in lint at my place. The lint is taken to Yeotmal and sometimes to Amraoti. Even if the same price is obtained for *roseum* and *jari*, the buyer loses something on *jari* for he gets a higher percentage of lint in *roseum*. I gin the cotton and after that I have no further dealings with the cotton itself. The actual owner of the cotton sells the lint independently.

497. (Mr. Henderson.) If I could get a higher price, I would very gladly grow *buri* cotton. As to the extra price that we should need to be able to grow it, I cannot say, but it would depend on the outturn that it gave. If we got the same crop as *roseum* and if we got the difference in price to compensate for the loss by *roseum* of the lower percentage of lint, we should be quite satisfied. At least I should be, I cannot say anything about others. If we get Rs. 3 as premium for *buri kapas* over *jari*, I do not think that this would be sufficient. I am not sure about the outturn of *buri* but I should say that the premium should be about Rs. 8 to Rs. 10. I cannot say definitely whether, on good land, *buri* would be a safe crop. As to

whether I should be inclined to grow *buri* on good land, I should say that anything that is an advance is quite welcome to me when I can be certain of the crop. I do not see any disadvantage connected with *buri*. If the climate were favourable to it, it would be the same to us. It would be in a way better to grow it because it would connect us with the country which governs us. If Mr. Clouston recommended it, we would take it up. He did recommend it sometime ago and we tried it but it was found that *roseum* was more profitable and therefore *buri* was given up.

498. Mr. Ghulam Ahmad added that wilt attacked both *roseum* and *bani* but not *buri*. *Buri*, however, suffered from blight which led to leaf curl.

Mr. D. CLOUSTON, M.A., B.Sc., Officiating Director of Agriculture, Central Provinces.

EXAMINED AT AKOLA ON NOVEMBER 17TH, 1917 AND AT KHAMGAON ON NOVEMBER 18TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short-staple cotton.

499. (1) Experience.—I have been stationed for twelve years in the cotton tract of the Central Provinces and have been in actual touch with cotton cultivators for all that time.

500. (2) Varieties.—I have supplied in a separate note the information asked for regarding the varieties of cotton grown, their outturns and the proportion of the cultivated area under cotton in our chief cotton growing districts.*

501. (3) Size of holdings.—The size of holdings in the cotton tract varies from about ten acres to two or three hundred; but the bulk of the holdings are about thirty acres.

502. (4) Yields and profits.—The cultivation of cotton gives a net acreage profit of about Rs. 20, but this year it will be at least Rs. 28. The limiting factors as regards the area likely to be put under cotton are (1) the area available after providing for the production of food crops for the cultivator and his bullocks, (2) the extent of the area suitable for cotton but cropped at present with cereals, oilseeds, and pulses, (3) the necessity of rotating cotton with some other crop to check the spread of wilt disease and (4) the net acreage profit derived from the cultivation of cotton. Of these No. 4 is the most important. The introduction of a heavy-yielding strain of *roseum* which gives much larger net profits than any of the other varieties tested encourages the grower to increase the area under this variety at the expense of less profitable crops.

503. (5) Rotations.—The commonest rotation is cotton followed by *juar*, but on our best black cotton soils cotton is often grown year after year in the same field without a break.

504. (7) Conditions affecting increase in area.—The area under cotton fluctuates slightly: the tendency is for it to go on increasing. When the rainfall proves unseasonable during the sowing season, a small proportion of the area sown with cotton fails to germinate or is damaged after germination has taken place, and the area has often to be re-sown with some other crop, such as *juar* or *til*. The area under short-staple cotton will continue to increase if prices remain high, more especially in districts like Nagpur and Wardha, where there is still considerable room for the substitution of cotton for cereals and oilseeds.

505. (8) Uses of seed and seed selection.—Cotton seed is used (1) for sowing, (2) as a cattle food, (3) for export and (4) by local oil mills for the production of cotton seed oil and cake. Seed selection is now practised on the cotton seed farms which have been started by the Department of Agriculture. We have this year 513 *roseum* seed farms and 25 registered and 26 unregistered Co-operative Seed Unions by which this same variety, viz., *roseum*, is being propagated.

506. (17) Prevention of mixing of different varieties.—To prevent the mixing of improved cotton large concentrated blocks should be sown in rotation if possible with *juar* or some other crop. Cattle manure should not, if possible, be applied in the year in which cotton is grown. Roguing should be carried out when the plants are in flower so as to get rid of all alien plants: and the grower should have a small ginning plant of his own to avoid the mixing of seed which goes on in factories run on a purely commercial basis.

(c) Exotic cotton.

507. Experiments with exotics.—Every known variety of long and medium-stapled cotton grown in India has been tried by the department. American and Egyptian cottons have also been tested: but not one of these even approaches *roseum* in the average value of its yield per acre. As the whole object of the department has been to work in the interests of the cultivator, we have pushed the introduction of *roseum* with great success. We supply annually through our Co-operative Seed Unions and seed farms nearly two million pounds of *roseum*, strain No. 1, to cultivators for sowing.

508. Experiments with exotics under irrigation.—From the experiments being carried out with irrigated cotton on the Chandkhuri farm, it would appear that, given irrigation and a well-drained soil, a long-stapled cotton like Cambodia gives a larger yield of lint and a larger acreage profit than *roseum*. It is in the interests of the cultivator therefore to grow Cambodia in preference to the shorter stapled variety under these conditions, and the department will see that he does it.

(2) Exotic cottons when grown under the soil and climatic conditions which obtain in the cotton tract of the Central Provinces suffer from red leaf blight when the rains cease, the outturn is poor and the lint produced weak. When these same exotics are grown under irrigation on well-drained land, the plants thrive much better: the outturn too is larger and the lint is of much better quality. This I attribute to the fact that our rainy season is too short for these comparatively long-season cottons, and that irrigation renders the cotton-grower independent of the vicissitudes of the weather.

509. Possibilities of extension of long staple cotton.—Exotic cottons like Cambodia and *Luri* can be grown very well with irrigation on porous soils, such as the lateritic soils (*bhata*) of Chhattisgarh. The *wardi* soil of Chanda district and the *sihar* of Balaghat and Bhandara districts are sandy loams somewhat

*Not printed. Vide Mr. Clouston's article on "The Improvement of Cotton Cultivation in the Central Provinces, studied from an economic point of view" in the Agricultural Journal of India, Special Indian Science Congress, Number 1917.

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[Continued.]

similar in physical texture to *bhata*; such soils produce fairly good crops of long-staple cotton despite the high rainfall of these rice districts. But in these three districts, the demand for labour during July and August is very great owing to the fact that most of the rice is transplanted: the weeding of cotton has to be done about the same time and clashes with the transplantation of the staple crop rice. This in itself will probably prevent any great extension of the cotton area in this part of the rice tract. In Chhattisgarh, on the other hand, the large rice area is nearly all sown broadcast and a minimum amount of labour is expended on the cultivation of the crop. *Bhata* soil, moreover, produces very few weeds, and the weeding of cotton requires but little cultivation. There are large areas of land lying waste in this tract, more especially in the Chhattisgarh division on which long-staple cotton can, I believe, be grown with irrigation.

III.—STATISTICAL.

510. (33) **Improvement of cotton forecast.**—I consider that the cotton forecast at present published for the Central Provinces is sufficiently accurate.

511. (35) **Publication of Liverpool and Bombay prices.**—During the cotton season there is a keen competition among buying agents at all the cotton markets. These agents have daily telegraphic intimations sent them from Bombay and the market prices paid here are nearly always in keeping with Bombay prices. Cultivators living far from any cotton market sometimes sell their cotton to middlemen in their villages and do not therefore get a fair price from it. To remedy this, the opening of more cotton markets would appear to be necessary.

V.—GENERAL.

512. **General.**—When *lani* (Hinganghat) cotton was grown, the buyers paid less for *bani kapas* than for the *kapas* of the much coarser and shorter-stapled *kativilayati* or *jari* cotton because of the low ginning outturn which *bani* gave. The grower of this fine quality cotton was hit in two ways. He got a relatively low average yield of *kapas* as well as a relatively low price per *khandi* of that *kapas*. The cultivation of *buri* cotton was at one time pushed by the department: the area rose to about four thousand acres and the Department of Agriculture arranged for the sale of the lint to the Manager of the Empress Mills who paid an enhanced price for it. *Buri* however failed to justify its introduction. Our growing season proved too short for it and in years of short rainfall it suffered badly from red leaf blight. The bolls were ripened prematurely by the dry weather and hot sun of October: the vegetative growth of the whole plant was also checked and the outturn and quality of the lint suffered. Buyers invariably classed it as "weak."

VI.—IRRIGATION.

513. **Experiments with cotton under irrigation.**—Experimental work with irrigated cotton in the Central Provinces has only lately been started. Cotton grown on lateritic soils requires from five to six waterings of about two inches each to produce a maximum crop. Irrigation is seldom needed before the end of October and it does not pay to continue to irrigate the crop after the middle of March. The irrigated crops that will compete with cotton on these soils are groundnut, sugarcane and rice. Irrigation will have to be done from existing tanks. Some of these will be fed by the canals already constructed or under construction. There are no wells in the tracts where irrigated cotton could be grown.

514. (71) **Cropping and causes affecting it.**—In the rice tract an average holding of 100 acres would be cropped as follows:—

50 acres, approximately, would be under rice.

20 acres, approximately, would be under other *kharij* crops such as *kodo*, *tur*, *til*, etc.

30 acres, approximately, would be under *rabi* crops such as wheat, gram, linseed, etc.

The cultivation of cotton on light lands in this tract would mainly affect the cultivation of *kodo*; but it is not in the interests either of Government or the cultivator to grow on irrigated land a crop like *kodo*, the gross value of which is only about Rs. 12 an acre. On these lands, cotton could be grown in rotation with groundnut, sugarcane and green fodders, thus:—

1st year.	2nd year.	3rd year.	4th year.
Cotton	Cotton	Groundnut	Irrigated fodder
or			
Cotton	Cotton	Groundnut	Cane

This system of cropping light soils of which there are large areas lying waste in the rice tracts at present would largely revolutionize economic conditions.

History of attempts to introduce long staple cotton in the Central Provinces

515. **Historical.**—The history of the different attempts to introduce the cultivation of long-stapled cotton may be arranged in chronological order as shown below:—

1866.—"A Superintendent of Cotton Affairs" was appointed for Wardha District. Mr. Rivett-Carnac became Cotton Commissioner and held the appointment till 1871 when he was appointed Commissioner of Cotton and Commerce to the Government of India.

The primary object of the Cotton Commissioner's appointment was the introduction of foreign long-stapled cottons and the improvement of the indigenous plant. Experiments were started with "New Orleans" and other American cottons which were being tried in Jharwar by Dr. Forbes, Cotton Commissioner of Bombay. Despite the fact that the Cotton Commissioner gave the new cotton under trial in the Central Provinces every attention, the outturns were small and the staple much weaker than that of indigenous cotton. Egyptian varieties proved equally unsuitable for the climatic conditions of the Central Provinces.

Having satisfied himself that none of the exotic varieties under trial were ever likely to do well, Mr. Rivett-Carnac determined to fall back on *bani* (Hinganghat) cotton, one of the indigenous varieties widely grown at that time. *Bani* was equal in quality to "middling American." Seed and Experimental Farms for the propagation of this variety were opened under the supervision of gardeners from home and large quantities of *bani* seed were distributed.

1869-70.—The area of these *lani* Seed Farms was largely increased.

1870-71.—These same Farms were developed into general Experimental Stations,

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[Continued.]

The results of these experiments may be briefly summarised as follows:—The exotic cottons even when cultivated with great care and expense had given small yields: they never escaped partial damage from the effect of the season. The attempt to extend the cultivation of the indigenous variety *bani* failed to produce any lasting effect.

The cultivation of Khandesh cotton (Berar *jari*) introduced in Amraoti about this time found much favour with the cultivators and began to extend very fast despite the efforts of the Berar authorities to check it. Of this cotton the Manager of the Empress Mills, Nagpur, writing in 1880, said that its introduction would be a calamity both to the cultivator and the trade. By 1880, its cultivation had spread to such an extent that it was almost impossible at that time to get pure *bani* cotton as it was being grown as a mixture with *jari*.

1883.—On the foundation of a Department of Agriculture in the Central Provinces in 1883, the trial of *bani* and exotic cottons was again made, but with no greater measure of success than crowned the efforts of the Cotton Commissioner. These trials were still being made in 1905 when the undersigned came to the Central Provinces as its first Agricultural Expert, for the Government of India, a few years previously, had in response to an appeal from Lancashire again taken up the question of growing long-staple cotton in India, and the British Cotton-growing Association had come forward to finance schemes for cotton improvement in the Empire.

1904-05.—Large quantities of *bani* seed were purchased by the Department of Agriculture in the Central Provinces for distribution to cotton-growers who were to be paid a premium for all the *bani* lint produced. The so-called *bani* seed offered for sale was purchased by the Department from ginning factories. But by this time the very name, *bani*, stank in the nostrils of the cultivators, and very few of them could be induced to try it. Those who did reported that it gave a poor outturn and that it was difficult to pick, the bolls being so small. When they brought their *bani kapas* (unginned) cotton to the market, buyers invariably refused to pay as much for it as they paid for *jari kapas*, because of the low ginning percentage of the former.

1906-07.—I have already sent the Committee articles describing the work done in the improvement of cotton within the last eleven years.

516. **Comparative returns.**—In one of these articles on "The improvement of cotton cultivation in the Central Provinces from an economic point of view," I have given the average outturns of cottons under trial for nine years on the Akola Farm. For ready reference that statement is given below:—

Variety.	Percentage of lint.	Average outturn lint per acre in lbs.	Value of lint at present prices.
Roseum	40	214	Rs. 93
Cutchicum	38	201	87
Verum	32	147	64
Malvenso	32	138	66
Buri	33—34	128	67
Bani	25—26	103	54
Jari from Berar	34	158	69
Saugor Jari from Central Provinces	32	147	64

We may take it that in normal years the ryot gets about $\frac{2}{3}$ ths of these yields and that *roseum*, *bani*, *luri* and *jari* would give him the following yields of lint per acre:—

	Lbs.
Roseum	128·4
Bani	61·8
Buri	76·8
Berar Jari	94·8
Central Provinces Jari	88·2

If we take the price of *roseum* as being eight annas a pound of lint at present, *bani* and *buri* would, in order to be equally profitable, have to be sold at approximately 17 and 13½ annas per pound respectively; but as no buyer on the other hand would be willing to give more than ten annas a pound for the lint of these when *roseum* could be purchased for eight annas, the grower would lose at the rate of 7 and 3½ annas per pound respectively by growing these long-stapled varieties.

I have taken *bani* and *buri* for comparison with *roseum* because the one was once grown on a large scale throughout the Central Provinces, while the other I consider to be the most promising exotic even tried in the Central Provinces.

517. **Conclusion.**—In conclusion, I would add that there is little doubt but that the increase of about one million acres in the area cropped with cotton in the Central Provinces, between 1870 and 1900, and the great increase in material prosperity which took place during the same period, was largely due to the substitution of *jari* for *bani* cotton. The substitution raised the margin of profit on cotton cultivation to a figure which made it profitable to grow cotton on lands which had previously been reserved for other crops. Though there is now less scope for any extension of the area, I am convinced that the introduction of *roseum* cotton which far surpasses *jari* as a profit-yielder will, in turn, result in a further increase in the area cropped with cotton. The experiments with long-stapled irrigated cotton in Chhattisgarh are promising. Quite contrary to the generally accepted opinion, the rainfall is not the determining factor in

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this case. Given porous well aerated soil, a heavy rainfall between the middle of June and end of September does not detrimentally affect the growth of the cotton plant.

ANNEXURE I.

The organization of district agricultural work.

It was at first thought that it would be possible to appoint Inspectors of Agricultural Unions who would work under the supervision of the Department of Agriculture, but who would be under the administrative control of the co-operative central banks. This has been tried but does not promise to work well, for the reason that the Directors of central banks are, as a rule, not directly interested in agricultural improvements. They are busy men who devote part of what little spare time they have to the interests of these banks. To push agricultural improvements they have neither the time nor the inclination. The department is therefore trying to fit Taluk Agricultural Associations for the work of controlling Agricultural Unions. The Taluk Associations will sooner or later consist entirely of representatives of these unions. All our work will be linked up—the unions into one central Taluk Association with the Tahsildar as president, and the Taluk Associations into one central District Association of which the Deputy Commissioner is President. We have even gone a step further by appointing a Circle or Divisional Committee consisting of selected members of the different District Associations. This committee meets at the time of the Divisional Show and Conference under the presidentship of the Commissioner and decides on the new lines of agricultural work to be taken up in the division.

2. But we want to go a step further. Taluk Associations require paid workers, and should therefore be supplied with the necessary funds. Questions of this kind are discussed by our Circle Committee. It was decided by the Berar Circle Committee, last year, for instance, that District Boards in that division should be asked to give a grant to the Taluk Associations. They have since done so in some districts; Buldana District Board, for example, allotted Rs. 1,200 last year for its five Taluk Associations, or Rs. 240 per association. *Kamdars* on Rs. 20 are being appointed to look after the interests of these Taluk Associations. They are paid from this allotment of Rs. 240. Each association also raises money by asking its members to pay an annual subscription. This money is being used in some cases for the purchase of iron ploughs which the association gives out on hire for prizes for agricultural shows, for the printing of leaflets regarding the supply of *roseum* seed available, etc. One Taluk Association has put up proposals to the effect that a second *kamdar* should be appointed so as to allow the man already employed more time for touring. The second *kamdar* they propose to put in charge of a shop to be started for the sale of improved seeds and agricultural implements.

3. A few of our Taluk Agricultural Associations in short are deeply interested in the work of developing agriculture and are now coming forward to initiate new ways of extending agricultural improvements. I hope that, at no distant date, it will be possible for the more promising associations to have their own trained agricultural assistants who, working under the supervision of the Department, will help to organize and to supervise all the different lines of work which the Department has in hand in the districts. Our aim as a Government Department will in future as in the past be to win the confidence of the actual cultivators and to be their guide, philosopher, and friend.

4. Our work has increased by leaps and bounds within the last twelve years. We cannot now afford time to deal with each cultivator as an isolated individual and have therefore fallen back on the device of grouping them into Co-operative Unions, Co-operative Societies, Taluk Associations, etc., all working together towards a common end, namely, the economic development of agriculture.

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ANNEXURE II.

Demonstration report of the Western Circle for the year 1916-17.

This report deals with the work done by the Department in the cotton tract of the Central Provinces, which includes all four districts of Berar, the districts of Nimar and Wardha, and part of Nagpur, Chhindwara and Chanda. There are seven District Agricultural Assistants in charge of the work. The district staff is very inadequate, but it is not possible to recruit trained men for the Department faster than we are doing at present. To assist these Assistants, seventeen *kamdars* have been sanctioned.

The programme of demonstration work to be carried out by Taluk Agricultural Associations during the year was considered by a Circle Committee which met at the time of the Agricultural Conference held on the Akola Farm in December 1916. Over this committee the Commissioner of Berar presided; several district officers and leading landholders were also present.

Much attention has been given during the year to the Taluk Associations of which there are now 32 in the circle with a membership of 1,560. Every *tahsil*, except the Melghat in Amraoti district, has an association of its own with the tahsildar as Chairman and a non-official member as Secretary. Most of these Taluk Associations are doing good work under the guidance of the Department in carrying out agricultural improvements in their respective *taluks*. The members are the most enterprising landholders of the *taluk*: they are the men who propagate our selected *roseum* cotton seed, push the sale of improved implements and demonstrate whatever agricultural improvements the department desires to introduce. The members pay a subscription of from Re. 1 to Rs. 2 each per annum. With these small contributions, they hope to build up a fund which will be utilized in furthering agricultural improvements. Some of the associations have already purchased improved ploughs for the use of their members as well as for demonstration purposes. The Khamgaon Association purchased seven Turnwrest ploughs last year at Rs. 44 each. These they hired out at the rate of two annas per day, and in four months made Rs. 102-10. The Akot Taluk Association purchased two ploughs and one winnower for the same purpose. The members of the Khamgaon Association have appointed a *kamdar* to look after their implement depot and to do a certain amount of demonstration work. A sum of Rs. 1,200 has been given by the district board, Buldana, to the Taluk Associations in that district to enable them to purchase implements for hire, and to carry out such other improvements as the Department of Agriculture may recommend from time to time.

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The programme of work drawn up for these Taluk Associations and approved by the Circle Committee included—

- (1) the opening of a large number of new *roseum* seed farms,
- (2) the sale of copper sulphate for steeping *juar* seed to prevent smut,
- (3) the distribution of groundnut and improved *juars*,
- (4) the sale of improved ploughs and other implements,
- (5) the reporting of outbreaks of cattle disease,
- (6) the formation of seed unions, co-operative credit societies, and pig-killing clubs, and
- (7) the holding of agricultural shows.

In the year under report, ten new unions have already been registered, and two applications are pending with the Registrar of Co-operative Credit Societies for registration. In addition to these registered unions, of which there are now 25, there were 411 seed farms. 102 more seed farms have been started during the current year, so that at the present time there are 25 registered, 26 unregistered unions, and 513 seed farms in the circle.

As will be gathered from the report on the working of the Akola Experimental Farm, the year was a very poor one for cotton. The quantity of *kapas* produced by seed farms and unions was in consequence little more than half that of the outturn expected. The statement below shows the actual quantity produced:—

	Name of source.	Quantity in lb.
Registered unions	.	346,594
Groups of seed farms (unregistered unions)	.	625,068
Individual seed farms	.	665,346
	TOTAL	1,637,008

In addition to this 1,883,905 lb. of *roseum* seed were distributed by the cotton-growers, factory-owners and petty traders working independently.

There was, as usual, a big demand for *roseum* seed at prices varying from Rs. 30 to Rs. 40 per *khandi* of 560 lbs., which was approximately double the *bazar* rate for ordinary cotton seed.

The Divisional Agricultural Show and Conference held on the Akola Farm on the 8th and 9th December was attended by about 1,000 cultivators, who were shown round the farm where they saw the different implements recommended by the Department at work in the fields. At the Conference held in connection with the Show, the following medals and *sanads* were presented to landowners who have played a leading part in popularising agricultural improvements in their districts:—

Gold medal

1. Rao Bahadur K. J. Doshmukh of Khamgaon.

Sanads

1. Mr. M. R. Dokras of Chandur, district Amraoti.
2. " Motiram Parashram Patel of Navasari, district Amraoti.
3. " S. R. Ambikar of Saoli, district Nimar.
4. " Madheorao Tejkaram Mandloi of Khandwa.
5. " Kesharao Govindrao Deshmukh of Shirso, district Akola.
6. " Mansing Bapuji Patel of Alegaon, district Akola.
7. " Krishnarao Ganpatrao Deshmukh of Garadgaon, district Buldana.
8. " Nagorao Wamanrao Deshpande of Borakhedi, district Buldana.
9. " Sampatrao Parwatrao Deshmukh of Malkapur.
10. " Shrihari Deorao Deshpande of Warora, district Chanda.

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Mr. D. CLOUSTON called and examined.

518. (Mr. Henderson.) The main aim of the Agricultural Department in the Central Provinces is to benefit the cultivator. I would not recommend him to grow any cotton that would not pay him well. *Roseum* pays him better than any other variety that he has ever tried. If it were possible to get a long staple cotton that would pay him better, we would have no trouble in substituting it for *roseum*. The difficulty which we have experienced in introducing *buri*—a long stapled exotic variety is that, as a crop, it cannot be depended upon to the same extent as *roseum*. It suffers much from drought in years of short rainfall. The cultivator, needless to say, cannot afford to take risks. A cotton that is much affected by the vicissitudes of the weather is not one which he would care to grow. There has been a tendency since the eighties or even earlier for the area under short stapled cottons of ginning percentage to expand at the expense of *bani* which was formerly grown on a large scale in these provinces. The substitution of short stapled *jari* for *bani* has added enormously to the wealth of the cultivators. The Department of Agriculture has done much within the last ten years to extend the cultivation of *roseum* which is one of the types of *neglectum* cottons found in the ordinary mixture commonly known as *jari*. In introducing *roseum*, we have not ousted a long-stapled cotton. All we have effected is simply a substitution of a high yielding uniform type of *jari* for the mixed *jari* which was formerly grown.

519. We have pushed *roseum*, because it gives the grower a much larger profit than *jari* or any of the long-stapled varieties such as *bani* and *buri*. Success in farming must eventually come back to profits. If a long-stapled cotton capable of giving a more profitable yield than *roseum* could be found, the department would, with its present organisation, have no trouble in getting hundreds of thousands of acres of it grown within a few years. Arrangements would have to be made no doubt for the ginning of *kapas* in reliable factories and for the marketing of the lint to such buyers as would be prepared to purchase the cotton at its true market value. It is true that the gin-owner would rather buy on ginning percentage than on quantity of staple, but that feeling would cease to exist as soon as it was found more profitable to buy the long stapled variety.

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520. In my opinion, the present tendency of prices in favour of long-stapled cotton will continue only so long as the war lasts. When the war ends, America will again increase her output of raw cotton, and the demand for long-stapled cotton grown in India will decrease. The price is dependent on economic laws over which the cultivator has no control. In the production of long-stapled cotton, America has been able to undersell us in the past, and will, I believe, continue to do so. The construction of new mills in America involves an increasing demand for the American crop no doubt, but America is making great strides in the development of her agriculture, and can, I believe, increase her output very considerably by popularising improved methods of cultivation. As to what the result would be if America were to impose a heavy export duty on cotton, I should like to say that too much stress should not, in my opinion, be attached to calculations drawn from hypotheses of that kind. There will be a demand for long-stapled cotton in India after the war no doubt, just as there was a demand for it before the war began but that demand will not be so great as to enable the purchaser to pay a premium sufficient to induce the cultivator to grow it in the cotton belt of the Central Provinces and other cotton tracts where short-stapled but much hardier and more prolific cottons are being grown at present. There are tracts in India where, owing to the humidity of the climate or to the facilities offered for irrigation, long stapled cotton, even at present prices, is more profitable than short-stapled and short season cottons grown in less favoured tracts.

521. From the experience gained by us in the Central Provinces, it would appear that it would not pay to grow long-stapled cottons such as *buri* and *bani* nor *jari* cotton of mixed staple in preference to *roseum*, unless a premium of about 70 per cent. for *buri*, 106 per cent. for *bani* and 31 per cent. for *jari* were paid. If given that premium for the lint of *buri*, it would be possible to grow a few thousand acres of this variety on the best deep black soils of the cotton tract. Our experiments in which we compared the relative yields of *buri* and *roseum* were carried out on land that was not infected with wilt. In wilt infected areas the outturn of *buri* is much more nearly equal to that of *roseum*, and for that reason we have for years been recommending its cultivation in such areas. In the rice tract which includes all Chhattisgarh Division, Balaghat, Bhandara, Chanda, and part of Nagpur, there are large areas of soil derived from laterite and crystalline formations which, being very porous, are quite suited for cotton cultivation, despite the fact that the rainfall of this tract is much above the average rainfall of the cotton tract. On this class of soil an outturn of 770 lbs. of *kapas* per acre was obtained from a field of *roseum* grown on the Sindewahi Farm in 1913-14. On the Chandkhuri Farm, where we have been growing Cambodia for the last four years on a lateritic soil locally known as *bhata*, in three years out of four the yield of cotton was good. It suffered in the fourth year from an attack of caterpillars. We are now trying this same long stapled cotton, viz., Cambodia, in other parts of Chhattisgarh on soils considered to be below the margin for cultivation. About 1,000 acres of Cambodia are to be grown by cultivators in Chhattisgarh on these poor soils this year 1918-19. We hope that the area will go on doubling every year as long as the price remains high. But even at pre-war prices, it would pay handsomely to grow cotton on this land which up to the present has nearly all lain fallow. The area will increase faster, if prices remain at the present level. There will be a steady increase, but it will not be a startling one. The cultivators of this rice tract are most backward and unenterprising, and cotton is to them an entirely new crop. We hope, however, that in the course of five or six years, it will be possible to work up to an area of ten or twelve thousand acres in this tract.

522. It is true that in the ordinary *jari* mixture there is sometimes twenty per cent. of American cotton. This exotic variety was introduced in the sixties when an attempt was made to grow it pure, but cultivators have long since ceased to take an interest in this long stapled variety. It has been grown pure by the Department on Government Farms, and our experience has been that the lint is so very weak that it does not fetch more than good *jari*. This and other varieties were introduced in the sixties by the Cotton Department of which the head was Mr. Rivett-Carnac who was designated "Cotton Commissioner for the Central Provinces." On the abolition of the Cotton Department about 1873, cultivators ceased to take any further interest in exotic cottons. Upland Georgian had been grown on a considerable scale, however, and its seed had got irretrievably mixed with that of the indigenous cotton. No system of seed selection is practised by cotton growers in these provinces, and the result is that, when a cotton of this kind once gets introduced, there is little chance of its being got rid of again.

523. In East and West Khandesh, the cotton grown is almost exactly similar to that which is found in the Central Provinces. When I made a classification of the cottons of the provinces eight or nine years ago, I found that the percentage of Upland Georgian in the *jari* mixture varied considerably in different parts of the provinces. It is higher in Berar than in the north of the provinces. From Akola I got a sample containing 49 per cent. of Upland Georgian. This I attribute to the fact that in Berar there are now considerable areas of land which are badly infected with wilt disease, and that there is a practice in vogue by which cultivators keep the seed of cotton grown on these areas. Upland Georgian like *buri* is immune to wilt, and the result is that by growing *jari* cotton on lands so affected, the percentage of Upland Georgian in it tends to increase by leaps and bounds. Some cultivators who have given up the cultivation of *buri* as a pure crop, still make a point of sowing it as a mixture with *roseum* in their fields affected with wilt. In years in which wilt does not do much damage, *roseum* is a good crop. When it is badly affected by the disease, the *buri* survives. I am not sure how much of the whole cotton area in the provinces is infected with wilt, but I am of the opinion that it does not exceed one or two per cent. *Buri* is a better cotton than Upland Georgian, as it gives a higher yield of *kapas* and a slightly higher ginning percentage.

524. *Roseum* cotton is now well-known all over the Provinces as a heavy yielder, and cultivators are prepared to pay a high price in order to get pure seed. *Bani* is not now grown as a pure crop in any part of the provinces, but it is found as a mixture in *jari* in the southern portion of Berar which is far from the railway and where, owing to the difficulty of getting pure seed, it has not yet been found possible to grow *roseum*. Pure *bani* is still grown in parts of the Nizam's Dominions, I believe. It still survives in tracts which are backward agriculturally just as *kodo*, one of the inferior millets, is grown on a large scale on good land in the more backward parts of Chhattisgarh. At present prices *bani* in the Nizam's Dominions is certainly much less profitable than *roseum* would be if grown there. In a notice compiled by Mr. Schotfield of the Revenue and Agriculture Department, about 1866 when *bani* was grown absolutely pure, the normal yield of clean cotton is shown as being 34 lbs. per acre only. In my opinion *bani* is likely to disappear in a few years in the Nizam's Dominions from all tracts where the climate resembles that of the Central Provinces.

525. I do not think that the danger of *roseum* spreading in tracts which at present grow long stapled cottons is one to be guarded against. Cultivators will not grow it unless they find that it pays them better than other varieties. I do not think that the price at present paid for *roseum* is an artificial one. It is

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the duty of every Agricultural Department to try both short-stapled and long-stapled cottons and to advise the cultivator to grow that which will pay him best. It is the duty of the department to take the lead and to help the cultivator to decide what cotton suits him best. As a rule the Departments of Agriculture in India have sufficient staff to get desirable cotton grown on a large scale in a few years, and to check the extension of undesirable types which may be introduced by fraud or otherwise. Some merchants brought down a very poor quality of United Provinces cotton (Bengals) to Berar last year, with a view to having it classed as Akola *jari*. As soon as we came to know about it, steps were taken to prevent the seed of this cotton from being given out for sowing, and the persons who brought the cotton to Berar were warned by the Commissioner not to repeat the experiment. To place a ban on the introduction of a short stapled cotton merely because it is short stapled would be unwise. The duty of the Department of Agriculture clearly is to help the cultivator to grow whatever cotton pays him best, be it short stapled or long stapled. It is our duty first to experiment and then to advise. Steps were taken in the sixties to prevent the extension of *jari* cotton in Khandesh and the Central Provinces, because it was thought that *jari* was much inferior to *bani*. The mistake was made of encouraging the cultivation of a variety which did not pay for no better reason than that the trade demanded a supply of a longer staple.

526. The soil of the Akola Farm is typical of the best black soil in Berar. It is deep and retentive of moisture, and for that reason *buri* has done better there than on lighter soils in other parts of the Division. Manure is scarce in the cotton tract for the reason that the number of cattle kept per acre of land cultivated is relatively small. We have been trying to get the people to use nitrate of soda, as our black cotton soil is very deficient in nitrogen. Cotton is not grown as a rule in rotation with a leguminous crop. I have not done much work on leguminous fodders in the cotton tract for the simple reason that *juar*, which is an excellent fodder, is already grown there on a large scale, and meets the requirements of the cultivator admirably in so far as it supplies him with food grain for himself and fodder for this cattle. There is no leguminous crop, as far as I know, that would have any chance of competing with *juar* with the exception perhaps of groundnut, but the quantity of fodder which it yields is very small. *Juar* is sometimes sown as a mixture with a leguminous crop such as *urad* (*Phaseolus mungo*) and *kutki* (*Dolichos biflorus*). I do not think that the cultivator would grow a leguminous crop by itself on a large scale. *Tur* (*Cajanus indicus*) is sometimes grown as a pure crop, but is more often sown with cotton. So long as cotton continues to be as profitable as it is at present, the cultivator will hesitate to grow purely leguminous fodder crops.

527. We have been experimenting with different crops grown in rotation with cotton in order to ascertain which is the most profitable for the cultivator to grow. Curious to say, the result of the rotation series for the last ten years on the Akola Farm indicate that the highest acreage profit is obtained by growing cotton, not in rotation with another crop, but year after year on the same field. This system no doubt has its disadvantages, as continuous cropping with cotton tends to intensify the damage done by wilt disease.

528. The experimental work carried out on the Akola Farm with manures of different kinds has shown that a light dressing of cattle dung supplemented by a light top-dressing of nitrate of soda is a profitable cotton manure. Nitrate of soda has given better results than sulphate of ammonia. I think that it is quite possible that cotton-growers may take to the use of nitrate of soda as a manure. The Commissioner of Berar suggested this year about a lakh of rupees should be spent in stocking nitrate of soda for sale to cultivators in Berar. On making enquiry as to the price we found, however, that it had gone up considerably and we therefore decided not to buy any considerable quantity. In the rice tract we have got over the manure difficulty to some extent by using *san hemp* as a green manure. It is not possible to use green manure for cotton land, however, unless we adopt a system of growing green manure in rotation with cotton, as both are grown as *kharij* crops. There are no irrigation facilities in the cotton tract, and green manure cannot, therefore, be raised under irrigation in the cold weather. We have tried a large number of leguminous fodder crops on the experimental farms of the provinces, but there is little or no prospect of being able to introduce any one of them in the cotton tract for reasons already explained. Berseem (*Trifolium Alexandrinum*), grown under irrigation as a *rabi* crop, has done well in rotation with cotton in Chhattisgarh. The berseem is sown early in November, and cut as a fodder from December till May. The land is then prepared for cotton which is sown when the monsoon breaks in June. Berseem sown between the lines of standing cotton in October was found to do fairly well. Berseem is easily the best leguminous crop ever tried by the Department. The seed, however, is expensive, as it has to be imported from Egypt. When allowed to seed, the yield is only sixty lbs. per acre. As a fodder for the Telinkheri Dairy Farm, it has proved almost indispensable. It is also being grown on our cattle breeding farms where there are irrigation facilities. Other leguminous fodder tried by the Department on Government Farms are soybeans, velvet beans, shaftal, *guar* (*Cyamopsis psoraleoides*) and *Melilotus alba* (wild lucerne).

529. As to the feasibility of colonization in Chhattisgarh and Chanda by a corporation buying land, I should like to point out that it is very difficult in the Central Provinces to get land on suitable conditions for any such object. If a whole village were to be purchased, the occupancy tenants could still have the right to stick to their fields and could not be ousted by the corporation. Government could not very well acquire the land under the Land Acquisition Act unless it were possible to prove that the land was being acquired for a public purpose which would be difficult to do in a case of this kind. It might be possible no doubt to get the existing tenants to grow cotton without acquiring the land, but the rate of progress would in that case depend on the extent to which they accept our advice. *Bhata* land in Chhattisgarh can be bought for about Rs. 3-8-0 per acre. Some of this land is held by tenants who do not necessarily cultivate it. Some of it is in the possession of *malguzars* who keep it either as waste or grazing land. That part of it which is cultivated is cropped with *kodo* after intervals of two or three years. In Chhattisgarh, where we are now trying to grow long staple cotton under irrigation, land is plentiful and cheap, and even the best land can be purchased at Rs. 20 an acre.

530. My estimates as to the relative outturns of *roseum* and *buri* cottons are based on the results obtained on experimental farms and on returns obtained from co-operative seed unions and seed farms. Where the varieties of cottons are being tested on an experimental farm, each variety is grown on a different plot of the series every year so as to reduce as far as possible the experimental error. The yields of the different varieties grown on the Akola Experimental farm are average for a period of ten years.

531. About seventy per cent. of the cotton produced in the provinces is grown in Berar. There is not much variation in the soil and climatic conditions from district to district in this division. The rainfall varies from about 33 inches in Akola to 40 inches in Yeotmal, but the period of rainfall is the same all over the division. We have not repeated these varietal experiments in districts other than Akola, but they

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have been tested by the owners of seed farms who are convinced from the results obtained that *roseum* is easily the most profitable cotton to grow. This corroborates the results obtained on the Akola Experimental Farm.

532. As regards the question of improving cotton by hybridization, I may say that I doubt whether much can be done in this direction. It would be advisable, however, for the Economic Botanist to take it up when he finds time. In the past he has devoted most of his time to the study of rice and *juar*. A great deal of work in cotton breeding has been done by my staff on the Akola and Telinkheri farms. We have invariably found that, when a long-staple cotton such as *bani* is crossed with a short-staple cotton with a high ginning percentage, the hybrid fails as a rule to have the two good qualities at which we aim, viz., length of staple and a high percentage of lint. It may yet be found possible to produce a hybrid in which these two qualities are combined, but I should like to point out that it has not yet been accomplished anywhere in India. Of the thousands of crosses which we have produced only two or three are of any promise. Of these, the Sindewahi cross is now being tried on a field scale but the lint is not quite uniform as yet, though the plant is absolutely fixed as regards its leaf and flower characters. The ginning percentage of this cross ranges from 35 to 36. This cross is being grown by cultivators this year for the first time. It is being tried in 21 villages in Chhattisgarh where it is grown with irrigation. It is an early cotton, and should do fairly well in the cotton tract without irrigation. It will be difficult to substitute any cotton of this kind which is only slightly better than *roseum* for that heavy yielding variety which is now so much appreciated by cotton growers. Much will depend on the price which the buyer is prepared to pay for the better lint. If the premium paid is sufficient to make it worth while for the cultivator to grow it, he will do so without doubt. The Sindewahi cross is a cotton of better staple than *roseum* as one of the following valuations will show :—

1912—	d
<i>Buri</i>	6.9/16 per lb. value at Liverpool.
<i>Bani</i>	6.3/8 " " " "
<i>Roseum</i>	5½ " " " "
Valuation for 1915 :—	
Cambodia	Rs. 124 per <i>bhoja</i> of 392 lbs.
<i>Roseum</i>	70 " " " "
Sindewahi Cross	92 " " " "

533. Cotton wilt has done a good deal of damage in small concentrated areas, more especially in Berar. It will, I believe, tend to spread so long as cotton-growers continue to grow cotton year after year on the same field as some of them do. I have given a good deal of attention to the question, and have worked out the percentage of plants affected with this disease in infected villages in different districts. Specimens of the plants affected were sent to Dr. Butler. Experiments were also carried out to ascertain the relative immunity of pure *bani*, *buri* and *jari* cotton to this disease. The *buri* was found to be immune but *jari* and *bani* were about equally susceptible. I am not in a position to say to what extent the yield of cotton for the whole province is reduced by this disease. Cultivators, in order to reduce the damage done to a minimum, use a higher seed rate in wilt infected areas or they sow *buri* or Upland Georgian as a mixture with the *jari* in such areas. When once the disease gets established in a field, it continues to damage the crop year after year. It has been found in America, I believe, that its ravages can be reduced very much by rotating cotton with other crops and that after cropping affected areas with other crops for at least six years the virulence of the disease is very much reduced.

534. Boll-worm is not a very serious pest in the Central Provinces. An experiment carried out on the Telinkheri Farm some years ago showed that about eight per cent. of the plants were affected by boll-worm. It was found on the same farm that *bhindi* sown with cotton as a trap crop reduced the damage done by this pest to some extent, but the remedy was not an economical one. In the neighbourhood of towns where *bhindi* is in demand in large quantities as a vegetable, it may be possible to use it economically as a trap crop in areas affected by this pest. But as I have already said, boll-worm cannot be regarded as a serious pest in these provinces.

535. Exotic cottons such as Cambodia, *buri* and Upland Georgian suffer from red leaf blight in October. This blight is, I believe, due to the physiological condition of the plant resulting from the sudden cessation of rains followed by hot sunshine in that month. The leaves affected get red, wither and drop, and this necessarily checks the growth of the plant. Indigenous varieties remain green throughout the cold weather. Picking starts as a rule, in the third week of October, and is finished by the end of January. Later pickings are obtained when the cold weather rainfall is good. The growth of the cotton plant is checked not by cold but for want of moisture. Where irrigation facilities are available, cotton continues to yield till the end of March. We stop irrigating and picking after that month for the reason that, owing to the excessive heat, the plant, while yielding much less cotton, requires much more water. Long season exotic cottons such as Cambodia are benefited to a greater extent by irrigation than short season cottons like *jari*. *Jari*, even when irrigated, gives at least two-thirds of its total yield before the end of December. Cambodia on the other hand gives more than half its total yield after that date.

536. (Mr. Roberts.) The position of affairs when I took over charge of the cotton work in the provinces, was that, though many efforts had been made to grow long-staple cottons, no real attempt had been made to go into the question of profit and loss to the cultivator. My first work was to classify the cottons grown and to ascertain their outturns and ginning percentages. Having picked out the most profitable cotton for the ryot to grow, the next step was to get it propagated on private seed farms run by individuals or co-operative unions. Similar efforts are now being made to extend the cultivation of *roseum* in parts of the United Provinces and Bombay Presidency. The total annual yield of cotton for the provinces is about one million bales. I do not consider that the quantity of short-stapled cotton grown is ever likely to be in excess of the demand. In Japan, the number of spindles is being increased as fast as possible and the quantity of cotton imported from India is increasing every year; the demand for Indian yarn in China, too, shows no signs of decreasing.

537. The difference in quality between the lint of *jari* and of *roseum* cotton is very little. *Roseum* is slightly inferior in quality to *malvense* and *verum* which are two of the *neglectum* types which constitute the *jari* mixture. It is, on the other hand, distinctly superior to *cutchicum*. Pure *roseum* is therefore of

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better quality than a *jari* cotton containing a very high percentage of *cutchicum* but slightly inferior in quality to a mixture containing *malvense* and *verum*. The percentage of *bani* in the mixture is ordinarily so very small that it need not be taken into account. The presence of a high percentage of Upland Georgian tends to depreciate rather than to increase the value of the mixture, as its lint is distinctly weak.

538. We have a certain area under selected strains of long-stapled cottons every year on our Government Farms. When a sufficiently high premium is paid for long-staple, it may pay to grow one of these varieties on a large scale. But we do not intend to push them at present except in the limited areas to which I have already referred. Upland Georgian we have fully tested. Its chief defect lies in the fact that it is a poor yielder, but the lint is also distinctly weak. It is a mistake, in my opinion, to try and push any variety with a weak lint for the reason that the strength is dependent very largely on climatic conditions which are not under our control and a weak cotton cannot be improved to any great extent by selection. Selection work on all cottons which were promising was taken in hand from the very beginning. Mass selection was first carried out in a large yield of from thirteen to twenty acres. From that field we selected at the same time about 100 plants, the cotton of which we collected in separate bags. The *kapas* of each bag was ginned separately so as to get the yield and ginning percentage. The number kept for sowing in the following year was reduced to 100. The seed of each of these ten plants superior to the rest was sown in a separate line from which selections were made again the following year, while seed of the remaining ninety plants was utilised for sowing in a larger plot. Continuous selection was thus practised in order to keep up the standard. All the *roseum* now grown in the provinces has been propagated from the best of these ten strains selected in this way nine years ago. The strains of *buri* has been propagated in the same way. In selecting *buri*, special attention was paid to strength of fibre, as the Manager of the Empress Mills had laid stress on the fact that *buri* like Upland Georgian gave a weak fibre which was not suitable for warp. No precautions were taken to prevent crossing between different types. I believe that crossing the field is very uncommon. No special attention has been paid to leaf characters in cotton beyond selecting plants which were strong and free from leaf blight. I believe that, to improve the quality of American cottons, much could be done by a system of selection based on a knowledge of leaf characters. Our Economic Botanist will no doubt find time to go into this after completing his study of *juars*, rices and wheats. He has already done some work on cotton but has not given nearly so much time to it as he has to these other crops. He is of opinion, I believe, that to effect any improvement by crossing will be a difficult problem.

539. There is a considerable diversity in the soils of the cotton tract. Some are light and readily lose moisture after the rains; some are heavy and much more retentive. Now that the price of cotton has gone so high it is being grown to a larger extent than formerly on light soils. *Roseum* does very much better than *buri* on light soils for reasons already given. *Buri* is seen at its best in rich heavy soils in which *jari* is apt to suffer from waterlogging. *Buri* has been compared with *jari* and *roseum* in different classes of soil in the cotton tract. We had, some years ago, *buri* growing on forty private seed farms. Their opinion was that, in wet years, *buri* did better in waterlogged and wilt-infected areas than *jari*. In dry years, however, it proved a comparative failure even on these deep rich soils. A short monsoon followed by a dry hot October is fatal to this variety.

540. The figures showing the relative outturns of the different cottons as given in my written evidence relate to the results obtained on the Akola Experimental Farm, the soil of which is typical of the best heavy black soil in Berar. On that farm we have grown cotton on the same land for eleven years in succession, but over the greater portion of the farm we rotated it with *juar*. Rotation will have to be practised to a greater extent in future, as some fields are now infected with wilt. The different varieties of cotton under trial were tested both on the Akola and Telinkheri Farms.

541. It will take a long time to get the whole cotton tract sown with pure *roseum* for the reason that the ordinary cultivator, as a rule, sells his cotton as *kapas*, and the seed is not kept for sowing purposes. The owners of some ginning factories, however, now make a point of keeping the seed of *roseum* cotton for sale, because they get a very much higher price for it than for *jari* seed. Such seed is not always pure, as no attention is paid, as a rule, to its being kept entirely apart from that of other varieties. Big landowners who grow large areas of *roseum* sell it as lint rather than *kapas*, because of the high ginning percentage which it gives and because of the high price received for its seed. A large quantity of seed is being distributed in this way by landowners who are not working under the control of the Department. Pure seed is supplied by our co-operative seed unions and seed farms, the number of which is limited for want of staff to supervise them. We gave out last year about seventeen lakhs of pounds of *roseum* seed from these unions and seed farms. The number of these farms and unions was increased very considerably this year, as the supply of seed was still far short of the demand. Had the season been a good one, we had hoped to be able to supply nearly four million pounds of seed for sowing in the coming season. As the result of our labours the area under pure *roseum* is increasing every year, and the ginning percentage of *jari* cotton is also being increased. I expect to get almost the whole cotton area specially suited for *roseum* sown with the variety within the next ten years. With that object in view we are increasing our agencies for seed propagation as fast as we possibly can. We have 513 seed farms, 25 registered unions and 26 unregistered unions at the present time. At present we are working with a very small staff, but good progress is being made nevertheless, as the demand from the people for seed is very great. They know the intrinsic value of this cotton, and do not require to be pressed to grow it. The actual premium paid by buyers for *roseum kapas* varies from two to five rupees per *khandi* of 560 lbs. As the cultivator sells his cotton as *kapas* he therefore loses badly as the buyer does not allow enough for the higher ginning percentage which it gives. We therefore try to get those who grow it on a large scale to gin it for themselves. We also wrote to several of the big buyers to ask whether they would be prepared to purchase the *kapas* and to give a sufficiently high premium in the event of our collecting it for them at certain markets. Their reply was that they were not in a position to do so as they have their buyers in big centres only. When cultivators sell *roseum* lint, they ordinarily get from three to four rupees more for it per *bhoja* of 392 lbs. than for *jari* lint. Large buyers who buy for export are prepared to pay more for clean cotton of good colour; they do not attach much importance to the staple.

542. Cultivators do not sell their cotton direct to the Empress Mills, but to their agents who purchase for these mills.

543. We have tried *guar* (*Cyamopsis psoralioides*) as a fodder crop.

544. We have private cotton seed farms in every *taluk* of the cotton tract. On these seed farms, *roseum* seed is propagated by the owners and sold direct to cultivators the following year, but no attempt is made

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to collect the seed of the cultivators' crop. In the case of our seed unions, each union consists of ten or more seed farms, one of which is designated the central seed farm of the union while the others are called branch seed farms. Our procedure is to supply the central seed farm with seed from the Akola Experimental Farm. It is grown on the central seed farm of the union under the supervision of the District Agricultural Assistant. This pure seed is distributed in the following year to the branch farms of the same union. In the event of its not being all required for that union, it is sold to other unions or seed farms. It may take four years for a selected strain of seed to reach the cultivator in this way. But in actual practice it generally reaches him in three as sufficient seed is now being raised on the Government Farm to supply not only the central farms but also the branch farms of co-operative seed unions in the first year so that when a new union is started, all the ten or more branch farms can be supplied with Government seed which, on being propagated, is distributed to the cultivators the following year. If we desired to introduce a new variety of long-stapled cotton, it would take about four years to get two million acres of it under cultivation, working of course under optimum conditions. We have about 250 acres under cotton every year on the Government farms. This area could all be cropped with the new variety. In the second year, the seed produced would suffice for 5,200 acres, in the third for about 100,000 acres and in the fourth year for about 2,000,000 acres.

545. I have already given it as my opinion that the price of cotton is likely to drop to nearly the pre-war rate shortly after the war ends. America will increase her output, and we are not in a position in these provinces at least to compete with her in the production of long-stapled varieties. The price is dependent on the interaction of the laws of supply and demand. Under war conditions, the supply has for the moment decreased, and the price has in consequence increased. The same thing happened at the time of the American Civil War, but prices dropped as soon as the supplies available became normal. In 1913 the American crop amounted to over sixteen million bales, and the price was about 6d. per pound. I see no reason why America should not produce more than sixteen million bales when the war ends, and she will, as usual, be able to export some portion of this. Before the war, America used to consume $3\frac{1}{2}$ million bales, while now she is reported to be consuming about twice that quantity. But this, I hold, is largely due to war conditions and to the fact that the export of cotton goods from America has increased enormously owing to the decrease in output of cotton mills in Europe. But this condition of affairs is the result of the war, and should cease shortly after the war ends. The price of cotton will then become normal again, and America will be in a position to export "Middling American" at a price at which it would not pay the cultivator to grow it in India, except in tracts which are specially suited for the cultivation of long-staple varieties. There is no reason, as far as I know, why America should not continue to increase her output of raw cotton by adopting improved methods of cultivation. There is a great shortage of labour in Texas and other parts of the cotton belt no doubt, but the labour shortage is experienced mainly at the time of picking, and the improved cotton pickers now under trial promise to solve this difficulty.

546. We have proved conclusively that the premium paid for long-staple cotton in the Central Provinces is not sufficiently high to make it profitable for the cultivator to grow it in the cotton tract proper. The difference between the price of long and short-stapled cotton should tend to widen, owing to the impossibility of importing the former quality from America, under existing conditions; but the difference at present is still very small. Broach, which is one of the best cottons grown in India, only fetched about Rs. 20 per *khandi* of 784 lb. more than our *rosum* last year. Most of the cotton sold in the Central Provinces is purchased by buyers who pay little or no attention to staple. What they want is clean cotton which is free of dirt. Japan has purchased large quantities of late years. Their mills are fitted with machinery which spin low cottons, and they eagerly purchase cotton of the quality of our *rosum*. For pure *rosum* lint we have this year been paid a premium of from three to four rupees per *khandi* more than for mixed *jari*. That the demand for short-staple cotton is likely to decrease and that the cultivator who continues to grow it will suffer in consequence is an argument which has been used time and again for the last sixty years. The argument unfortunately has not been justified by actual facts. I am convinced that the extension of long-staple cotton in the Central Provinces is not at present desirable, and is not likely to be desirable in the near future, except in restricted areas where irrigation facilities have been provided or where, owing to the nature of the soil, indigenous varieties suffer. Some of the local cotton mills have in the past paid a premium of about 25 per cent. for long-stapled cotton like *bani* and *turi* but even that is much too low: other buyers have given no premium at all. The attempts repeatedly made within the last sixty years to get cultivators to substitute long for short-stapled varieties in the Central Provinces have proved a complete failure. That pure *bani* is still being grown in parts of the Nizam's Dominions proves nothing. It is due, I believe, to the fact that the cultivators there are very backward agriculturally and still continue to grow a comparatively unprofitable variety, because they have not yet been able to get seed of a more profitable kind.

547. Our organisation of Agricultural Associations started with the District Associations of which the Deputy Commissioner in each district was the president. Members of these District Associations were not carefully selected, and few of them took any real interest in the objects of their Association. Taluk Associations were formed later. The men selected for membership were leading landowners who had shown interest in improved agriculture. Many of them were the owners of private seed farms. The President of the Taluk Association is the Tahsildar. When our co-operative agricultural seed unions were formed, most of the members of these unions also became members of the Agricultural Association of their Taluk. The Taluk Association meets twice or thrice a year. Each Taluk Association has its representatives in the District Association which meets once a year under the presidency of the Deputy Commissioner. The Divisional Meeting of the District Associations is held under the presidency of the Commissioner at the time of the annual Divisional Show and Conference. A few of the Taluk Associations are now employing their own *kamdars* who carry out a certain amount of propaganda work in villages and who book orders for improved seed, implements, etc., stocked by the Taluk Association. Grants of from Rs. 1,000 to Rs. 1,200 are given by some District Boards for the improvement of agriculture. This money is divided between the different Taluk Associations of the district. The money is being utilised for the payment of the *kamdars* employed by these Taluk Associations.

548. (Mr. Hodgkinson.) I said yesterday that America would after the war increase her output of cotton. This, I believe, she can do by more intensive cultivation. I have seen it stated that America is reaching the limit of the area which she can put under cotton. I am also aware that the question of labour is becoming a very serious one in America. On the other hand, they are trying to introduce cotton picking machines there which will, if successful, solve the labour difficulty. These have, I understand, not been a success so far. As to whether Lancashire would benefit more by India increasing her output of long-stapled

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cotton by 100,000 bales or her output of short-stapled cotton by 500,000, I am of the opinion that in the interest of Lancashire an increase of 100,000 bales of long-stapled cotton would be preferable, but in the interests of the cultivator in the cotton tract of the Central Provinces, I would prefer to concentrate our efforts very largely in increasing the output of the shorter-stapled but more profitable cotton which we are now pushing. Where irrigation is available, we shall, of course, continue to push the cultivation of long-stapled cotton, where it pays the cultivator to grow it.

549. The average yield of a normal crop of cotton in the provinces is about 280 lbs. per acre which is equivalent to an output of about 95 lbs. of lint. From the statistics published in the eighties it would appear that the outputs were only little over half of these. In a note compiled by the Revenue and Agriculture Department of the Government of India, I find, for example, that the yield of lint per acre in 1881 was 29 lbs.; in 1882 it was 40; in 1883 it was $57\frac{1}{2}$; in 1884 it was 41 and in 1885 it was 54. The large increase in yield is due mainly to the fact that *boni*, which was the cotton chiefly grown at that time, has been ousted by the much more prolific *jari*. The cultivation of cotton has also become more intensive no doubt, and the yield could be increased still further by better cultivation. The introduction of *rosum* has increased the acreage yield by about 30 lbs. of lint over that of *jari*. The average output of cotton could certainly be doubled by more intensive cultivation. On irrigated land we have obtained yield of 700 lbs. of *rosum* *kapas* per acre which is equivalent to about 280 lbs. of lint.

550. There is great scope for the extension of cotton cultivation outside the cotton tract but the establishment of the Department is much too small to do justice to this work at present.

551. Each province requires an Economist Botanist and an Agricultural Chemist. I do not consider that we require a second Botanist in the Central Provinces. Our Botanist has already completed the classification of the principal crops so that he will have ample time in future to devote to plant breeding. We require a larger number of Deputy Directors, at least one for each division is urgently needed, and each Deputy should have an Assistant Director to assist him. This staff would suffice for the next ten years.

552. (President.) In forecasting the output of cotton for the year, the methods which we employ are as follows. A field is selected in each cotton-growing *taluk* where the crop represents the average crop of the year. In this field a plot of one-tenth of an acre is selected. The number of plants in this plot is counted, and the average number of bolls, flowers and buds on 100 plants is ascertained. From this we deduce the total number for the whole plot. Knowing as we do the weight of cotton given by a known number of bolls, flowers and buds in the previous year, we draw conclusions as to the yield of a plot this year. Allowance has to be made for a certain amount to loss, owing to buds and flowers failing to mature. This is a formidable source of error, as the number which falls in any one year before maturing is largely dependent on weather conditions which cannot be forecasted. For the first three years in which we employed this method our forecast was fairly accurate. The error never exceeded six per cent. This new system was started four years ago. Before that, the Settlement Department prepared the cotton forecast. The Commissioner of Settlements used to rely on the information supplied by Revenue Inspectors and *patwaris* as to the state of the crop in their circles. They gave the output in the American notation which showed how much the crop was better or worse than that of the previous year. Our forecast last year proved inaccurate. The heavy rainfall at the end of November damaged the crop to such an extent that a large number of immature bolls dropped.

553. I have not experienced any difficulty in obtaining fortnightly returns from gins and presses. These returns are sometimes sent in late in which case they are published along with those of the following fortnight. These returns should, in my opinion, be made compulsory. To facilitate the clerical work involved in sending in these returns, we supply the managers of gins and presses with postcards so that they have merely to fill in the figures in the blank spaces.

554. Those who were consulted regarding the advisability of publishing Bombay and Liverpool prices in the cotton markets have given it as their opinion that this is not necessary for the reason that these prices are known to all the buyers between whom competition is so keen that they have to offer top prices. The result is that, allowing for freight charges, there is very little difference between the market price here and that in Bombay on the same day for the same quality of cotton. I doubt therefore whether the cultivator would be benefited to any extent by publishing these prices in our local markets. Where the cultivator loses is when the buyer goes to his village and buys his cotton there, thereby preventing him from coming to know what real market value of his cotton is.

555. I do not consider that the appointment of an Imperial Cotton Specialist is ever likely to help us materially in improving the cotton industry in India. Improvement must come from within, and can only be carried out effectively in a province by a staff of experts working therein. What we want is to increase the staff of experts in the cotton-growing provinces rather than to appoint one Imperial Expert for all India.

556. It would, in my opinion, be advisable to have a permanent Standing Sub-Committee of the Board of Agriculture consisting of Botanists and Deputy Directors actually employed in the improvement of cotton with representatives of the trade and shipping interests and possibly a permanent president. The function of such a Board would be co-ordination and generally to keep in touch with the Central Bureau at home. It would also be advisable to provide in Bombay some agency to test the extent to which cotton is watered. Cotton sent from the Central Provinces to Bombay contains, if not previously watered, a comparatively low percentage of moisture. It absorbs moisture in Bombay where the humidity is greater and increases in weight in consequence. Cotton purchased in a dry tract is thus worth more per pound than cotton of the same quality obtained in a tract where the humidity is greater. Buyers in the dry tract naturally try to gain an advantage by adding the water while the cotton is still in their hands. This is a point which our Central Committee would consider.

Supplementary written statement submitted by Mr. D. Clouston.

A Note on the possibilities of growing long-stapled cotton in the rice tract in 1918-1919, submitted to the Central Provinces Administration on November 27th, 1917.

557. After going round with the Cotton Committee and sitting in the witness-box for most of one afternoon and part of another, I am convinced that in the interests of the Empire we should do what we can to produce long-stapled cotton in the Central Provinces. To put the position in a nutshell, America is increasing the number of her spindles at such a rate that the time is not far distant when she will be able to spin

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almost all her own cotton. Britain relies almost entirely on America for her raw cotton at present and India relies to some extent. If then we can't do something in the way of taking America's place as a producer of long-stapled cotton, woe betide the great cotton industry of Lancashire and the cotton mills of India which are spinning high counts.

558. We cannot, at present prices, grow any considerable quantity of long-stapled cotton in the cotton tract of the Central Provinces for the simple reason that the season is too short for such cottons. We can do so in the rice tract, because when given irrigation facilities we make our own season so to speak.

559. Our cotton experiments on the Chandkhuri Farm have clearly proved that contrary to generally accepted notions, excellent crops of cotton can be raised on light well-drained soils with a rainfall which far exceeds that of the cotton tract. We have got yields of over 1,000 lbs. of *kapas* per acre on the *wardi* soil of Chanda; we got a yield of 783 lbs. of Cambodia *kapas* on the *bhata* soil of Chandkhuri Farm last year; and some of the *malguzars* who are trying this same variety on *bhata* this season will get even higher yields than that. The average yield of short stapled cotton in the cotton tract last year did not exceed 180 lbs. of *kapas* per acre, and the crop this season appears to be very little better than that of last year. The outturn of long-stapled cotton grown experimentally for the last two years on *bhata* has, in short, been approximately four times as great as that of the average yield of short stapled cotton grown in the cotton tract.

560. Let us next compare the value of the lint produced. Short staple is at present being sold at about nine annas a pound; but the lint of Cambodia, the cotton which does so well on irrigated *bhata*, fetches twelve annas. If then it pays the Berar cultivator to raise 180 lbs. of *kapas* per acre which corresponds to approximately 63 lbs. of lint which he sells at nine annas a pound, it will certainly pay the Chhattisgarhi to grow long-stapled Cambodia which yields four times as much lint and which fetches 33 per cent. more money per pound of lint.

561. Let us try to put at least 1,000 acres under Cambodia this year on *bhata* and *bhata malasi* soils in Drug and Raipur. Rai Sahib Tundilal thinks that it is possible, and I say that if it is possible, it simply must be done. The trade demands it and it is up to Government to push on an improvement which will benefit both the cultivator and the trade. Our Department can provide the seed and implements required, if the Irrigation Department can supply the water. I know as a matter of fact that there will be no difficulty in supplying the latter. To swell the area under Cambodia still further we are to include Chanda, Bhandara, Balaghat and Ramtek in the scope of our operations. I know the Chief Engineer is exceedingly keen on making a beginning wherever there are porous soils of the *bhata* type commanded by irrigation. Now is the time to begin when such high prices are being paid for cotton of good staple.

562. As the cultivation of cotton is new to the rice tract, all the operations connected therewith will for some years be carried out under the supervision of Agricultural Assistants. They will select suitable areas, i.e., well-drained lands which are commanded by irrigation and they will see that the cultivation is properly done. I do not anticipate that there will be any difficulty in finding sufficient labour for the cultivation of this new crop in Chhattisgarh at least. The cultivator can well afford to switch off the labour he has hitherto expended on the cultivation of *kodo* to the cultivation of cotton which is at least ten times more profitable.

563. There is every encouragement to go ahead. The quality of the cotton produced by these soils has been described by a competent authority as being of the very finest produced in India. The lint is strong, long and soft and is just what is wanted both by Lancashire and Indian Mills. Now that irrigation facilities have been provided for large stretches of *bhata* land in Drug and Raipur, this poor lateritic soil will, I anticipate, become a veritable gold mine. The same remark applies to the light or *wardi* soil of Chanda and to the *sihar* and *bhata* soils of Bhandara and Balaghat.

Rao Bahadur K. J. DESHMUKH, Landholder, Aratya, and Vice-Chairman, Taluk Agricultural Association, Khamgaon.

EXAMINED AT KHAMGAON, NOVEMBER 17TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short-staple cotton.

564. (1) **Experience.**—I have lived in Buldana District all my life and have been in actual touch with cultivators.

565. (2) **Varieties.**—*Roseum* and *gaorani* are the two varieties grown.

566. (3) **Size of holdings.**—The average size of a holding is twelve acres and nearly three-fourths of the above holding is under cotton cultivation.

567. (4) **Yields and profits.**—The average yield per acre is eight maunds and the net profit is Rs. 15 per acre.

568. (5) **Rotations and manures.**—*Kadbi* is the general crop for rotation, but it has no manurial value at all, and it exhausts the soil. Other rotations which are beneficial for cotton cultivation are tobacco, til, groundnut, *bajra*, and linseed.

569. (6) **Comparative returns.**—The return of *deshi* short stapled cotton as compared to *deshi* long stapled varieties, namely *bani* and *buri*, is superior.

570. (7) **Conditions affecting increase in area.**—The area under *deshi* short stapled cotton is gradually increasing for the last twenty years, because the cultivator gets the crop earlier and at the same time more in value than the other varieties of crops. Besides this, the crop is not affected to that extent by short rainfall as is the case with other crops.

571. (8) **Uses of seed and seed selection.**—The cotton seed is used for (1) Feeding cattle. (2) Extracting oil. (3) Sowing purposes. In general, seed selection is not practised on any scientific principle. Seed farms and unions distribute pure *roseum* seed. Seed selected for sowing is not specially hand ginned. From a monetary point of view, the effect of cotton cultivation has been desirable for the last 25 years, but at the same time, the spendthrift habits of the uneducated cultivator have much increased and so the general condition of the agriculturist is not satisfactory.

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[Continued.]

To remedy the evil—

- (i) Agricultural education in the secondary and high schools should be imparted and that too in the vernacular.
- (ii) At least two agricultural assistants should be appointed for each *taluk* to educate the masses of agriculturists theoretically and practically in the principles of co-operation, thrift and improved agricultural methods and to form unions in as many villages as possible for getting their cotton ginned, pressed and sold.
- (iii) The system of sub-dividing fields into co-shares should be discouraged, as small and scattered holdings require expense comparatively much, and supervision.

II.—COMMERCIAL ASPECT.

572. (30) **Local trade customs.**—The agriculturist takes his *kapas* cart to the cotton market and entrusts the sale of *kapas* to an *aratya* who settles the bargain with all possible advantage for his constituents with the purchasers. The carts are then taken to the ginning factories, weighed there, and the agriculturist is paid his money by the *aratya*.

In my opinion, the present system is fully perfect and advantageous except in the following respects:—

- (a) Many a time when the purchasers receive the wires of decline in rates they try to reduce unreasonably the rates previously settled in the market, and as this is done in latter part of the day the *aratya* is placed in an awkward position and many a time he is compelled to sell *kapas* even at a disadvantageous rate. In such cases of dispute regarding rates, there should be an arbitration of two purchasers and two sellers whose decision should be final and binding on both the parties.
- (b) There should be one inspector whose appointment and removal should wholly rest in the hands of the cotton market committee specially appointed to check the weights while the weighments are going on. This procedure will save the agriculturist from over weighments or any frauds.
- (c) License to any person to work as an *aratya* should not be granted unless he has an experience of cotton business at least of five years or he undergoes a certain commercial test and unless he is a person of some status and good reputation.
- (d) The present system of calculating a *khandi*, at the rate of 28 maunds instead of 20 maunds as prevalent in India from times immemorial, is very unpopular among the agriculturists and difficult for working the accounts of business men.

573. (32) **Buying agencies.**—In my opinion, there are practically no buying agencies in India. The present agency of purchasers is more or less a sort of buying commission agents. This system works to the disadvantage of cultivators because there are several factors such as *aratyas*, commission purchasing agencies who absorb to some extent the profits of the cultivator. It would be advantageous if attempts are made to start commercial cotton purchasing banks on the share system (shares to be purchased by agriculturists and merchants). Such banks should purchase cotton from village unions, store the bales and sell them at advantageous prices in lots and give dividends to its members, and the whole scheme should work on a co-operative basis.

III.—STATISTICAL.

574. (33) **Improvement of cotton forecast.**—I do not consider that the cotton forecast, as at present published, is fully perfect. I believe that the statistics of forecast of cotton cultivation should be prepared by the village *patwaris* at the end of July showing the name of each cultivator with his area in acreage under cotton cultivation. This statement should be signed by the village *panchas*. For this purpose the soil under cotton should be divided into four or five classes. Such statements should be submitted to the Revenue Inspector who, with the help of *taluk* and District Association, will prepare the figure for his circle, and similarly the figures for the whole *taluk* and District be prepared with the help of *taluk* and District Agricultural Association, and thus the figure for the whole Province should be published by the Deputy Director of Agriculture. The second forecast of the condition and progress of crop should be published at the end of September, October and November, and should state the prospects of the yields in annas and cents.

575. (34) **Improvement of other statistical information.**—From the month of November, the reports of arrival of cotton carts in each cotton market, number of bales pressed, number of bales exported by rail and the number of *bhojas* ginned in each factory should be published. At the end of each week, printed copies of all such reports should be freely distributed or sold on a nominal price at all the cotton markets, all *taluk* places, important towns and agricultural and commercial institutions.

576. (35) **Publication of Liverpool and Bombay prices.**—Similarly each cotton market should get at its cost wires of daily prices of cotton from Bombay markets. Copies of such telegrams should be pasted in the cotton market for the information of the public concerned.

IV.—MANUFACTURE.

(a) Ginning and Pressing.

577. (36) **Type and number of gins.**—I have got two ginning factories consisting of eighteen gins of Platt Brothers make.

578. (42) **Effect of replacemet of short-staple cotton by long-staple.**—No substantial alteration in the machinery will be necessary if long-stapled cotton is introduced.

Rao Bahadur K. J. DESHMUKH called and examined.

579. (President). I am the Vice-Chairman of the Taluk Agricultural Association. I have no official connexion with the cotton market but I am an *aratya*. As to the various improvements that I would suggest in the method of marketing, I have given my ideas in my written evidence. I would have an inspector to

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[Continued.]

check the weights. *Aratyas* are often not men of experience or of status because a license is given to any man who applies for it. I would suggest the consideration of the following:—Arbitration, appointment of an inspector of weights, appointment of qualified men as *aratyas* and the alteration of the *khandi* because it is very difficult to work under the present system. Formerly there were twenty maunds to the *khandi* and then it was easy to calculate even by the uneducated cultivator. A *khandi* of twenty-eight maunds is peculiar to the Central Provinces and outside the province it is twenty. A *khandi* of twenty-eight maunds is very unpopular. The *khandi* was changed about two years ago under the orders of the Commissioner to the cotton market committee. It was changed owing to the standardization of weights. Fourteen seers make a maund. There are therefore 392 lbs. to the *khandi*.

580. In regard to buying, I would suggest cotton purchasing banks. The disadvantage at present is that the cultivator as soon as he gets his crop from the field, brings it at once to the cotton market. He has no convenient method of storing it. So there is a sudden rush lasting for two or three months and the *kunbis* (cultivators) have to sell their *kapas* at the option of the buyers. Cotton purchasing banks would enable the *kunbi* to hold his cotton up for a better price. The banks would have facilities for ginning, pressing and storing and would only sell the cotton when a fair price was obtainable. The market this year opened with cotton at Rs. 140 per *khandi* or even Rs. 137. Now the rate is Rs. 170 per *khandi* and the *kunbi* has therefore had to lose about Rs. 60 each cart unnecessarily. Had there been a bank, such would not have been the case. If there is no rush, there is no chance of the value going down. The stock of bales would be sold in lots and there would be a fair demand from Bombay. At present about one hundred to two hundred bales are despatched to Bombay, retail selling.

581. As to forecasts, I have suggested another method of framing them and I have said that the dates of publication are not suitable. I think that they should be published at the end of each month. In July, the forecast should state the net area under cotton. In August, September, October and November, the condition of the crop should be stated as well as the area. We should still have the February forecast. In December, the forecast should show the arrivals in each market. The forecasts should be attested by *panchayats* and by the members of the Taluk and District Associations, so that they will create more confidence.

582. The Chairman of the Taluk Agricultural Association here is the Tahsildar. It was founded in 1914. Formerly there was a District Agricultural Association but as it had a meeting only once a year, practically very little could be done. It consisted of about 25 to 30 members, i.e., five or six members from each *taluk*. It was too big and the members were too busy and had no time to explain its objects to the people in the district. By forming smaller Taluk Associations we have enlisted the sympathy of many agriculturists in each *taluk*. Each *taluk* is divided into groups of about twenty groups, each group being in charge of a circle member. The circle members explain the objects of improved implements and if there is any demand, they communicate with the Secretary of the Association, who supplies from headquarters, such implements as winnowing machines, ploughs on hire, etc. These are found to be of great advantage to the cultivator. Seed is supplied as well also copper sulphate. Advice on all agricultural matters is also furnished. We have a managing committee, that is the working body. In order to have a fund from which to purchase implements, we have just started a class of patrons, who give a donation of Rs. 25 to the Taluk Association to enable us to purchase improved implements. Besides these, we have got members paying a subscription of Rs. 2, and "sympathisers" paying Re. 1 to the Association annually. Regular accounts are kept and scrutinised. I recommend that these Taluk Associations should be registered under the Co-operative Act and that they should work on a share system, because this year we purchased ploughs worth Rs. 300 and the profit we made by hiring them out was Rs. 100, i.e., one-third of the investment made. My idea is that these associations, who do good work, should be given some grants from the Agricultural Department for the purchase of implements, because at present, as they have to depend on the public for their funds, the progress made is not satisfactory. It is now rather a charity affair. By getting these associations registered, we should be able to give some dividend to the agriculturists and they would begin to take more interest in these associations. Grants should be made by Government for starting libraries and museums. Half the cost at least should be contributed by Government.

583. (Mr. Wadia.) I have suggested that two persons on the buyer's side and two on the seller's should be arbitrators in disputes. Their decision should be final. There should be a rule in the cotton market law, making it a condition of a license, that the licensee should act as an arbitrator whenever he is called upon to do so. There should be a rule, making both purchasers and sellers work as arbitrators whenever they are called for to do so, but they should not be concerned in the transaction.

584. (Mr. Henderson.) About three annas or rather less than one-fifth of the total crop which comes into the market is pure *roseum*. The mixed *roseum* is about four annas, i.e., about a quarter of the crop. The cultivators are pleased to pay an extra price for seed. All the Seed Unions at Khamgaon this year sold the seed at the rate of Rs. 35 per *khandi* when the price of ordinary seed was only Rs. 15 to Rs. 18.

585. (Mr. Roberts.) We do not find any difficulty in selling all our seed. We cannot cope with the demand. In the beginning, we had to call for the assistance of the revenue authorities in selling our seed but for the last two or three years we have been selling it independently and cannot meet the demand. The cultivators come in for it. The total quantity of seed which we sold last year was about 50,000 lbs., sufficient to grow about six to seven thousand acres. Our seed farms, i.e., central farm and branch farm amounted to 300 acres altogether. I cannot say how much we sold from the central farm last year. The 50,000 lbs. I mentioned is for the branch farm as well as for the central farm. I find the same customers come again every year but there are also new ones as the reputation of the *roseum* seed spreads. Roughly the proportion of new customers might be about twenty per cent. In reality, my business is to keep an area of five to six thousand acres pure within my immediate reach. I have not very much influence outside my circle. We only supervise the area of the branch farms, and once we sell the seed produced on the branch farms we do not follow it up. The cultivators come back to us again for fresh seed. They sell the *kapas* directly to the merchants in the market and they come back to us for fresh seed except in a few cases where the cultivator wishes to get his *kapas* ginned for himself. Some cultivators wish to have their good *kapas* ginned as they do not want to pay a higher price for the seed. The Associations certify the purity of the seed. The cultivators sell their *kapas* mostly direct to the merchants because they are poor people and want the money at once. The cultivators would prefer to come to the association for seed than go to a person who is not responsible to any one. They sell the *kapas* because it is too much trouble to get it ginned separately and also because it means waiting for the money.

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Thakur KISHORE SINGH.

Thakur KISHORE SINGH, Malguzar of Mauza Jaswadi, Nimar District.

THIS WITNESS WAS NOT ORALLY EXAMINED.

Written Statement.

I.—AGRICULTURAL EXPERIENCE.

(A.)—"Deshi" short-staple cotton.

586. (1) **Experience.**—I am a resident of Mauza Jaswadi of Khandwa Tahsil in Nimar District which is a cotton tract. I have been living there ever for 58 years. I am in touch with cotton-growers and I am myself a cotton-grower.

587. (2) **Varieties.**—There are four varieties of short-staple *deshi* cotton grown mixed in this district—*malvense* (yellow flowered broad lobed), *verum* (yellow flowered, narrow leaves like *roseum*), *cutchicum* (white flowered and leaves like *malvense*) and *roseum* (white flowered narrow lobed).

588. (3) **Size of holdings.**—The average size of holdings is thirty acres which is shared by cotton and other crops in the proportion of twenty and ten, respectively.

589. (4) **Yields and profits.**—On an average, the value of the yield per acre of cotton is Rs. 40, out of which putting Rs. 33 for cost of cultivation, etc., a net profit of Rs. 7 is effected. I give below a statement of the income and expenditure for the last three years:—

Receipts.		Rs.	A.	P.
Cost of 15 maunds at Rs. 100 per man (= 12 Bengal mds.) at 5 maunds per acre per year for three years		125	0	0
Expenditure.				
Two ploughings at Re. 1-4 per day for five days		6	4	0
Fifteen cart loads of manure at Rs. 2 per cart		30	0	0
Charges for <i>bhakkaring</i> twice at Re. 1 per day for five days		5	0	0
Picking of cotton stalks		0	5	0
Cotton seed, ten seers		1	0	0
Hoeing three times		2	4	0
Weeding, 18 coolies at As. 4 per day		4	8	0
Picking of cotton for five maunds at Re. 1 per maund		5	0	0
Land revenue		2	0	0
TOTAL		56	5	0
Expenditure for second year excluding the cost of manure, Rs. 30, and the ploughing Rs. 6-4-0		20	1	0
Expenditure for the third year excluding the cost of manure, Rs. 30, and the ploughing Rs. 6-4-0		20	1	0
GRAND TOTAL		96	7	0
Receipts		125	0	0
Expenditure		96	7	0
		28	9	0
		profit for three years		

The average profit per year is thus Rs. 9-8-4.

590. (5) **Rotations and manures.**—Cotton in this part is rotated with *juar*, *tur*, *urid*, *mung* and gram. The manure generally applied is sheep or cattle dung.

591. (6) **Comparative returns.**—The return in income from the short-staple cotton is comparatively higher than the profits per acre from *deshi* long-staple cotton, exotic cotton and other *deshi* crops as shown in the following statement:—

	Rs.	A.	P.
Income from an acre of short-staple cotton (five maunds)	41	4	0
Long-staple cotton, yellow flowered, per acre (three maunds).			
Exotic cottons, <i>buri</i> and Upland Georgiana, give as much as the <i>deshi</i> short-staple. This requires a rich soil and good rainfall.			
Other crops, per acre (five maunds) give a gross income of Rs. 20 which includes the value of fodder, etc.			

592. (7) **Conditions affecting increase in area.**—The cotton area in our tract fluctuates every year. It depends on the favourable rates prevailing. If one year the prices are high, there is a corresponding increase in the area of cotton of the following year. And if, on the other hand, the rates of cotton are below normal and also in the event of the rise in prices of staple food grains, there is a decrease in the cotton area next year.

593. (8) **Uses of seed and seed selections.**—Cotton seed is used for sowing and feeding cattle. Some seed is taken away by traders from outside. Seed selection is not generally practised. Hand ginned seed is valued.

594. (9) **General.**—If seed is grown pure and such seed be paid for more in the market, there is a likelihood of increase in the yield of cotton and the outturn of pure seed. The following, in my opinion, would help much in this direction, viz., establishment of central and branch seed farms and grant of compensation for the loss per acre.

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(b) "Deshi" long staple cotton.

595. (10) **Experience.**—Long-staple cotton was grown in our district some twenty years ago, but no variety of this cotton is now found in this tract.

596. (17) **Prevention of mixing of different varieties.**—It is necessary, in my opinion, to stop mixing of one variety of cotton with others and for this legislation is needed.

597. (28) **Importation of seed.**—When reliable seed is available in India, I do not think the importation of foreign seed will be worth while.

598. **General.**—In my opinion, research is very essential for the development of the cotton industry in general and the following may be the useful auxiliaries for the advancement, viz., establishment of seed farms on the lines of those worked by the Department of Agriculture for the propagation of *roseum* seed and the appointment of an Agricultural Assistant for each *taluk* helped by *kumars* under a District Supervisor.

II.—COMMERCIAL ASPECT.

599. **Organization.**—To guarantee true weights and measures and the announcement of the correct ruling rates in time it is necessary to form a committee of traders and cultivators and the same organization would be an useful adjunct to the ginning factories.

600. (30) **Local trade customs.**—The cotton trade in this tract may be summarised as below:—The traders generally send their agents in villages and fix a certain rate at which they may buy cotton. On mutual settlement of rates with cultivators, an earnest money of from Rs. 10 to 25 is advanced. Should there be a favourable market, the agents hurry up with the weighments. In case of a dull market, the weighments are delayed for one or two months. If the market goes much below the rates of the original bargain with the cultivators, the buyers do not scruple in pointing out false defects in the quality of the cotton and ultimately cancel the bargain. The traders have to forfeit the earnest money to the cultivators in such cases. The loss to traders of this earnest money is smaller than the loss the cultivator has to sustain. The latter loses the opportunity of favourable prices.

(2) The other system of selling is that the cultivators bring their cotton in cart loads to the nearest cotton market and there sell through an *aratiya* who charges the rate of about one per cent. on account of brokerage.

601. (31) **Standardization of commercial names.**—The names given to the various varieties of cotton in our district are white flowered, *Dharwari*, *Mewari* and *gingla kapas*. The first two are grown in the Nimar District. The fourth hails from the Burhanpur Tahsil and from the border districts of Berar adjoining this district; but these are all short-staple cottons. The third is imported from Mewar by rail and is slightly long-staple cotton. I do not consider the names enumerated above as fitting, as they do not imply quality, and the traders are apt to be duped by them. If the short staple is termed *jari* and the long stapled *bani*, there is no chance of the traders being outwitted.

602. (32) **Buying agencies.**—The best form of buying agency would be, in my opinion, that the cultivator be paid for his cotton the proper price prevailing in the market. The buyers should be responsible for the safety of the cotton before it is finally sold on the spot and adulteration should as well be safeguarded against.

III.—STATISTICAL.

603. (33) **Improvement of cotton forecast.** The system of forecasting in vogue is not to a certain extent what it ought to be. The Revenue officers forecasting do not consult the cultivators and base their estimates on mere guess. It is necessary therefore to take opinion of a select committee of cultivators of a representative village and then work it out in consultation with them.

604. (35) **Publication of Liverpool and Bombay prices.**—The daily publication of Liverpool and Bombay market reports will tend to facilitate much the cotton trade.

The Hon'ble Mr. B. P. STANDEN, C.I.E., I.C.S., Commissioner, Berar Division.

THIS WITNESS WAS NOT ORALLY EXAMINED.

Written statement.

605. (1) **Experience.**—I first came in touch with cotton cultivation when appointed Director of Agriculture in 1904. I served in that capacity for two years until 1906. Since December 1911, I have been Deputy Commissioner for three months and Commissioner for the remainder of the time in Berar.

606. **Area under cotton in Berar.**—In the four years ending 1915-16, the average area under cotton in Berar was 3,115,000 acres. This represented 44½ per cent. of the area under crop in those years. The greater part of the black soil area of Berar is so quickly drained after rain that it will not grow *rabi* crops unless the season is exceptionally wet. At the end of the cycle of wet years which ended in 1895-96, there were 1,039,000 acres under wheat and 786,000 acres under other *rabi* crops. The price of cotton was at that time low. The normal area of cotton at the time was about two million acres, so that with seasons very favourable to *rabi* and a low price for cotton we had about a million acres less cotton than we have now with seasons generally more favourable to cotton and *rabi* and a very high price for cotton. If we again got a cycle of wet years or if prices fell largely, we might expect a reduction in the cotton area. For instance, after the low prices of 1914-15, the area fell from 3,180,000 acres to about 2,800,000 acres. I think we cannot expect any appreciable increase in the cotton area. The record area was, I believe, that of 1913-14, when it reached nearly 3,300,000. The price of *juar* and *karbi* has now reached such a high figure that *juar* is not much less profitable than cotton to cultivate and cotton cannot be further substituted for *juar* without causing considerable inconvenience to the cultivating classes.

607. (3) **Size of holdings.**—Our revenue papers show the areas held by individuals in each village. An examination of these papers shows that the average area held by individuals in a single village may be put at about ten to fifteen acres in the best parts of Berar, twenty to twenty-five acres in the open hilly parts and thirty-five to forty acres in the small area in the south-east of Berar, in which there is still a good

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[Continued.]

deal of forest and many of the holdings have not been long in occupation. But there are of course many persons who hold land in several villages and it is probable that the average total holding per individual is at least double the above. There are 421 holders who pay Rs. 1,000 or more land revenue. These men hold from about 750 to 1,000 acres each. There are many holders of 100 or 200 acres. On the other hand, most of the large holders habitually sub-let a great part of their holdings in small blocks of fifteen to twenty acres.

608. **Conditions affecting increase of long-staple cotton in Berar.**—The cultivation of a long-stapled cotton in Berar is dependent on the production of a variety which will pay the cultivator as well as or better than *roseum*. On the basis of the present relative values of long and short staples, a long-stapled cotton to compete successfully with *roseum* must be a good yielder and give a good proportion of lint. The variety known as *buri* has been successfully grown in that small part of Berar in which a considerable proportion of the black soil is not sufficiently well drained to suit the ordinary *gaorani* variety. I do not know whether the staple of *buri* is sufficiently good to make it worthwhile to press its cultivation on an extended scale. If it is, I think it would be possible to keep a few thousand acres under that crop. I take it, therefore, that until a suitable variety has been supplied by the Agricultural Department we can do nothing appreciable in Berar to increase the production of long-stapled cotton.

609. **Organisation used for introduction of roseum in the Central Provinces and Berar.**—It may be of interest to the Committee if I describe the organization which is being used to introduce *roseum* cotton, since a similar organization would serve to introduce any other crop.

(2) In 1905, after reading the reports of the Cotton Commissioner who was employed in the sixties and observing during a short tour in Berar that the measures taken at that time had failed to achieve any permanent result, it occurred to me that the active association of cultivators in any attempt to introduce a new crop was necessary. In the hot weather of 1905, I arranged with the Deputy Commissioners of the Berar Districts and the Nagpur and Wardha Districts of the Central Provinces to establish a few cotton seed farms. At that time we had no good variety to introduce to the people, but it was known that certain villages in the cotton districts had a reputation for exceptionally good seed of the *gaorani* varieties. It was believed that this reputation was largely due to careful cultivation, and it was expected that by requiring the seed farmers to follow certain rules which experience on the Government Farms had shown to be beneficial in their effects, they would be able to produce seed which would be more productive than that which was ordinarily purchasable in the market. A few years later, Mr. Clouston discovered that *roseum* was the most profitable variety to grow in Berar and the Central Provinces and the private seed farms were used for growing and distributing this variety. The original idea has now been amplified. The organization aimed at is the establishment of a number of Seed Unions each consisting of a few prominent cultivators, associated for the purpose of producing *roseum* cotton and selling the seed to the public for sowing. Each of the members of the Association appropriates his farm or a part of it (I believe about twenty acres is the usual area per member) for the purpose. The best of the farms (known as the central farm) receives its seed direct from the Government farm: the owner sells its produce to the remaining members of the Union whose farms are known as branch farms. The seed produced on these branch farms is then sold to the public. In the fourth year therefore after a crop is sown on a large scale on the Government farm, the seed can be put in the hands of cultivators in large quantities. These Associations, if properly managed, are essentially co-operative in character. The members have to submit to certain regulations for the common object. They must take measures to see that their crop is pure and must deal with it so as to ensure that the seed produced is sown and not otherwise used. It has been recognized that they should be brought under the Co-operative Societies Act, and registered. Up to date only eleven Unions have been registered out of 37 established. Those that have been registered have been regarded as subordinate for inspection and audit purposes to the Co-operative Central Banks. There has been some delay in registration owing, I believe, partly to the fact that the Agricultural Department has not been fully persuaded of the necessity for registration, and partly to the dislike of some members of the Unions to subject themselves to the discipline, which would follow on registration. The unavoidable expenses of such an Association are small: the pay of a farm servant to see to the "rogueing" of the crop and the hire of a store for the seed. But for the most efficient working more than this is required. The great difficulty is to ensure that the seed is kept pure while the cotton is being ginned. Owners of gins have always been found willing to gin the *roseum* cotton separately for the Unions, but with the best intentions there is always a possibility of mixture in the gin. The floor or the machines may not be properly cleaned and swept before the *roseum* is brought in to the gin or a dishonest member of the Union may take advantage of the distance of the gin from the Union head-quarters to introduce amongst his *roseum* some *gaorani* with the object of securing the higher price for the seed. For really efficient working it is necessary that each Union should be provided with its own gin. Half a dozen of the Unions are so provided. In all but one case, I believe, the gins are the property of one member of the Union. At Paras, however, the members of the Union who are also members of co-operative credit societies, have borrowed money in the latter capacity and have purchased for themselves an oil engine and some gins. These Unions have done much to extend *roseum* cultivation in Berar and they are capable of doing much more both in this particular item and in the direction of general agricultural improvement, if developed on suitable lines and kept under close supervision. The Registrar of Co-operative Societies deprecates rapid expansion on the ground that supervision would be defective: he fears that, without close supervision, the Unions would not work satisfactorily so that the whole organization would be discredited. He is, however, in favour of expansion within the limits imposed by the necessity for supervision. I recently recommended to the Local Administration active measures to secure the establishment of additional Unions and to extend the scope of their work and suggested some modifications of the organization, of which the principal were the substitution of the Provincial Co-operative Bank for the Central Banks as the financing agency and of the Taluk Associations for the Central Banks as the organizing and inspecting agency. These proposals were made after consultation with the Director of Agriculture and the Registrar, Co-operative Societies, whose assent they had, and are still under the consideration of the Hon'ble the Chief Commissioner. The Taluk Association may be seen in its most active condition at Khamgaon. The moving spirit of this Association is Rao Bahadur K. J. Deshmukh, who is a witness before the Committee. The best Seed Union is that at Gaigaon near Akola: the leading member is Rao Sahib V. C. Kulkarni.

610. **Marketing arrangements.**—As regards the marketing arrangements and the effect of commercial custom on the tendency to mix inferior with better qualities, I would say that we have, in Berar, cotton markets subject to excellent rules which are not so fully enforced as they might be, but nevertheless give the cultivator a large measure of protection in respect of correct weighments and a fair price and immunity from illegal

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[Continued.]

exactions. The arrangements for these markets are described in my letter dated the 8th May 1916, to the address of Mr. Low, Secretary to the Government of India, a copy of which is attached. The commercial classification of Berar cottons encourages the mixing of inferior with good varieties, because it is based solely on the place from which the bales are despatched to Bombay. For instance, cotton is classified as Khamgaon, because it is despatched from Khamgaon. This encourages people at Shegaon, eleven miles away, to send their bales to Khamgaon for despatch and large quantities of cotton may be seen any day in the season being carried by cart eleven miles to Khamgaon although Shegaon is about twenty miles nearer Bombay by rail. Last year, some cotton was sent from Central India to Berar and was shipped (I think from Akola) as Berar cotton although properly classified as Bengals. This classification by place of despatch must, I think, now be more or less obsolete within the general class of *Oomras*. It was based on the fact that, some years ago, considerable quantities of *bani* cotton were grown in the south of Berar and the north of His Highness the Nizam's Dominions, so that the mixed staple exported from those parts had a higher value than the ordinary *gaorani* cotton of the plains of Berar. The railway stations from which the majority of the produce of the south of Berar was despatched thus got a good reputation. At present, I am told, there is still a small difference in the quality of cotton going from the south of Berar and that from the plains, but I believe it is very slight. To abolish this classification within the main class of *Oomras* would however not tend to the improvement of cotton, though it would remove an encouragement to dishonest trade.

(2) Mixture of Bengals with *Oomras* as in the case quoted above and sale of the whole as *Oomras* amounts to cheating and I tried to get the guilty parties in that case prosecuted, but without success, as the Bombay buyers of the mixed cotton would not admit that they had been swindled.

(3) In order to afford the cultivators the full measure of encouragement possible, we require some organization to ensure that they shall get the full value of an improved crop. For instance at present from Rs. 2 to Rs. 4 per *khandi* more than the ordinary *gaorani* rate is paid for *roscum kapas*. But this is much below the full value of this cotton to the merchant at present prices. It means that he is paying only Rs. 2 to Rs. 4 for twelve seers of lint which was worth Rs. 12 last year. I believe this is mainly due to the fact that in the press of work, cotton buyers cannot satisfy themselves fully as to the percentage of lint in the *kapas*. They see, no doubt, that the sample is better than the ordinary, but they cannot give the matter sufficient attention to warrant them in paying on a basis of 39 or 40 per cent. lint.

(4) It was resolved at the Agricultural Conference held at Akola in December last that the Deputy Director of Agriculture should consult with the buyers and suggest some means of securing to cultivators the full value of the *roscum*. But the Deputy Director of Agriculture has gone to the Indian Army Reserve of Officers and I have not heard that anything has been done.

611. *Classification of cotton in Berar*.—At present cotton is classified in Berar Land Records as long staple, short staple and mixed staple. This is a relic of some thirteen or fourteen years ago, when more *bani* was grown and *roscum* was not separately cultivated. The question whether *patuwaris* (village accountants) should now distinguish only between (1) *roscum* and (2) other cotton, is under discussion. The Director of Land Records is doubtful whether *patuwaris* would distinguish *roscum* correctly and also says that unless considerable areas are sown with pure *roscum* bought in the bazaars, there is nothing to be gained, because the Agricultural Department have full information as to the quantity of seed sold from Unions. The matter is of some importance from the point of view of the forecast as *roscum* gives a larger outturn and eleven per cent. more lint in a given quantity of *kapas*. It is also important for the Department to know how it progresses in various parts of the country. I may say that my observations lead me to think that the area under fairly pure *roscum* does not much exceed that sowable with the seed produced from the Unions. I have recently suggested that this subject of the separate record of *roscum* by the Land Record staff should be placed before the Agricultural Conference in December next.

612. *Measures necessary to increase production of long-staple cotton in Berar*.—In my opinion, measures necessary to increase the produce of long-staple cotton in Berar are—

- (1) To produce a long-staple cotton which will pay the cultivator better than *roscum*.
- (2) To encourage the use of artificial manures.
- (3) To extend and perfect our organization of Agricultural Improvement Societies.
- (4) To devise some means in concert with the buyers to ensure that producers get the full value of any new crop.

As regards manure, I would mention that at present artificial manures are practically unused. A few of the more progressive cultivators sometimes use saltpetre as a top dressing in combination with farm-yard manure and I believe in the current season a very few, on the advice of the Agricultural Department, have used cotton cake as a manure. Apart from this, cultivators are almost entirely dependent on the manure of their working cattle, since, with the exception of a small number of buffaloes, these are the only cattle which are decently fed and the greater part of whose manure comes to hand. The manure of a pair of bullocks suffices, I believe, to manure reasonably a couple of acres of land. The average area worked by a pair may be put at about sixteen acres. Only a very small part of the land under cultivation in Berar receives all the manure it should get and an enormous area gets practically no manure at all. The effect of manure on the cotton crop is most marked not only in producing a larger crop in a normal year but also in counteracting the effects of bad seasons. If all land under crop were reasonably manured, the outturn of Berar cotton could at once be more than doubled.

ANNEXURE.

Copy of letter from B. P. Standen, Esq., Commissioner, Berar, to the Hon'ble Mr. C. E. Low, C.I.E., I.C.S., Secretary to the Government of India, Department of Commerce and Industry, dated the 8th May, 1916.

The rules of business as distinguished from the statutory authority and the rules regulating the management of the market are contained in the following rules:—

Rule 39 [requires payment of the market fee on every package (*docra*) ^{or} cartload of cotton entering the market]. Rule 50 [permits registration of names of buyers or sellers and requires registration of *aratyas* general commission agent] on payment of a licence fee up to a maximum of Rs. 50 for a buyer or seller and Rs. 100 for an *aratya*. Buyers and sellers only register themselves in order to make themselves eligible as candidates or voters for the Market Committee. Rule 51 (empowering the market committee to remove the name of a buyer or seller from the registers). Rule 52 (requiring the use of authorized weights and scales). Rules 53—55 (empowering the committee to licence brokers and weighmen on payment of fee and prohibiting

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[Continued.]

any person in private employ from holding such a licence). It is to be noted that there is nothing to prevent parties from employing unlicensed weighmen or brokers. Rules 56—59 (fix the amount of brokers and weighmen's fees and explain the obligations of buyers and sellers in regard to the payment of the fees). Rules 67—74 (fix the weights to be used and state powers of committee in regard to inspection of weights and punishment for infringement of rules regarding weights). Rule 76 and section 6 of the Law (prohibit the taking of trade allowances).

Rule 75 empowers market committee to make subsidiary rules with sanction of the Deputy Commissioner. Some committees have not taken advantage of this power. Some, e.g., Yeotmal and Karanja, have framed long rules, others, e.g., Amraoti, have a rule or two only. Of the Yeotmal and Karanja subsidiary rules (which are almost identical) the following may be considered to regulate business.

Rule 1 (prohibits sale of cotton at any place outside of and within one mile of the cotton market yard. This rule is *ultra vires* and no attempt is made to enforce it). Note.—Several other of the subsidiary rules are *ultra vires*. Rules 4—6 (require brokers and weighmen to keep accounts. An attempt to enforce this rule in Karanja caused such dissatisfaction amongst the weighmen that the committee cancelled the rule so far as it related to weighmen. In Yeotmal the rule is enforced without objection).

Rule 21 (a) (requires prompt payment). Rule 25 (requires *aratyas* to keep accounts).

The one subsidiary rule framed by Amraoti empowers the committee to levy a fee of anna one for every *docra* left on the cotton market yard over night.

The *kunbi's* interests are affected to the following extent by these rules:—

He may deal with the purchaser direct, or with a general commission agent (*aratya*) or may seek the assistance of a broker (*dadal*). The fees to be paid for the assistance he receives in the disposal of his crop are fixed by rule and he should get the advantage of correct weighment. He is also protected from various exactions commonly taken by the gins, where there are no markets, under the name of samples or allowances of one sort or another. This does not cover nearly all the ground however and I give you below a brief summary of the usual practice:—

The cotton carts time their journey so as to reach the market early in the morning. About 8 A.M. the various buyers and *aratyas* receive telegrams from their agents or principals in Bombay stating the price of cotton in Bombay. This is the Bombay price of the best quality local cotton (Amraoti, Khamgaon or whatever it may be). The cotton market committee receives no advice of prices and does not publish prices. But the price for the day is very soon known to all the buyers, *aratyas* and brokers and through them to the *kunbis*. I never heard of any attempted combination in a market with the object of hoodwinking the *kunbis* as to the price and I think the conflicting interests of buyers would make this impossible. In some markets, e.g., Yeotmal, the buyers agree to and declare the rate of the day in a more or less formal manner. The rate of the day being known, the buyers make their mind whether to buy or not and if they are buying, they either themselves or through the *aratyas* or *dalals* secure the number of *docras* (of ginned cotton) or carts (of unginned cotton) they require. If competition is keen, buyers sometimes offer a speculative price higher than that warranted by Bombay parity, e.g., the Japanese bought much cotton on these terms this season. A *kunbi* with *roscum kapas* can always get more than the Bombay rate for yarn cotton. The ginned cotton is usually put on the market by dealers and not producers: its quality is decided at the time the price is fixed as the quality is readily determinable. But in the case of unginned cotton, the price offered is understood to be offered on the assumption that the cotton is local cotton of the best quality. The bargain being made, the cart is taken to the gin where the purchaser wishes to get it ginned and the cotton is there weighed (if the purchase has been made through an *aratya* by the *aratya's* servants, if by the buyer direct or through a *dadal*, by licensed weighmen) opened out and examined. The buyer may then assert that the cotton is not up to the standard, it may be stained by rain or may contain a large proportion of the later pickings. He then knocks the price down: the *kunbi* is at liberty then to break off the bargain and remove his cotton if he likes. But this rarely happens: by the time this stage in the transaction is reached, it is often pretty late in the day and he knows he is not likely to get a good market again till the next day: so he usually accepts the valuation of the buyer (taking the advice of the *aratya* or *dadal*) and takes what he can get. If the bargain has been made through an *aratya*, he always settles up with the *kunbi* at once, recovering from the purchaser at his leisure; this is the great advantage of *aratyas*. If the *kunbi* is dealing direct with the buyer or through a *dadal* he may have to wait a day or two for his money.

Now as to "difficulties and abuses."

I may say at once that though I have very frequently questioned *kunbis* on the subject, I have never got them to admit that they receive anything but fair treatment except at Bassim. Any *kunbi* who knows Bassim will tell you that there is a danger of being swindled there and the result is that market has greatly declined.

The commonest complaints of unfair dealing are those made by the big buyers like Ralli, Volkarts, Gaddum, etc., against the *aratyas*. Their charges are—

- (a) That *aratyas* use their position to secure the best cotton for themselves or their friends.
- (b) That they swindle the *kunbis* by asserting in collusion with the ostensible buyer that the cotton is of inferior quality, thus securing good cotton at a low price for themselves or their friends: a fall in price in the course of the day sometimes supplies a special motive for this fraud. Telegrams announcing the fluctuations of price during the course of the day are not as a rule made public property.
- (c) That they swindle in weighing: showing less weight. By this means they are enabled to offer an impossibly high price and so to obtain an unfair advantage for themselves or their friends over other buyers who are driven off the market.

Aratyas are always men of some capital, often lending money to *kunbis* and almost always buying on their own account as well as for their principals. The restriction placed on them in this connection is contained in paragraph 7 of the agreement which runs as follows:—

"I shall not purchase either in my own name or in the name of another or in the name jointly of myself and another or others and entirely on my own account or partially on my own account and that of another or others, any cotton in respect of which I have been employed as an *aratya* :

Provided that when a sale to a purchaser has failed and a re-sale cannot be effected before 2 P.M. and the seller insists on re-sale, I may be permitted to purchase the cotton as a special case, in which case I will report all the facts in detail to the chairman of the committee at the earliest possible opportunity, stating the original price offered by the intending purchaser for the cotton, the reduction in the price or allowance which he claimed and the price at which the purchase was made by me."

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[Continued.]

It is obvious that the *aratya* is exposed to considerable temptation to defraud his client and I regret to say that the cotton market committees are admittedly so loath to take action that the *aratya* has little to fear even if he is detected. The fact that *kunbis* do not complain of unfair treatment must be borne in mind; at the same time it must be remembered that a good many of them are very much in the hands of the *aratyas*. This practice of *arat* is certainly a weak point in the markets, but we have the considered opinion of Mr. Rich of Messrs. Ralli Brothers, who had an unrivalled knowledge of the trade, that "*aratyas* have always existed in the Berar markets and the interests of the *kunbis* would undoubtedly suffer, if they (the *aratyas*) were debarred from their calling."

I have for some time past been considering whether any amendment of the rules would improve matters: but think this is very doubtful. It would obviously make things much safer for the *kunbi* if the price could be finally settled in the market; but this is impossible. A fair idea of the value cannot be obtained till a cart-load is opened out: the *kunbi* himself is not above a swindle. The most serious weakness in the market administration is the unwillingness of the committee to take energetic action; the majority of members are either *aratyas* or large buyers, and these men naturally do not wish to offend a class to which they belong or on which they are very closely dependent for a successful season's trade. An influential *aratya* can boycott a buyer who displeases him, even firms like Ralli and Volkarts are subject to this influence: the Agent, Bank of Bengal, who has sometimes been a member of a cotton market committee, is not exempt, as many of the principal *aratyas* do a big *hundi* business. In Yeotmal there are very few *aratyas*, but the *dalals* are very strong and complaint is made of collusion on their part with buyers, by much the same methods as those practised by *aratyas* elsewhere.

A good many carts go direct to the gins without passing through the market; they thus avoid paying the fee, but lose the advantage of the market; under the existing law, sellers cannot be forced to use the market: a proposal is before me to amend the law so as to compel all persons bringing cotton for sale to any place within a specified distance of the market, to pass it through the market. I am doubtful whether such a degree of interference with the liberty of trade would be reasonable also whether it would be practicable to enforce such a rule, since a good deal of cotton that comes into a market town is not brought for sale locally.

The big buyers are so much in the hands of the *aratyas* that they no doubt make the most of any fraud that does go on. The attitude of the *kunbis* towards the markets makes it certain that they are a great advantage to the producers. I am now receiving applications for the establishments of new markets and except that before next season there will be three or four new markets open.

I append copies of the Cotton Market Law and Rules* thereunder and of the Yeotmal subsidiary rules.

ENCLOSURE.

Yeotmal Subsidiary rules.

No person shall expose for sale or cause to be exposed for sale ginned or unginned cotton at any place within the area of the market, i.e., one mile from the centre of the market yard, other than the Yeotmal Cotton Market yard.

2. The cotton carts are allowed to enter the market yard from sunrise to sunset. No carts laden with cotton shall be taken out of the market yard during the market hours until the rate for the day is announced and the bargain is struck.

3. Licenses granted under Rule 53 of the Cotton Market Rules shall, unless suspended or cancelled, be in force from 1st November of the year in which they are granted up to the 31st October of the ensuing year. Licenses granted on any date subsequent to the 1st November shall be in force from the date of issue to the 31st following and no longer.

4. Licenses once granted, and not suspended or cancelled may be renewed from year to year by the Chairman of the Committee subject to the confirmation of such renewal by the Cotton Market Committee.

5. Every licensee shall keep regular and accurate accounts of all his dealings as a broker or weighman in a bound book, which shall be supplied to him at his expense by the Cotton Market Committee, and in the manner prescribed by the Committee. The pages of such book shall be stamped and numbered consecutively in the office of the Committee and the first and last pages of such book shall be signed by the Chairman who shall certify to the number of pages contained in such book.

6. The following procedure should be adopted for filling the account books:—

(A) The weights of carts both loaded and emptied should be entered by the weighman in the book called *takpatti* and a duplicate of it duly signed by him shall be delivered to the sellers. He should take an endorsement in the said book from the buyer showing the number of carts and the weight of cotton purchased by him.

(B) Every broker will enter in his account book the weights of loaded and unloaded carts from the duplicate *takpattis* from sellers, together with the rate and the amount of money paid for their cotton.

7. Every broker shall furnish a weekly report on a printed form on each Monday showing the number of carts and the quantity of cotton purchased by each buyer with the names of weighmen for comparing the register kept under Rule 2 (2) and (3) of the Cotton Market Rules.

8. Every licensed weighman and, when his services are unsought, every broker shall furnish to the Committee a daily report on a printed form prescribed by the Committee. He shall collect the passes granted to the sellers at the time of weighing cotton and deliver them to the Committee with the above report on the next day on which the cotton is weighed for comparison from the collection register.

9. No carts of cotton shall be weighed by any licensee unless the owner or any person in charge of carts has obtained a pass from the Committee's office.

10. The Cotton Market Committee may, for misconduct of or non-compliance by the licensee with the requirements of these Rules or the orders in writing of the said Committee, suspend or cancel his license. The suspension or cancellation under any circumstances shall not entitle the licensee to any refund of fees paid on account of such license nor shall he be entitled to any license in future subject to the orders of the Deputy Commissioner.

11. Every order of the Committee refusing the grant of a license under the rules or cancelling or suspending a license so granted shall be recorded in writing with a brief statement of the reasons for the same. A copy of such order shall be supplied to the person thereby affected, on application by him to the Committee in payment of a fee of five annas for every two hundred words or its fraction.

* Vide Appendix VI to Report.

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[Continued.]

12. Any licensee, convicted under the Cotton Market Rules, shall forfeit his license.

13. A fee of Rs. 2 shall be paid to the Committee by the licensed weighman for supplying a badge under Rule 60 of the Cotton Market Rules when first supplied or on renewal of it when it becomes unserviceable. The badges are not transferable.

14. No licensee shall demand, receive or retain any sum which is not authorized by the Cotton Market Rules.

15. Every licensee under these rules shall, when practising his calling, produce his license or badge or both as the case may be, for inspection on demand made at any reasonable time by the Deputy Commissioner or any member or any officer or servant of the Committee who (the servant) has been duly empowered by the Committee in this behalf.

16. If after issue of any license or badge granted under the rules, such license or badge is lost or destroyed, the licensee shall not practise in any place within the area of the market as a broker or weighman until he has, on application to the Committee, obtained a fresh license or badge. If the Committee or the Chairman is satisfied that such license or badge has been accidentally lost or destroyed a fresh license or badge may be issued by the Committee to the licensee on payment in either case of an additional fee of one rupee. Every license thus issued shall have the word "Duplicate" written in large letters across it in red ink.

17. The following acts are included in the term "Misconduct" within the meaning of rule 10:—

(A) Taking part in a combination to enhance or reduce the prices of cotton or to divert traffic from the cotton market.

(B) Intentional betrayal by a licensee of the interests of any person employing or connivance in any fraud against persons not employing him.

(C) The purchase or sale of cotton on his own account direct or indirect during the period of his license.

(D) Interference by a licensee between buyers and sellers when his services are unsought.

(E) Demand or receipt by a licensee prohibited under rule 14.

18. Every person intending to deal in cotton either on his own account or for any person or firm shall get his name registered under Rule 50 of the Cotton Market Rules as a regular buyer or as a regular seller or as a regular buyer and seller.

Exception:—Casual buyers (by which term is meant the buyers who have no home at Yeotmal but who come from elsewhere to make their purchases and where their period of stay does not exceed seven days at one time) need not register his name or pay the registration fee.

19. All registered buyers or sellers or buyers and sellers or a trader shall have their *taks* or weighing machines and the places where they are set up for the purpose of weighing registered at the Cotton Market Office in a book kept for the purpose. Places registered as such shall be deemed to be open places.

20. Such places shall be open between sunrise and sunset for inspection under Rule 69 of the Cotton Market Rules.

21. Every buyer or his servant or agent shall, at the time of weighing, enter in his *takpatti* book the names of persons whose cotton he purchases.

22. Servants and agents employed to weigh cotton, whether remunerated or not, shall be held bound to weigh cotton within the area of the market by the standard weights and scales sanctioned by the Government in the Cotton Market Rules and their names shall be entered in a book kept under Rule 19.

23. All payments to the sellers shall be made by the buyers or their servants or agents and, when possible, in the presence of brokers whose services are employed.

24. The Committee shall keep a weighing machine which shall be at all times available to the public for comparison with their own machines at all reasonable times.

25. Persons who may have their cotton weighed on the weighing machine maintained by the Committee shall pay a fee of Rs. 0-0-6 (six pies) per cart (loaded and empty).

26. Persons who constantly transact business in *hundis* in local markets and who pay to Government either Rs. 200 or more as land revenue or Rs. 50 or more in the shape of an income tax shall be eligible to register their names as *aratyas* or commission agents under the proviso to rule 50 of the Cotton Market Rules.

27. Every *aratya* shall keep regular and accurate accounts of all his dealings which shall be brought for inspection on demand made at any reasonable time by any member or officer or servant of the Committee who (the servant) has been duly empowered by the Committee in this behalf.

28. All *aratyas* shall charge *arat* or commission on the value of ginned or unginned cotton up to rupee one per cent. only from seller or buyer or from both:

Provided that in case both parties (buyer and seller) employ the services of the same *aratya* he shall charge up to only rupee one per cent. on ginned or unginned cotton purchased and sold excluding other necessary charges and expenses.

29. No *aratya* shall be allowed to engage the services of a broker or weighman in any transaction or charge fees for a broker or weighman.

30. No *aratya* shall be allowed to charge any sum which is not authorized by the Cotton Market Rules.

31. Every *aratya* shall be allowed to engage up to the number of three persons to assist him in his work in the market on registering their names in a book kept by the Committee and for whose acts he will be held responsible.

Exception:—Persons whose licenses as brokers or weighmen have been cancelled or who are convicted under the Cotton Market Rules or any other law shall not be allowed to be so engaged.

32. The names of servants registered under the above rules shall be removed at any time by the Committee if they do not act according to the Cotton Market Law and Rules framed thereunder either by the Government or by the Committee.

33. All *aratyas* shall furnish to the Committee a daily report of all their transactions on the next day on which it is made at a time fixed by the Committee showing the number of carts and the quantity of cotton or the number of *bhojas* and the quantity of cotton as the case may be for maintaining a register in the Cotton Market Office kept under Rule 2 (4) of the Cotton Market Rules.

34. Persons who apply for licenses of brokers and weighmen must send Rs. 10 and 2 respectively with their applications for licenses and, in case, applications are rejected the amount deposited will be returned in a week thereafter and in case the applications are sanctioned and the applicants fail to pay the remaining amount of fees within a fortnight the deposits will be forfeited to the Cotton Market Committee.

Burma.]

Mr. T. COUPER, I.C.S.

III.—Burma.

Mr. T. COUPER, I.C.S., Director of Agriculture, Burma.

EXAMINED AT POONA, DECEMBER 12TH, 1917.

Written statement.

I.—AGRICULTURAL EXPERIENCE

613. (1) **Experience.**—This note is compiled mostly from office records and Settlement reports. I have never been stationed in a cotton-growing tract and have been very little in actual touch with cotton cultivators.

614. (2) **Varieties.**—The short-staple cottons commonly grown in Burma are called *wa-gale* and *wa-gyi*. The former is cultivated in Myingyan, Sagaing, the Lower Chindwin and the west of the Meiktila district. The length of the fibres as reported by the Imperial Institute is "from 0.6 to 1.0 inch; mostly from 0.7 to 0.9 inch." *Wa-gyi* is grown in the Thayetmyo district. The Imperial Institute examination found the length of the fibres to range "from 0.6 to 1.1 inch; mostly from 0.7 to 0.9 inch." The area under *wa-gale* was in 1916-17 approximately 187,000 acres and under *wa-gyi* 26,500 acres. The total area under cotton in the province was 223,500 acres.

615. (3) **Size of holdings.**—Accurate information about average size of holdings is not available. In the *wa-gale* tract, holdings are thought to range from 16 to 25 acres, two-fifths of which are placed under cotton. In the *wa-gyi* area, cotton is not sown as a single crop, but along with sesamum and mostly on a temporary clearing, abandoned after a single year's cultivation.

616. (4) **Yields and profits.**—The average yield of *wa-gale* is 300 lbs. an acre, of *wa-gyi* 150 lbs. The ginning percentage of *wa-gale* is about 35 per cent., of *wa-gyi* about 40 per cent. If in the *wa-gale* tract, he does not get a price of Rs. 20 for 300 lbs., the cultivator begins to bethink himself of other crops. In the *wa-gyi* area, the cultivator looks to the sesamum for his profit, and if that fails, he often abandons his cotton, going elsewhere to work as a labourer.

617. (5) **Rotations.**—On a moderate loam in much of the *wa-gale* tract cotton is followed by sesamum and beans or sesamum and millet. On a gravelly soil he follows his land in the third year and waits till the succeeding year before returning to cotton.

618. (7) **Conditions affecting increase in area.**—If he can grow rice, the Burman will do so in preference to cotton. As regards the upland, millet or sesamum are preferred in some localities, in others cotton according to rain and soil and market.

619. **Attempts to introduce exotic cottons.**—Ginning firms have tried to introduce Cambodia cotton into Burma, but without success. The Agricultural Department is experimenting with it, both as a rain crop and under well irrigation. On a sample submitted to it in 1914, the Imperial Institute reported that the length of the fibres ranged "from 0.9 to 1.3 inch; mostly from 1.0 to 1.2 inch," and that a large proportion of immature fibre was present. Experiments with exotic cottons, American, Egyptian and Indian have failed, but Mr. McKerral is trying to obtain a longer fibre by hybridization. An attempt was made by an English firm to introduce, on a large scale, Egyptian and American Upland cotton into the Amherst district, but without success.

620. **Fluctuations in area under cotton.**—The area under cotton fluctuates with the price. In 1914-15, this fell to Rs. 10 for 360 lbs. and next year, the area fell from 291,000 to 187,000 acres. This is merely an extreme instance of the readiness with which area adapts itself to price. After price, early or late rainfall is probably the most important factor in determining area. Ten years ago, the area under cotton was 204,000 acres and part of the increase in the years preceding the war should perhaps be ascribed to the better recording of areas. There is little in the statistics to justify expectation of any rapid increase. The factors which limit the outturn appear to be price and transport.

621. (8) **Uses of seed and seed selection.**—Seed selection is practised very little, if at all. Seed is crushed for oil or exported for this purpose. A few of the more provident cultivators keep back a little seed for hand ginning, but there is difficulty in disposing of the lint and, especially if prices are high, almost everything is sold and the seed repurchased. If a cultivator goes to the ginnery and sees to it that he gets seed from the first picking, he is said usually to obtain fair germination, but if he buys from the heap of seed from various pickings thrown together and heated, he takes risks. Formerly cotton was much watered before sale, but the combine some years ago rigorously refused watered cotton and the quality of the seed improved.

622. (9) **General economic conditions.**—Two large firms have of late years ginned and pressed perhaps four-fifths of the cotton exported from Burma. Of the remaining seventeen presses, only three are of importance at present. The two large firms are believed to have a working arrangement as to the price they will pay and the quantity each will buy. The smaller presses, if sufficiently important are, if possible, induced to enter into the combine or paid not to work. The result is that the cultivator is paid less than his cotton is worth in the world's market. In these circumstances, co-operative credit societies are thinking of erecting co-operative ginneries.

(2) Cotton was originally exported overland to China and the cotton-growing tracts are still on or near the Irrawaddy. So far as soil is concerned, there is thought to be no reason why cotton should not be grown over much of the Yamethin district and in parts of the east of the Meiktila district. But there are no ginneries there and no market; the reason perhaps is that the cotton at present prices whether unginned or baled cannot bear the cost of railway freight to the river at Myingyan. In the tracts where cotton is already grown for export, the construction of light railways would probably result in extension of area. In parts the quantity of farmyard manure available is the limiting factor; were there sufficient, the necessity for rotation would be less. Increase can be brought about only by improved conservation and better fodder crops, with its consequence, more cattle-breeding.

623. **General recommendations.**—The dry zone of Burma should be the charge of a Deputy Director of Agriculture and he should have an assistant to every two districts, who in turn should have an assistant in each district. The Agricultural Department is under-staffed at present. Seed farms should be established in each district; a very promising strain of *wa-gale* with a high ginning percentage has been bred on the experimental farm and is being multiplied for distribution by arrangement with private land-owners.

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Mr. T. COUPER, I.C.S.

[Continued.]

II.—COMMERCIAL ASPECT.

624. (30) **Local trade customs.**—In the *wa-gyi* tract, cultivators have now themselves to bring their cotton to the ginnery; the broker is being eliminated. In the *wa-gale* area, the large firms give advances to brokers for ten days at a time, fixing the price at which the cotton is to be delivered. These large brokers employ smaller brokers, who purchase from the cultivator in his village. The cultivator nominally gets the price which the firms have fixed, without any deduction; the broker is thought able to do this by using irregular weights, by mixing good and bad qualities of cotton, and by watering. Part of the crop estimated at twenty per cent. is sold in advance to the broker.

625. (33) **Improvement of cotton forecast.**—The cotton forecast frequently underestimates the outturn. Its preparation is under the control of the Commissioner of Settlements and Land Records. Efforts are, I know, being made to obtain greater accuracy. Possibly the Agricultural Department might help, when it has a sufficient staff, by submitting to the Commissioner of Settlements estimates of probable outturn.

626. (35) **Publication of Liverpool and Bombay prices.**—The daily or weekly publication of Liverpool and Bombay prices might put the cultivator in a stronger position, changing him from a weak into a firm holder.

Mr. T. COUPER, I.C.S., called and examined.

627. (President.) The position is that the systematic study of the cotton problem has hardly been taken up in Burma. Both our two kinds of cotton, *wa-gyi* and *wa-gale*, are short staple. We have still got the farm at Tatkon which Mr. McKerral is carrying out experiments. I do not know what happened at Tatkon with the experiment on Cambodia but it has been tried at Allanmyo and some was planted out this year at Mahlaing in Meiktila. I think Mr. Thompson has some under well irrigation near Bugyi. We grew some Cambodia on the seed farm at Allanmyo and a little has been distributed in the neighbourhood there.

628. From my experience as a Settlement and a District officer, I think it very unlikely that the Burman could be induced to grow cotton on the canal area in preference to rice. The only inducement would be a greater pressure on the soil and a higher price for cotton.

629. I think we ought to have a larger staff but not specifically for cotton. What is especially wanted is a Deputy Director in charge of the dry zone who would have to pay a great deal of attention to cotton. A third Deputy Director has been sanctioned and our idea is to cut out the dry zone and make it a separate charge. That will be the next step.

630. The seed farms are separate from the experimental farms, but are very largely in the experimental stage. Cotton is being tried at Allanmyo, Tatkon, Padu and on a plot at Nagu which is near Bugyi in the Shwebo district. The latter is about two miles west of Tantabin outside the canal area. In Pwinbya in the Minbu district, Mr. McKerral tried Egyptian cotton this year, but without success so far as I know.

631. It has been the experience in past years that the cultivator does not get a fair price for his article, that is in relation to the Bombay and Liverpool prices. It is very difficult for him to do so because the Myingyan combine has a monopoly. If Cambodia were introduced, I think that the ginning firms would give a better price for it in comparison with *wa-gyi* and *wa-gale* in their own interests but they would not give the full price. The Co-operative Department is developing the co-operative movement in the cotton tracts but the project for co-operative ginneries is very much hampered by the high price of ginning machinery. Once you got the cotton ginned, it could be sold to outside firms in Rangoon. It would have to be baled. The small co-operative ginning factories might have a hand screw press. I think some of the bales sent off to India are pressed in hand screw presses. I think it is probable that the development of longer stapled cotton would be strengthened by the establishment of co-operative agencies alongside. That is the policy which we should like to follow. Co-operative societies would certainly be necessary at the beginning.

632. We have not got an Economic Botanist in Burma but we want one very badly. One has been sanctioned but the difficulty is to get a man owing to the war. I would emphasise the need for an Economic Botanist and the general strengthening of the staff.

633. The forecasts are done by the Settlement Commissioner and not by the Agricultural Department at all. We deal with the ginning and pressing returns. They are sent to us but do not get them from all the factories. It would be very difficult to get them out of the smaller ginning factories. I am not in favour of penal legislation for that purpose.

634. (Mr. Wadia.) I think that I was told that the price of cotton was Rs. 51 for one hundred viss (one viss=3.6 lbs.) of unginned cotton. That was the latest price I heard. Cambodia has not been marketed at all so far. It has merely been grown for seed. It is very much in an experimental stage and has not been successful so far. The mills give a premium of Rs. 5 for Shan States cotton but there is very little of it. I do not think they give a premium for anything else. Shan States cotton has a longer staple but has not the same strength. Two lakhs of viss of Shan cotton were marketed at Myingyan this year. Bhamo cotton so called is the first pickings but the mills do not give any premium for that as the pickings are mixed before sale.

635. In Upper Burma, the big firms give advances to the big brokers: the big brokers use smaller brokers who go out into the villages where they buy cotton and bring it in. The big firms give advances for ten days; the cotton has to be brought in within those ten days. They fix the prices at which they will take over the cotton. They do not fix the price before the season but notify the prices for the next ten days. The cultivators do not take big advances. A man may sell a small part of his crop five or six months before it matures. I believe about twenty per cent. of the crop is sold in advance in order to get living expenses during the cultivating season and that sort of thing. I cannot say whether the cultivator gets a less price for his article as a result of the existence of this practice. The cultivators have to accept the price the brokers offer in consequence of their ignorance of market conditions. The brokers pay the same price to the cultivators as they get from the factories. I think the profits of the brokers come in from watering the cotton, using false weights and from mixing good and bad qualities, such as the first picking with the third picking. The combine has very largely succeeded in stopping watering by refusing to take watered cotton.

636. I do not know what the law is about weights and measures. I have no remedy to suggest. There are no small markets in Burma. The small brokers go out to the villages and buy from the cultivators. There are township officers. Possibly weighment could be done under their supervision but the cultivators would not necessarily take their cotton to them for weighment. They are alive to the brokers' methods of weighment or think they are. They go to a broker whose weights they believe in.

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637. All the ginning and pressing factories are not in the combine. Some of them try to stand out. Two very large ginning factories try to get all the smaller men into the ring but occasionally some of the smaller factories stand out. There is one at Mahaling which is standing out. I have heard that the high price of cotton in that neighbourhood this year was attributed to the fact that this small ginning factory had remained outside the combine. This small factory has a 20 H. P. engine with 24 Platts roller gins costing Rs. 15,000, a hydraulic press and a screw press. It is a small factory as compared with the big factories at Myingvan. There is not much hand-ginning. The charge for ginning is about Rs. 7-8 per hundred *viss*, i.e., 360 lbs. of lint. For pressing hydraulically, the charge is Rs. 5 for a bale of 400 lbs. and for pressing in a hand screw press Rs. 3 for 360 lbs.

638. I think the high prices now obtaining should induce an extension of the cotton area in Burma. The acreage answers very readily to prices in Burma. Unfortunately we have nothing better to offer the cultivators immediately than the cottons already grown. As to pushing of Cambodia in the north of Burma, I should say that the Burman prefers to grow rice where he can. We have no experience of growing cotton under irrigation. Cotton is manured with farm-yard manure in parts of the dry zone where it can be obtained.

639. (Mr. Henderson.) In the report of the Imperial Institute it was stated that the staple of Burma cotton varied from half an inch to one inch. That is based on two samples of one pound each of *wa-gyi* and *wa-gale*. I think that would be representative of the whole crop. There must be a good many types in that cotton. Mr. Pearce when he was in Burma said that if the long-staple cotton were picked out, it would fetch a premium but the cultivator says he cannot pick it out as the premium that he would get for it is not worth the trouble. There must be a great mixture of types to get such varying lengths of staple.

640. Mr. McKerral is working on cotton. He is distributing one good strain. It has not gone to the mills yet. The Department is buying back what the cultivators are growing and is going to gin it and give the seed back to be grown next year. There is a certain amount of keenness in the villages to get good seed, and if we had good seed to give out, it would be taken up quickly. Proposals for the establishment of new farms have been submitted and are being considered. Proposals have also been submitted for the enlargement of the Department. The proposals are to have eight Deputy Directors in all and an Agricultural Assistant for every two districts. The idea of Government as laid down is to have an Agricultural Assistant in every district ultimately and one Deputy Director to each Commissioner's Division. These proposals were submitted not long ago by my predecessor.

641. The ultimate area under cotton will depend on the price, I think. There is a really good demand and the prospects are encouraging. I do not think that a large extension of the staff and an increase in the number of farms would have much effect if prices were not high. Indications, however, show just now that the prices will be high for a considerable time. A combination of the ginning factories might prevent the world price from reaching Burma. I suppose this combination might be broken by other people and putting up factories. The cotton area is not a compact block but it is not distributed over a very large tract of country. In Thayetmyo there is a large room for expansion but I could not give any estimate of area. The population is very sparse. They work land for some years and then they abandon it. There would be difficulties as regards labour. If there were light railways, the area under cotton could probably be extended. As to the prospects of colonization, I suppose land could be got in the Thayetmyo district for the purpose supposing that the revenue rules were favourable. The Co-operative Department is starting colonization but not specially for cotton.

642. Crop cutting experiments are part of the work of the agricultural staff. This work has just been handed over to the Department. It seems to me that it is part of the work of the Department, so long as there is no separate statistical department.

643. I do not think that there is any chance of the big ginning and pressing firms taking up cotton growing. I do not suppose Government would give them grants of land for the purpose. The object of Government is to have peasant proprietors. The Government would object to exploitation. If a definite proposition were put forward for the grant of land on lease to grow long-staple cotton, there would probably be no objection to it on the part of Government.

644. The Agricultural Department had some long-staple cotton picked and sent to Liverpool and India for valuation. The price quoted was not such as to justify the cost of selection. It is not quite fair to say that cotton is practically a *tabula rasa* in Burma as Mr. McKerral has done a good deal of work on it. We have wanted a botanist for a long time. Mr. McKerral has very many other things to do.

645. (Mr. Hodgkinson.) There are possibilities of growing Cambodia on a commercial scale. What strikes me about Cambodia cotton in Burma is that it does not open very well so far as I have seen. The Imperial Institute mentioned that there was a great deal of immature stuff about it. I do not know if that is the result of the bolls not opening well. I have no right to offer any opinion as I have only seen it once or twice. In the first year it was very badly attacked by insects.

646. (Mr. Roberts.) The price of cotton in Burma has responded to the general movement of prices. The cultivators told me that the high price this year was due to one of the smaller factories standing out of the ring. I do not know whether this factory was out of the ring last year when prices were also high. The publication of Bombay and Liverpool prices might be of use. I do not think that it would do any harm. It would give the cultivators some idea of what they ought to get.

Mr. E. THOMPSTONE, Deputy Director of Agriculture, Northern Circle, Burma.

EXAMINED AT POONA, DECEMBER 12TH, 1917.

Written statement.

Note on Cotton in Northern Circle, Burma.

I.—AGRICULTURAL EXPERIENCE.

647. (1) Experience.—The principal cotton-growing districts in this circle are Sagaing (54,800 acres approximately), Lower Chindwin (19,000 acres, approximately), Kyaukse (400 acres). I have been in charge of this circle for over ten years.

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[Continued.]

648. (2) Varieties.—*Gossypium neglectum* is practically the only species grown. It occurs (mixed) in two varieties: (a) *Gossypium neglectum verum* (yellow flowered), and (b) *Gossypium neglectum roseum* (white flowered).

There are two sub-varieties of (a) *verum*, viz.:—

- (i) *Burmanicum*, with white lint, called *wa-gale*; and
- (ii) *Kokatha*, with khaki lint, called *wa-ni*.

Gossypium obtusifolium, Roxb. var. Nanking (flowers yellow, lint white) also occurs very rarely. This is the "*wa-gyi*" more common on the borders of the wet zones.

649. (3) Size of holdings.—I estimate the average size of holding in the cotton tracts at eight to ten acres of which not more than one-third or half is under cotton.

650. (4) Yields and profits.—The average yield runs from 90 to 110 *viss* of seed cotton per acre (one *viss* is equal to 3-6 lbs.). The ginning percentage is 27 to 29. The profit per acre (normal) is Rs. 20 to Rs. 25. Price of seed cotton is normally Rs. 28 to Rs. 35 per 100 *viss* (360 lbs.). In 1916-17, the price rose to Rs. 42 per 100 *viss* and this year 1917-18, it is as high as Rs. 54 per 100 *viss* in many places. In consequence of high prices, the area is very rapidly increasing.

651. (5) Rotations and manures.—No definite rotations are followed. Other crops grown on the land are chiefly *pyaung* (*juar*) and sesamum. Manure is seldom applied; but village refuse is sometimes dumped on the land and unevenly spread by harrow only.

652. (6) Comparative returns.—No long-stapled or exotic cottons are found (except on the experimental farms). A comparison with other *deshi* crops is not easy to make. Cotton is grown, in normal times, only on the very poorest land. Sesamum is grown on similar land but the returns are poor and the lands are often left fallow. *Pyaung* (*juar*) is grown as fodder only in the cotton tracts. Cotton under the influence of enhanced prices is now spreading to the black wheat soils more and more but normally wheat is more remunerative there.

653. (7) Conditions affecting increase in area.—This question has largely been answered in the last paragraph. There is plenty of spare land in many places suitable for cotton and the area increases rapidly under the influence of a good market and decreases when prices are low. Land as a limiting factor to increase in area is not likely to come into operation for a long time. Given good prices, the present limit seems to be fixed largely by labour. Population is sparse in many parts.

654. (8) Uses of seed and seed selection.—Cotton is almost entirely ginned at central factories in the hands of a few firms. Some of the seed is sold back to the cultivator for seed purposes and the remainder is crushed for oil and cake, these two products being largely exported to Europe. The seed is seldom fed to cattle or used as manure in any form. Very little seed selection is practised though occasionally one comes across a cultivator who selects (mass selection) some of his best cotton and hand gins it, keeping the seed for sowing. Beyond this, little or nothing is done and the cultivator is at the mercy of the ginners for his seed supply. I have recently heard of a case where a ginners supplied some seed, which was quite unsuitable and resulted in a failure of the crop of a number of cultivators.

655. Experiments with improved varieties.—There are few data on which one can base any further agricultural information of use to the Committee and there appears to be little more for me to add to the above replies. There are no long-staple *deshi* cottons grown and exotics have been or are being tried only on a very small experimental scale. They give little promise of success, with one exception, viz., Cambodia under well irrigation in Northern Shwabo District. A number of line selections of the indigenous cotton at Padu farm in Sagaing District are very promising. These are now being tried in cultivators' hands.

656. General.—No irrigation is practised for cotton. There are large waste tracts which would, I believe, be found, suitable for cotton, and a number of other tracts where the prospects of growing long-stapled cottons under well—or canal—irrigation appear to me to be most promising. A wide field for all kinds of work on cotton would be opened to us but the Department has neither the money, the staff nor the equipment for carrying out more than is being done at present. The lamentably small district staff is employed largely in procuring crop measurement statistics and has little time to devote to other agricultural matters. There is a crying need for agricultural research and experiment, which will have to be supplied before much progress can be made in cotton cultivation in this circle.

A Note on Shan States Cotton.

657. General.—Until recently cotton has been grown in the Shan States for local consumption only and in some parts (e.g., Yawnghe States) the village spinning and weaving industry has assumed some importance and the local products are of good quality, cloth being produced in two natural colours, white and khaki. But owing to the influence of the recent high prices of cotton, some export of the seed-cotton is now taking place to ginning mills in Burma. Buyers are at work and enquiries on cotton cultivation are on foot. It seems likely therefore that the area under this crop will be considerably extended in the near future. The agricultural conditions of many tracts, particularly the valleys and lower hill sides, are favourable, and so long as prices remain high enough to cover the heavy export rates, cotton will be increasingly grown. There is a wide field for expansion, and in spite of the fact that exotic varieties such as *Caravonica*, so far tried, have not been a great success and are now represented by a few scattered plants only, there is no reason to believe that long-stapled cottons will not succeed in some part where the conditions are favourable to their growth. They should be tried as soon as circumstances permit.

658. (2) Varieties.—Apart from the few scattered plants already mentioned of Cambodia or *Caravonica* two principal varieties of cotton are at present grown, viz., *Gossypium neglectum* (mixture, with white lint), and *Gossypium neglectum*, sub-variety *kokatha* (with khaki lint). These are very similar to the ordinary Burma varieties (*Gossypium neglectum* variety *verum*, sub-variety *Burmanicum* and *Gossypium neglectum* variety *verum*, sub-variety *kokatha*) but they are superior in quality of produce particularly in length of staples. The correctness of the above nomenclature is uncertain. Shan States cotton is not explicitly mentioned by Mr. Gammie in "The Indian Cottons" and there appear to be mixtures of varieties. It has been suggested that the khaki variety may be hybrid (*Gossypium intermedium*) between "*wa-ni*" and Siamese cotton (*Gossypium hirsutum* Mill. var. *rufa*, Tod.), and that the white flowered variety is *Gossypium hirsutum*, Mill. In any case there is a great deal of variation and indications of a variety of strains, the isolation of some of which would result in considerable improvement in both quality and yield. It is part of our scheme to attempt improvement in this way.

(2) The average superiority of the Shan cotton is recognised by buyers and ginners and the latter at Myingyan report that it extends to the ginning percentage as well as to length of staple, though at present

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[Continued.]

we have no reliable figures to prove this. Shan cotton is being made use of in hybridising experiments at Tatkon; but I am inclined to believe that its superiority over the Burmese is due, in part if not entirely, to the influence of environment. For, though the methods of cultivation employed are no better than those of Burma Proper, the soil on which cotton is grown is generally of a better class and climatic conditions are usually more favourable than on the plains.

659. *Work on Shan States cotton.*—Selection work on local cotton was commenced last year at Yawngnaw Farm in the Southern Shan States and the programme of this farm and of the farm at Hsumhsai in the Northern Shan States include improvement of cotton by selection and better cultivation and also trials of introduced varieties, preferably long-stapled varieties.

Mr. E. THOMPSTONE called and examined.

660. (President.) Sagaing and Lower Chindwin are the two principal districts in my circle in which cotton is grown. There is a little in Shwebo. My circle goes down as far as the south of Kyaukse District. A certain amount of cotton is grown in Kyaukse. It is comparatively a small area. The area under cotton in the Sagaing district last year was 54,800 acres approximately. In Lower Chindwin, it was practically 19,000 acres. The two together made up rather more than a third of the total area under cotton in Burma. Practically there is only one kind of cotton grown in my circle, viz., *wa-gale* (*Gossypium neglectum*) of which there are two or three strains. There is the ordinary yellow-flowered variety known as *Gossypium neglectum verum*, sub-variety *Burmanicum*. Another variety *roseum* is found mixed with it. Mr. Gammie calls it sub-variety *arvense*. (The Burmese name for it is *ua-gyu*.) It has a white flower and white lint. We occasionally find another sub-variety of *verum* with a *khaki* coloured lint known as *Kokatia*. Those are practically the only cottons we have got in the Northern Circle but on the borders of the dry zone, we get *wa-gyi* which is *Gossypium obtusifolium*. *Wa-gyi* simply means a big cotton. It is a bigger shrub than the ordinary *wa-gale*; it is yellow-flowered with white lint. It is supposed to be a superior variety but it cannot be grown in the dry zone. It grows as far south as Thayetmyo which is on the borders of the wet and dry zone. The planting season for *wa-gale* begins immediately after the first rain fall about the beginning of June; they go on sowing in July; but do not sow very late. Picking lasts from December to the end of March. The staple is short. It varies considerably, but is seldom more than three-fourths of an inch. It is one of the shortest staple cottons in India. *Wa-gyi* has a slightly longer staple but it is hardly worth considering so far as my circle is concerned.

661. No cotton is grown under irrigation. It has been tried on the Mandalay Farm but the soil of that farm does not suit it. Some better varieties might possibly be grown in the Shwebo district under irrigation. Where the Burman can get water, he will grow paddy. There is, however, some small prospect of growing cotton under well irrigation in Northern Shwebo as the cultivators cannot afford lift irrigation for paddy. In the Monywa district, there are also possibilities for cotton under well irrigation.

662. Most of the cotton from the north of the river goes to Myinmu to the Burma Cotton Company's mills, south of the river, it goes to Myingyan. There are two or three buyers there, the Burma Cotton Company and Steel Brothers as well as the local buyers.

663. In my circle, we are devoting more attention than we did to the development of cotton. On the farm at Padu in Sagaing district, we have made some selections from the indigenous cottons and we have some cottons with higher yields and a better ginning percentage. It is a dry farm. There has been no great improvement in the length of lint. If possible, it is our intention to start this year above Shwebo a little Cambodia cotton under well irrigation. I think there are possibilities there for it as a village industry. We have tried experiments on Cambodia in my circle for years and we have not had any success at all. Apart from that we have done practically nothing. Nothing has been done in Mandalay, not even on Pernambuco. I think that there are some prospects of Cambodia under wells and possibly on the lighter soils under the canals of Burma if the cultivator could be induced to give up rice. The bigger money value of the crop would have to be demonstrated. At present we can do very little owing to lack of staff. I do not think that there would be any difficulty in getting better prices for better cotton. The mills have expressed their willingness to give a higher price for long-stapled cotton. The trade is largely in the hands of European firms who are reasonable. There is still village ginning in Burma: weaving is done for local consumption. The cotton is also frequently ginned to obtain seed for sowing. The Department has not organised any method for the distribution of pure and better seed. We are making a beginning near Padu, where cotton is being grown under co-operative societies. We are buying it up this year and ginning it ourselves and going to give back the seed. There are no power gins in the villages. Most of the gins are at Myingyan, there is one gin at Thayetmyo and there is one higher up at Myinmu, which is in the centre of my circle.

664. The possibilities of long-staple cotton are not very great but it is impossible to say anything about them until we have the money and staff to do something with them. Our staff is very limited and is mostly employed in doing crop cutting experiments. We want a district agriculturist in each district. We have four of these men but we want one for each district. The men we have are men from the Land Records Department with six months' training. The crop cutting work occupies nearly all their time; in addition it alienates the cultivators from the Department to some extent because they think it a revenue matter.

665. (Mr. Wadia.) There are four districts in which cotton is grown but there are only two in which there is any large quantity. In each of these two districts, the staff consists of one district agriculturist on Rs. 50 and he has only just gone there. My circle consists of ten districts in Burma Proper, and in addition I have all the Shan States, and the Kachin and Chin Hills, in fact all the hill tracts. I have more than one hundred and fifty thousand square miles in my charge. I have only two men on more than a hundred rupees a month; their pay is Rs. 150—250. My staff consists of nothing but the men I have trained myself as best I could on the farms.

666. Cotton is not marketed at all in Rangoon. It is all bought up by brokers and taken direct to the mills. There are no collecting stations. The brokers travel round and buy from the cultivators. They pay cash but sometimes they make advances too. The cotton goes down to Rangoon and much of it is exported to Japan. It is ginned and pressed at Myingyan. There is as yet no power spinning and weaving. There is a little hand weaving in Amarapura but that is negligible. There is no guarantee that the cultivator gets a proper price, so far as I know. A certain amount of competition sent the price up this year to Rs. 52 per 100 *vis* (one *vis* = 3.6 lbs.) of *kapas*. Last year it was Rs. 42. The price is regulated by the home market, where there is competition. There was a combination amongst the mills which recently broke

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down. The average price in normal years works out at Rs. 25 to 30 per 100 *vis* (360 lbs.) The area expands immediately when the price goes up. The area will go up again next year. It is now about 230,000 acres.

667. I have heard complaints that there is a certain amount of damping going on. The ginners themselves suppress it by cutting prices, but this is a point on which I am not very well informed. The ginners are also buyers. They gin, bale, and export. Cotton seed is crushed at Myingyan and the cake is exported to Liverpool. The crushing is done in combination with the ginning factories. Messrs Jamal Brothers, Finlay, Fleming and Company and Messrs. Steel Brothers are the three firms which do everything in Myingyan. They own mills both above and below Myingyan. There are, I believe, some Burma firms setting up gins.

668. (Mr. Henderson.) The total area under cotton in my circle was 76,000 acres in 1916-17. It has gone up this year on account of the high prices. All the cotton is grown on the very worst high land. It is never grown under irrigation. A good average yield is about 100 *vis* of *kapas*. It ran from 82 to 103 last year. In Sagaing, 102 is the normal. The ginning percentage is very low, on an average 28 to 30. The cultivation is very bad. The sowing is all broadcast but we are showing the cultivators how to do it in rows and they are taking it up. It certainly increases the yield. The two principal rotations are sesamum and *jaar* but where the cotton area merges on a black soil, wheat is sometimes found as a rotation. The land is too high to be commanded by irrigation and is therefore not useful for rice. If the cultivators could grow rice, they would not grow cotton. Cotton is sown broadcast after the first rains. The picking takes about two to three months, and there are about three pickings starting from about the end of November. There is no frost and the pickings go on right through the season. Cambodia could possibly be grown on better land but not on these high gravelly soils. In the first place, one could never get water there. The rain fall in the Sagaing district is about 24 to 25 inches; in some of the other districts higher up it comes from 24 to 32 inches.

669. I have only one station in the cotton districts at Padu and that is a very small one, only 3½ acres in extent. When we get anything good we put it out among the co-operative societies and they grow seed for use. If you can show the Burman that there is any advantage in growing something new, he will grow at once. It is only a matter of demonstration. As to a programme for the future, there is nothing except the improvement in the yield of the local cottons. We are selecting for yield and ginning percentage but not for staple. I have three or four good varieties, giving a ginning percentage of 34 to 38. That is pretty good for the dry area we have to deal with. I have a gin on the Mandalay farm and have the cotton ginned there. I am doing the selection work myself. There is only an assistant botanist in Burma. I am working on the principle of pure line selection. Above Shwebo, I have a small area under irrigation from a well. I have a small plot of Cambodia cotton in it which is flourishing but I do not know yet what the yield is going to be. It was put down rather late this year. I tried Indian varieties at Mandalay, when I first went there. I got some varieties from Bombay and some from Madras but with no success at all. I would not say that the Indian varieties have no prospect. If they were tried under better conditions and if we had really a good cotton farm, it is just possible we might be able to get good results. We want a good cotton farm under irrigation and then there would be some prospect of doing good work. There is no prospect of getting such a farm owing to lack of funds and lack of staff. I have not tried the Garo Hills cotton. I have tried the Indian cottons on small plots under irrigation at Mandalay but none of them was successful. The soil was absolutely unsuitable for them. Mandalay happened to be the only farm that we had then. There are areas in which these cottons would grow better. If we had a better staff and more money we could certainly give them a trial. The cultivator does not look upon cotton as a profitable crop in an ordinary year. The average price does not induce him to sow cotton. The average price is Rs. 25 to Rs. 30 but of late years it has been Rs. 40 to Rs. 45 and the area has been increasing. When it goes above Rs. 35 the increase under cotton is rapid. Now it is Rs. 50 and I imagine that there will be a very big increase next season. There are areas in which it can expand. I have not done anything under irrigation lately except the one experiment that I am now doing in Shwebo district. There is an opening for both irrigated and unirrigated cotton. The irrigated has the most chance because cotton is at present grown on the worst land. Selection is the only work that can be done and that is what we are doing now. In present circumstances it is no use introducing cotton from India because of the different conditions under which it is grown there. I think there are possibilities in regard to well irrigation according to Madras methods in Lower Chindwin and Northern Shwebo. There are fairly big areas available in Lower Chindwin. The possibilities in regard to canal irrigation are more limited. Most of the canal irrigated areas in this circle except Kyaukse are dark clay soils which are absolutely unsuitable for cotton. There are no new projects under consideration which would affect cotton.

670. (Mr. Roberts.) We are at the beginning of everything. It is practically a blank sheet. This is the first year that we have been able to put out some seed. It is one of our selected varieties. I have four varieties which are being grown by co-operative societies. They are not long-staple cotton. I propose to find out which is the best and to push that. I may push two of them if two are equally good. Some of them are white-flowered and some yellow flowered. It would probably do to push one variety. The conditions are not so different as to justify pushing two or three. We want two farms for cotton. We want a bigger farm at Padu and one for irrigated cotton under wells, preferably at Monywa in the Lower Chindwin district.

Mr. A. McKERRAL, Deputy Director of Agriculture, Southern Circle, Burma.

EXAMINED AT CALCUTTA, MARCH 21ST, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

671. *Indigenous cottons.*—The cotton areas of Burma are three in number: (1) the *wa-gale* area, (2) the *wa-gyi* area and (3) the Shan States. The total area for 1914-15 was 291,000 acres. This fell to 187,000 acres in 1915-16. During the year ending June 1917, it has however again risen to 223,000 acres.

(2) The *wa-gale* (early cotton) area is situated in the dry zone of Burma and the principal districts with the area under cotton in each are given below. The figures are for 1916-17 :—

	ACRES.
Pakokku	1,770
Magwe	3,254
Shwebo	2,062
Sagaing	54,793
Lower Chindwin	18,998
Meiktila	51,305
Yamethin	1,043
Myingyan	62,097

The principal districts in this tract are accordingly Sagaing, Meiktila and Myingyan.

(3) The plant grown is *G. neglectum* var *Burmanicum*. It is a hardy plant of sympodial habit maturing in about 5 to 5½ months and produces a coarse short-stapled cotton which will only spin up to about 15s and is not more than three-quarters of an inch in length. The lint is white, but not dead white, having a slightly greyish tinge. The ginning outturn at the miles varies from 31 to 33 per cent. There is a variety with reddish or khaki coloured lint which occurs mixed with it. This is regarded as an impurity and a large staff of coolies has to be maintained at the gineries to pick this out. Other than this *wa-ni* as it is called, there is no real admixture but the crop shows a yellow and white flowered form and there are other morphological characters which show variation on which selection can be based. The cotton is bought up by firms and ginned mainly at Myingyan town but also at Mahlaing in the Meiktila and Myimmu in the Sagaing district. The larger firms such as the Burma Cotton Company, Jamal's Cotton and Produce Company, and Messrs. Moolla Dawood have installed hydraulic presses and the seed is utilized for the production of oil, most of which is exported to Europe. This industry is run in conjunction with groundnut oil pressing, the same machinery sufficing for both.

(4) The *wa-gale* cotton is entirely rain-fed, the rainfall usually being between twenty and thirty inches. The average yield is perhaps about 300 lbs. of seed cotton per acre. There is accordingly no hope of introducing long-stapled exotics in this tract and the lines of progress which have been adopted by the Agricultural Department consist in improving the ginning percentage with a view to increasing the total output of cotton and, as a side line, in endeavouring to improve the staple of the plant in length and fineness by means of suitable crosses. This work will be described later in the note.

(5) The *wa-gyi* (long-lived cotton) area is mainly in the Prome and Thayetmyo districts but there are small patches scattered over parts of the *neglectum* area as well. The areas for 1916-17 were as follows :—

	ACRES.
Prome	1,137
Thayetmyo	25,074

The plant grown here is *G. obtusifolium* var *nanking*. It differs from the *wa-gale* or *neglectum* plant in being markedly monopodial in its branching habit and accordingly of longer life period. There is no white flowered form. Sown in May or June, it is not picked till February of the next year. There is no doubt that for a coarse cotton this is a very useful plant. The lint is very strong but coarse and short, spinning up to 15s only and having a length of about three-quarters of an inch. It is dead white in colour and has a normal ginning outturn of 39 to 40 per cent. Cultivation takes place along the foot hills of the Yoma and the plant is rarely found growing on level land. It gets a heavier rainfall than *wa-gale* and this probably accounts for the fact that a longer lived type has been chosen for these parts. Generally a second crop is taken which is often considered superior to that of the first year. The market is at Allammyo where there are ginning factories owned by the same firms as are at Myingyan.

(6) Whether any of the exotic *hirsutum* types would be a success on this area cannot be said at present. The area is difficult of access and the Department has only one subordinate in each of the Prome and Thayetmyo districts. Cambodia has been tried last year at the seed farm at Allammyo but the result could not be called a success. Further trials on actual cultivators' fields are necessary and this requires staff. The area shows considerable fluctuation and a decided tendency to increase when prices are good. It is probable that a very considerable increase of the cotton area could take place in this tract.

672. *Shan States cotton*.—Shan States cotton is the only indigenous cotton which we possess in Burma which can be called fine and long stapled. This plant does not seem to have been described by previous writers on the Indian cotton. It much resembles in habit and life period the *wa-gale* or *neglectum* type and exists in two forms, a yellow and a white flowered. The foliage however shows marked reddish coloration and the plant is on the whole less robust than *wa-gale*. The lint is up to 1-2 inches in length and is fine and silky but scanty, the ginning outturn in unselected samples being only 25 per cent. Messrs. Tata and Sons, Bombay, examined this cotton for me some time ago and stated in their report that it could spin from 28s to 32s warp and 32s to 36s weft. It seems to be grown to some extent all over the Shan country as samples have been received at the experimental farm at Tatkon from both the Northern and Southern States. These lie outside the circle of the present writer and he cannot say anything of the conditions under which the crop is grown. The Superintendent, Southern Shan States, however, has supplied the following information :—

"Speaking generally, cotton is a minor crop in the Southern Shan States. The greater part of the outturn is utilized locally. West of the Salween, Burma is the natural market for such cotton as is available for export, though Chinese caravans returning to Yunnan occasionally load up with it. The export from the trans-Salween State of Kengtung is invariably to China.

(2) Figures for the area under cotton and the yield per acre are not available. I believe the average yield is less than that of the cotton-producing districts of Burma: but whether this is due to natural causes, or to want of care in cultivation I cannot say.

(3) There are large tracts of waste land in the Southern Shan States and if some of these tracts, near the railway, are suitable for cotton, there is no reason why the cultivation should not be largely extended. I take it we want expert advice as to the suitability of soil and climate, and an assurance that the cotton produced could be sold profitably, before any appreciable development can be looked for. Some years ago buyers came to Taunggyi from Myingyan, and (if I remember rightly) paid up to Rs. 30 per 100 *ris* for cotton. They got a certain quantity within a radius of fifty to sixty miles of Taunggyi, and the demand led to increased production. The demand ceased, and people who had cultivated or collected cotton to meet it lost money. In my opinion little or no cotton is now grown in the States near the railway except for local

use. The retail price is about Re. 1 for five *ris*. There is little doubt that an assured demand, at a profitable price, would stimulate production amongst the people who grow cotton at present. But expert advice is required before urging cultivation on a large scale."

673. *Exotic cottons*.—During the last five years, the Department has made trials with Cambodia, *buri*, various Egyptian types and Bombay Broach. None of these have proved successful. The first year in which Cambodia was tried (at Tatkon) the results were promising and a yield of 1,200 lbs. of seed cotton per acre was got, of which at least half was cotton of good marketable value. The crop has been grown annually since then, but the yield has never come up to that of the first year. This is largely to be attributed to insect attack preventing the bolls from opening properly. The plant grows luxuriantly and produces a profusion of bolls which, however, either drop off or do not open properly. *Buri* has given much the same result while the Egyptian tried both at Tatkon and under irrigation in the Mon canal area have been complete failures. Broach cotton has also been a failure although Burmese *wa-gyi* in adjacent plots does well. As pointed out above, it has not been possible as yet to give these cottons a fair trial on an extended scale in the *wa-gyi* tract proper or in the Shan States but this should be done soon if staff can be provided for the proper supervision of the work. Some years ago an attempt was made to grow Sea Island cotton in the Amherst district. I cannot get any details of the attempt but apparently it was begun on the strength of certain samples from isolated plants which received a good report but without any attempt to take care about yields or work out the cost of cultivation. Insect attack and damage by winds coupled with poor outturns led to the abandonment of the enterprise.

674. *The improvement of Burma cotton*.—In 1914, a farm of forty acres was opened at Tatkon in the Yamethin district which had as its principal object the improvement of indigenous cotton and trials of exotics. In that year a collection of the indigenous cottons was made and observations began on them. As a result of one year's observations, it was seen that the ginning percentage varied much and that selection for this character was likely to lead to satisfactory results in increasing the total production of lint. Many strains were isolated and propagated pure the next season and as a result of this two final selections were made, viz., (1) a white-flowered strain of *wa-gale* (*neglectum* type) showing a ginning outturn of 40 per cent. as against 33 per cent. in the unselected crop and (2) a strain of *wa-gyi* (*obtusifolium* type) showing an outturn of 45 per cent. as against a normal outturn of 39 per cent. Of these (1) is now ready for distribution to cultivators and it is expected that seed for 300 acres will be available next year. The selected strain of *wa-gyi* will, it is hoped, be cultivated on a field scale next year. It is estimated that the substitution of these strains for the present stock will increase the annual value of the raw cotton produced in Burma by at least six lakhs of rupees, in normal times and more than double that figure should present rates continue, and as there is a constant demand for this short-stapled cotton from Japan, India and Europe it is probable that the best policy at present will be to organise the distribution of seed of these selected strains. Being derived from single plants, the product will also be more uniform and the strains are also free from the *wa-ni* impurity mentioned above. The increased value due to the absence of *wa-ni* cannot be expressed in terms of cash, but will be considerable.

(2) In view, however, of the certainty of Burma desiring to have its own spinning industry at a very early date attention has also been given at Tatkon to the improvement of the quality of the staple of the indigenous cottons. In all three crosses have been effected, viz :—

- (1) *Wa-gale* × *Shan*.
- (2) *Wa-gyi* × *Broach*.
- (3) *Wa-gale* × *raggyi*.

(3) The first two crosses are meant to improve the quality of the staple by crossing with the fine stapled *Shan* and *Broach*. The third cross is mainly a speculation with a view to getting a white flowered *wa-gale* of high ginning percentage, the presence of the white flower being a useful mark in inspecting the crop.

(4) The *Shan wa-gale* cross appears promising. This year several acres of the F2 generation were grown and a large number of single plants selected. Some of these gave promising lint the staple being longer and much silkier than the *wa-gale* while not so scanty as that of the *Shan*. In the case of the *Broach* × *wa-gyi* cross, it is too early to speak as yet. About four acres of the F2 generation are at present being examined but the trees were not in bearing at the time of writing.

(5) These crosses, even if successful, will take a considerable time to fix and in the meantime it would seem desirable to aim primarily at an improvement in quantity.

675. *Summary and suggestions*.—(1) The main area of Burma cotton is a tract with a very short growing season and light soils which are not retentive of moisture. For this reason exotic types as at present known such as Cambodia, Egyptian, etc., are not suitable for the tract and improvement can only be looked for in two ways: (i) an increase in the total output without reference to quality by the distribution of seed of high ginning and high yielding strains: (ii) by an attempt to improve the staple of the present hardy indigenous plant by crossing it with finer stapled strains, as indicated above.

(2) On the *Wa-gyi* (*obtusifolium*) area, which is smaller in extent but appears to be gradually increasing and where the rainfall is greater further attempts should be made to try exotics such as Cambodia, the American types, etc. This requires careful supervision and so long as the one District Agriculturist provided for each district has to undertake the crop measurement work in five different localities in his district and a seed farm as well, it is hardly possible to hope that such work as trials with exotic cottons can be efficiently supervised.

(3) The possibilities of the *Shan States* both with regard to the extension of the fine stapled cotton at present grown and with reference to trials with exotics require careful investigation. Little is known at present of conditions there and an Agricultural Survey of these States would be extremely useful. I understand that during the present year the high prices have again sent buyers to the *Shan States* and that a very considerable amount of *kapas* is being brought down to the mills to Myingyan. The danger of this is that the seed will get mixed up with that of *wa-gale* and *vice versa* in the same way that *wa-gale* and *wa-gyi* seed have got mixed to the detriment of cultivators in the dry zone. A pioneer ginnery erected and run by Government near Taunggyi which would ensure a supply of pure seed of *Shan* cotton would probably be the best way of developing the industry on sound lines. The advent of the railway makes the present time particularly suitable for taking some action of this kind.

(4) Attempts to introduce exotics of the *hirsutum* type do not appear to have been conducted in India on as scientific lines as they might have been. The usual method attempted seems to have been to introduce directly varieties which have had a reputation in America or elsewhere. The very fact, however, of a variety

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being one of repute in America shows that it has been chosen with reference to American conditions which are very different from those prevailing in India. Recent work, indeed, in certain provinces of India would seem to show that these types can be improved to a certain extent by intravarietal selection. The most direct and also the most scientific method would therefore seem to be to import a certain number of these exotic varieties and then proceed to cross them *inter se* with a view to selection in the second generation of new types to more suitable to the conditions of the locality in which it is intended to grow the cotton. This kind of work does not seem to have been attempted in India or if it has, no results have as yet been published. It would of course entail space, time, and the services of whole time plant breeders to undertake it but it would seem to be well worthy of trial.

(5) The question of pure seed supply is in Burma, as in other provinces of India, of great importance. Last year apparently some of the mills in Meiktila district, which ordinarily gin the short-lived *wa-gale* type stimulated by the high prices being paid, began to purchase *wa-gyi*, the long-lived cotton. The seed of the latter is reported to have been sold to cultivators in the *wa-gale* tract who, unable to distinguish it from *wa-gale*, planted it out and found to their surprise and chagrin that they got scarcely any crop at all this year. Shan seed is also reported to have been distributed in the same tract. The quality of the seed given out by the large ginneries is beside often of very bad quality. Ten pounds of seed if good should suffice to sow an acre but cultivators often broadcast as much as thirty pounds. In some cases, the *kapis* has to be carted 25 or 30 miles to the gin and the cultivator, unable to obtain seed at the time he sells his cotton, has to make a second long journey in March or April for this purpose. The only apparent solution of these difficulties would be to have small ginneries mainly for seed production erected in the middle of each important tract. Thus, in Burma, ginneries to deal with say 1,000 or 1,500 acres in the Meiktila, Sagaing, Myingyan, Thayetmyo and Prom districts, carefully supervised by the Agricultural Department, would serve as centres of pure seed for whatever strain of cotton it might be advisable to distribute. These could either be erected by co-operative credit societies themselves with help from Government or could be entirely under the control of the latter. At all times, provided the necessary mechanical skill were forthcoming, it would pay a society to gin its own cotton but it is highly improbable that in the present state of mechanical efficiency in Burma this line of development will be possible on a large scale. A few such ginneries are however extremely necessary from the point of view of the production and distribution of pure seed.

(6) For the reasons given above, *viz.*, the danger of haphazard distribution of mixed seed by ginneries, I would favour the compulsory registration and licensing of all ginneries. This would make ginners more careful in the matter of seed distribution.

Mr. A. McKERRAL called and examined.

676. (President.) I do not think *wa-gale* is a long-staple cotton. It is generally three fourths of an inch. That is the maximum staple. It varies from half to three quarters of an inch. Selection work is being done on *wa-gale*: we have got one selection which gives the high ginning percentage of forty per cent. as opposed to 31 to 33 per cent. for the ordinary crop. The length of the staple is just the same. Selection is being done for ginning percentage only. *Wa-gale* is spread over the principal cotton districts of Upper Burma.

677. As to attempts to introduce exotics in the principal cotton districts of Burma, I have had trials made with Cambodia but I came to the conclusion that it was not likely to prove a success; in the ordinary cotton tracts it did not do at all. Most of the cotton is grown on red soils in districts such as Sagaing, Meiktila and Lower Chindwin. It is grown on the highest soils. They are the very worst soils for other crops but probably the best soil for cotton. They consist of a sort of gravel. We have not had very much experience with Cambodia. We had it growing in the Yamethin district; in the first year it gave a promising yield—about 1,200 lbs. to the acre—but since then it has not been doing well. This year I got the Assistant Entomologist to examine the crop. He found that 75 per cent. of the bolls were attacked by boll worms. Well irrigation is not extending very much in Burma.

678. The bulk of the Burma crop is *wa-gale* and the remainder *wa-gyi*. The latter is grown in the two districts of Thayetmyo and Prom. The area in Prom is about a thousand acres. The whole area amounts to from 26,000 to 28,000 acres. It has been up to 30,000 acres. It varies every year. The staple of *wa-gyi* is much the same as that of *wa-gale*, *i.e.*, three-fourths of an inch but it has a better colour and a much higher ginning percentage and therefore fetches a higher price. I think the premium is Rs. 5 per hundred *risa* of seed cotton. There was some admixture of the two in the fields last year. This year, people in Myingyan started buying *wa-gyi* seed on account of the high prices of cotton. The plants did not produce any thing and the crop was a failure.

679. Cotton in the Shan States is at present negligible. We do not know what the area is. I believe there are about 2,000 acres in the northern Shan States. This year people have started buying there. It is good cotton and Messrs. Tata's report on it is that it is equal to Surat. It is very fine cotton, staple up to an inch or more and spinning from 28 to 32s warp and from 32 to 36s weft. It has got a very low ginning percentage. It is not the only cotton in the Shan States. Some one has lately been spreading some type of American cotton in this tract, probably Cambodia. The Shan States are practically untouched by the Agricultural Department but an experimental farm has now been started at Yawughwe in the Southern Shan States. They are not under my charge, but under that of Mr. Thompson. I cannot say anything therefore about the possibilities of extension in the Shan States. The population is limited. Much depends on prices. If people were there to buy, there might be considerable extension.

680. We have been selecting *wa-gale* for ginning percentage and are aiming at an improvement of quality by crossing *wa-gale* with Shan and *wa-gyi* with Broach. I cannot say very much about this because the crosses are only in the second generation but some of the plants are very promising.

681. We are suffering very much from shortage of staff, both superior and subordinate. I think we want seven Deputy Directors altogether, *i.e.*, five more. I cannot say whether in the redistribution we should have a cotton tract and a rice tract. I think it would be a very good thing for the Deputy Director working on cotton in Burma to make an extensive tour in the cotton tracts in India. With regard to staff, I have mentioned in my written evidence that demonstration at present is practically impossible because we have got to do the crop reporting of the district. The district staff consists of a single man in each of a few districts. During part of the year, their whole time is taken up by crop measurement work in the district. In the cotton districts, one man has got about thirteen crops to do in five different parts of the district. I consider that a very serious handicap to my work. Things are not so bad in other parts of Burma. The crop cutting is a serious hindrance to demonstration work. We have of course, protested but nothing has been done. I have had no experience of tree cottons.

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[Continued.]

682. (Mr. Wadia.) Ginning factories are controlled by big firms such as Steel Brothers and the Burma Cotton Company (Finlay, Fleming and Company). The gins are the ordinary single roller McCarthy gins. Damping and adulteration go on to some extent. There cannot be much mixing as Burma has only two kinds of cotton, which are grown in separate tracts. I do not think *wa-gale* and *wa-gyi* are mixed. What is probably is that there is a mixture of *wa-gale* with Shan States cotton. There is not much adulteration in the true sense. Complaints are heard about damping. Damping is done by the cultivator. I think that the price of cotton is reduced for carts found to contain damp cotton and that attempts are made to get over the difficulty in that way.

683. I do not think that a long-staple cotton such as Cambodia should be put out until proper experiments have been carried out because, in my opinion, there are some tracts which are not suitable for it. The *wa-gale* tract is not suitable for long-staple cotton because there is no irrigation in it. The rainfall is from 25 to 35 inches. It is not equally distributed; it all falls between May and October, *i.e.*, in five months in the year. We have not selected for yield but the yield of the selected strain is not less than that of the ordinary crop. We have not done any selection for staple. I do not think that we can produce a long-staple cotton from *wa-gale* by ordinary selection only but it may be possible to improve it by crossing it with a better cotton such as Shan States cotton and we might then get a cotton with a longer staple and with a fair ginning percentage: whether it would be better than ordinary *wa-gale* depends on the price which would be paid for it. The statement in my written evidence that "attempts to introduce exotics of the *hirsutum* type do not appear to have been conducted in India on as scientific lines as they might have been", is simply my idea. I think it might be advisable to try crossing among them and to pick out the best of the crosses. One gets tremendous variation amongst the crosses and by selection among them one might get types which might do without irrigation. That is only a suggestion. My idea is that more crossing should be done. We want a man who has practically nothing else to do but this work. Crossing cotton is complicated work and every second year it requires space and a lot of time for selection. I think each province should have a special botanist if it is an important cotton province: if it is not, it is not worth while. We have not got a botanist in Burma. The post has been sanctioned but it has not yet been filled. It has been sanctioned for the last ten years. The botanist might be put on cotton as a special job, though the post is a general one.

684. I have advocated in my written evidence the establishment of small ginneries in the middle of each tract to give facilities to the outlying villages. They are necessary not only for this purpose but also for the distribution of pure seed. I do not think we can do it unless the commercial people take it up. I think there is considerable danger of pure seed being mixed with impure. I think, to begin with, we want a considerable amount of pure seed put out. In my written evidence, I have stated that I would favour the compulsory registration and licensing of all ginneries as this would make ginners more careful in the matter of seed distribution. The first thing is to prevent mixing of seed and that is the idea entirely underlying my suggestion. We want some sort of legal enactment under which the license could be taken away, if mixing were detected. I am afraid that the question of the licensing authority is one I have not thought much about. I think a licensing committee in each province is all that is required. I would prefer a committee for each province instead of a central bureau for the whole of India.

685. (Mr. Hodgkinson.) I think the area capable of growing cotton could be very considerably increased—more especially in the Shan States and probably also in Northern Burma. I do not know Northern Burma myself. Shwebo and Katha are very similar in climatic and soil conditions to Thayetmyo district where *wa-gyi* grows. The population there is very scanty on the whole. At the present time, cotton pays the cultivator much better than any other crop except the white bean. In ordinary times, it does not pay as well as groundnut. If cotton remains at its present price, a considerable acreage under groundnut will go under cotton. The people want to stop groundnut now and begin cotton.

686. As to transport of cotton if there was any increase in its production, as far as the Shan States are concerned, a railway has been built as far as Kalaw. In the case of Northern Burma, you have got rivers right up to the Chinese frontier and I do not think there is much trouble in the way of transport. I do not think very much cotton now goes to China except the Shan States cotton. Originally the whole of the Burma cotton trade was Chinese trade: the Chinese came to Burma, bought the cotton and had it ginned. The European firms more or less collared that trade and developed it. There is not much chance of growing long-staple cotton at present, and we are increasing the area under short staple because that is all that it is possible to do in present conditions. I have not done much experiment to speak of on the point but I think there is some hope of long-staple cotton in Burma in the future.

687. (Mr. Roberts.) *Wa-gale* cotton is grown in places where the rainfall is very small—25 to 35 inches, and on soils where groundnut cannot be grown. It is grown on the top of undulating country where at the bottom there is paddy. Cotton is usually grown on the highest soils which are gravelly in texture; lower down where there is more sand, groundnut and sesamum are grown. Cotton is grown on the soil on which sesamum and rice could not be grown. I do not think that irrigation is possible. *Wa-gyi* cotton is grown more or less on the undulating land on the range of the Yomas. I do not think irrigation is possible. The soil is red and on the whole slightly more stiff than the *wa-gale* soil but free draining. It is stony. The rainfall varies considerably and is from 45 to 60 inches. Cambodia has not been tried all over this tract. It has been tried in Yamethin and in the Myingyan district: *wa-gyi* cotton is a mid zone cotton. The rain fall at Yamethin is similar to that in the *wa-gyi* tract but the soil is slightly different. It is more retentive of moisture. Yamethin is a place where winter crops can be grown and beans can be put down. We tried Cambodia there because we had a bit of land available. It is suitable enough for selection work but it is not a good place for testing yield. The soil might be suitable but we have no irrigation. Cambodia never succeeds on stiff soil. I think that it is possible that Cambodia may do in this tract. This year we gave some seed to a man who wants more seed for next year. He is satisfied with it but I have not seen it myself. We had a few other exotics in addition to Cambodia. I do not think that they have changed since their introduction in Burma. We have only grown them for two years. There has been no change in Cambodia. I think there is a good deal of scope for trying American types further in the *wa-gyi* tract; they ought to be more extensively tried. They might be tried persistently for some years. They have not been tried in the Shan States and in Northern Burma at all. No systematic experiments have been made by the Department. The Shan States are a huge tract of country which is comparatively thinly populated.

688. As to our methods of working, we go for selection and crossing. I am fairly sure that we have got all the types growing in Burma isolated. I have examined *wa-gyi* very carefully in the fields from plant to plant and so far as staple is concerned, there is little to select. I do not think we get a big mixture in our

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fields; we have a yellow flowered variety and a white flowered variety and there is a certain amount of variation in the leaf. There is no difference in staple between the white and the yellow and the ginning percentage is the same. We have two kinds of flowers in the case of *wa-gale*. They are yellow and white. In the case of *wa-gyi*, I have never seen a white flower. We can select within the white and within the yellow for ginning percentage. We have selected the white flower simply as a form of *wa-gale* cotton. It is more easy to find out whether the plants are pure or not. Our white flowered plants are not like the Central Provinces white flowered *roscum*. I have had Central Provinces *roscum* growing side by side with it. It is possible, according to Mr. Gammie, that white flowered *indicums* have a much higher ginning percentage than the yellow flowered ones. I do not think there is much more to be done in the matter of selection here. There is a considerable amount of variation in the staple in the field, due partly to difference in types and partly to difference in cultivation. There is some scope for finding which is the most profitable. It would be a step if we could get the staple uniform.

689. As to staff, I have got one assistant who has been trained by myself more or less for crossing work. During the last two years, we have had two others under training but they are not yet fully trained. They have been taught how to do crossing work. They made a great many crosses in which, of course, there were a great number of failures. It is complicated work for which I shall want a bigger staff next year. We have got seed of the higher ginning percentage type of the *wa-gale* last year for about 300 acres. I have not done any yield test. The cultivators are very pleased with it and they maintain that it is a better yielder than the ordinary variety.

690. (President.) The present price of Burma cotton is Rs. 75 for 360 lbs. of *kapas*. The ginning percentage is 31 to 33. The average ordinary price is Rs. 20 to Rs. 25. This has been the average price for the last five or six years. This is the price in the districts. The average ginning percentage of *wa-gyi* is 39. The price of Shan cotton so far as I know is just the same as the others. No higher price is paid for the better staple. It is difficult to get it pure; it is simply mixed with the others. We are aiming at uniformity and to get pure types out. That is the idea. The idea is to get the high ginning percentage variety out, give it to the co-operative unions and to get back the seed. I am afraid that I have not given much thought to the question of posting Bombay prices in Burma. Mr. Gammie sent one of his assistants to Burma; he took away one of our crosses and Mr. Gammie thought that it was very promising.

691. I have not heard of any cases in which large grants of land for special purposes have been given in Burma. I think it would be very difficult to get a grant of land in Burma, except perhaps in the Shan States where there is a lot of waste land available.

IV.—North-West Frontier Province.

Mr. W. ROBERTSON BROWN, Agricultural Officer, North-West Frontier Province.

EXAMINED AT POONA, NOVEMBER 12TH, 1917

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short-staple cotton.

692. (1) Experience.—I have been stationed in Lahore for five years and in Peshawar for seven years. I have been in the cultivators' fields, during the greater part of the past seven years.

693. (2) Varieties.—*G. neglectum*, is the only variety grown.

694. (3) Size of holdings.—The average size of holdings is about ten acres; the holdings are usually the property of families, and one-third of the land may be under cotton where the crop is most successful.

695. (4) Yields and profits.—The average yield is ten maunds of 82 lbs. per acre. The average profit Rs. 30 to Rs. 35 per acre, i.e.,

	Rs.
Cost of cultivation 1 picking, marketing	40
Ten maunds of <i>kapas</i> at Rs. 8 per maund	80

696. (5) Rotations and manures.—The usual rotation is cotton, wheat, maize, clover or cotton, barley, maize, when clover can not be grown owing to scarcity of water. Cotton is never manured; the crop already is inclined to grow too tall and to leaf.

697. (6) Comparative returns.—One cotton only is grown. It is a high yielding, medium long, silky cotton of good quality with poor lint percentage, which, usually, is not better than 25 to 26 per cent.

698. (7) Conditions affecting increase in area.—The area under cotton, where the crop is at its best, fluctuates little, and fluctuations depend on the abundance or scarcity of water in the river Bara. In certain parts, the area depends on the price of cotton. The area may be expected to increase very considerably as land on the Upper and Lower Swat Canals becomes populated.

(2) American cotton does very well in Dera Ismail Khan, where the climatic conditions resemble those of Sind, but this district is not yet irrigated. The limiting factor in the extension of cotton cultivation is perhaps chiefly lack of population on the Upper and Lower Swat Canals.

699. (8) Uses of seed and seed selection.—Cotton seed is used to some extent by the military dairies, and by private dairy men, but most of the cotton seed is exported. In the best cotton tract, indeed in the one and only cotton area, the seed for sowing is carefully selected and specially hand ginned.

700. (General.)—On the newly irrigated land where the population is yet scanty, cotton will find increasing favour because it may be grown with little tillage and without much intercultivation. On the more intensively cultivated land, cotton cannot compete with maize, which is a staple food in the North-West Frontier Province. Maize yields as much money, generally, per acre in ninety days as cotton gives in 290 days, and further, wheat suitably follows maize in the autumn. Cotton, on the other hand, is sometimes on the land till late November and even till mid-December, when it is very late for wheat sowing. Cotton is more exhausting than maize on Peshawar land.

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701. *Experimental work on cotton at Peshawar.*—All the more noted *deshi* and American cottons now grown in India have been tried at the Peshawar Agricultural Station, but there high humidity in September and October prevents the bolls from opening properly and the plants grow to leaf. American cottons nevertheless produce enormous crop of bolls that remain green and solid and are caught by frost in late December. The Peshawar cotton tract lies along the foothills, above the Peshawar valley and it thus escapes the high humidity and frost that together prevent cotton bolls in the valley from opening freely.

Mr. W. ROBERTSON BROWN called and examined.

702. (President.) The extent of cotton cultivation in the North-West Frontier Province is fully fifty thousand acres. It is below this at present but that is about the average area. The cotton tract is unusually compact, because there are only certain parts where cotton can be profitably grown. This area is between five to ten miles from Peshawar, and it is close to the mills, which is a great advantage. The species of cotton is *G. neglectum*. The staple is fully half an inch, and the quality is usually good, but the ginning percentage is only 26, which is very low. It is a very fine and silky cotton. It is handled in Peshawar itself, where it is ginned, pressed and baled. There are a press and two ginning factories, all in Peshawar. No spinning or weaving is done there. Messrs. Volkarts Brothers and the Lyallpur people take the greater part of the cotton.

703. Experiments have been carried out with cotton at the Tarnab farm, where the position is that cotton grows excessively and produces very little lint, as the humidity is too high in September and October. There is no hope of exotic cotton being grown in the Peshawar valley; the climate is against it. The land at Tarnab is rich red sandy alluvium. There is over half an acre of Cambodia at Tarnab at present which is about eight feet high. There is no possibility of introducing a long staple cotton to Peshawar, but there are possibilities in the Dera Ismail Khan district, and also on the newer canals that have just been opened, and which will open out about 200,000 acres. I am referring chiefly to the Upper Swat Canal in the Peshawar district. Cotton has been started there. As far as I remember, 200,000 acres is about the total area commanded by the Upper Swat Canal. The Dera Ismail Khan tract is irrigated by inundation canals. The position is that there is no hope of extending the cultivation of long staple cotton in the cotton tract around Peshawar, but there are possibilities in this direction at Dera Ismail Khan. There is no experimental station in the new tracts, where the population is thin. Cotton and wheat are the most promising crops for the new areas. The tracts are being developed. On the older, richer and more thickly populated lands, cotton cannot compete with maize. Maize is on the land for three months and yields Rs. 70 an acre, whereas cotton is on the land for nine months and yields very little more than maize. We want increased agricultural staff for the exploitation of these new areas. We require more Indian staff. The appointment of additional European staff is not, I think, necessary. There is no likelihood of getting a botanist. I do not think one is required. Plant breeding is done by an officer of the Punjab Agricultural Department and at Pusa and there is a great deal of intercourse between Pusa, Lyallpur and Peshawar. What we really want is an increase of Indian staff because the scientific work conducted in the Punjab largely applies to the work that is in progress in the North-West Frontier Province.

704. (Mr. Wadia.) Cotton is carried by bullocks and buffaloes in huge loads to the ginning factories. It is damped on the way. I have seen this done. Messrs. Volkarts have a practical monopoly of Peshawar cotton. I believe they value Peshawar cotton highly and they send a man to buy it. They have an agency in the city. At one time, they paid a premium on Peshawar cotton because of its fineness and colour. I think the cultivator watches prices very carefully. I do not know the trade well enough to say if the publication of Liverpool and Bombay prices would be of use at Peshawar, but I am going into the question to find if this is necessary. The gins and presses at Peshawar are owned by merchants in Peshawar. They compete with Volkarts but Volkarts may get the bulk of the stuff. I do not know where Volkarts get their ginning and pressing done. I believe some Punjab cotton is sent to Peshawar to be mixed with Peshawar cotton in order to get the higher price which Peshawar cotton commands.

705. (Mr. Henderson.) Dera Ismail Khan is very like parts of Sind and the Punjab. It has a long hot summer with very little frost in the cold season. Cotton bolls open well in Dera Ismail Khan. The Agricultural Department have not yet carried out experiments in cotton growing there. When the war is over, it is hoped that a farm will be opened at Dera Ismail Khan primarily for the improvement of wheat and secondly to encourage cotton cultivation. There is a good future for American cotton at Dera Ismail Khan where the climatic conditions are like those in Sind. If irrigation is provided there is a great prospect of agricultural development in Dera Ismail Khan. The canals are inundation canals. Water flows in these at intervals from June to October. Cotton seed must be sown in May. Any cotton that is sown at present is put in under irrigation. April is the best month in which to sow cotton at Dera Ismail Khan. A certain amount of irrigation is done in Dera Ismail Khan now from the Paharpur canal which is erratic and not very satisfactory. There are certainly possibilities in the production of cotton at Dera Ismail Khan. On the Upper Swat Canal, agricultural work is just beginning. There is only a scanty population; the people are from the transborder and they are beginning to establish villages. The land is being plotted now. I think cotton will be an important crop there. The variety No. 4-P. American is doing very well on occasional plots. The outturn of seed cotton within ten miles of Peshawar city is extraordinarily high. It averages ten maunds of 82½ lbs per acre.

706. (Mr. Hodgkinson.) The question of damping is a serious one in the North-West Frontier Province. Government went into the matter and decided that nothing could be done as the remedy lay with the ginners and the buyers.

707. There is no proposal to establish a farm on the Upper Swat Canal. The Peshawar Agricultural Station is 200 acres in extent.

V.—Punjab.

Mr. W. C. RENOUE, I.C.S., Political Agent, Bahawalpur Agency.

EXAMINED AT LAHORE, JANUARY 8TH, 1918.

Written statement.

708. (1) Experience.—I fear that I am not in a position to express an opinion that can have much value on the subject of American cotton, for my connexion with the matter was severed in March 1911, when

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[Continued.]

I handed over charge of the Punjab Department of Agriculture. The next four years of my service in India were in Rawalpindi where practically no cotton can be grown. I now hold the post of Political Agent, Bahawalpur, Malerkotla and Faridkot, and the only point I can discuss usefully is the prospects of American cotton in the Bahawalpur State.

709. *History of introduction of American cotton into the Punjab.*—I venture to offer a few preliminary remarks on my early connection with American cotton, although these have merely a historical interest. I think I may say that, prior to 1911, I was identified with the endeavour to introduce American cotton more closely than anyone else in India. On taking over charge of the Department of Agriculture in March 1913, I found that a small trial had been made at Hissar in 1902 under the advice of Mr. Mollison, Inspector General of Agriculture in India. This was adjudged very promising. I was directed by the then Financial Commissioner, the late Sir Lewis Tupper, to devote special attention to the improvement of cotton and I made this my first care, submitting, after such enquiry as was possible, a special preliminary report to Sir Lewis Tupper. There were no agricultural specialists in the Punjab in those days, and the Director had to do the best he could with a couple of very imperfectly trained and newly appointed Indian assistants. The expert advice available was that of Mr. Mollison. Agricultural specialists began to be appointed from England for the Punjab in 1905 and 1906. Mr. Dobbs took over the important botanical work in the autumn of 1906 and Mr. Milne in 1907. Outside trials and propaganda remained with me for a little time longer. The Hissar plots were abandoned in 1903, and the experiment was continued at Lyallpur. A few selected colonists at Lyallpur were persuaded to give a trial to various varieties of American cotton in 1904, and, at the same time, endeavours were made to secure a fair price for the better staple. The experiment was extended to Sargodha in 1905, and, here also, American cotton did well. Trials were made in Hissar, Patiala, and in one or two other places. The trial at Hissar was in the garden and in the care of the present Director of Agriculture in the Punjab.

(2) I am not in a position to trace the history of the experiment in detail, for I am writing entirely from memory. If the matter is of interest, I would refer to the annual reports of the Punjab Department of Agriculture from 1903 to 1911, in which I made a very careful annual summary. By 1911, the area had expanded to, I think, some thousands of acres, and I felt that the outlook was very hopeful indeed. I was of the opinion that what was first needed was a slightly improved staple, and, here, the experiments of Mr. Milne, the Economic Botanist, were full of promise. I also hoped that a slightly higher premium might be forthcoming for American cotton as the market price developed, and as the staple improved. I believed that very little would turn the scale and establish American cotton over a very wide area. The premia now realised are far beyond my most sanguine expectations.

(3) I should mention that although cultivation had expanded, it was not easy to say with certainty what the exact reason for this was. The issue was fogged by the fact that we at first thought a little extra water was needed for the cultivation of American cotton and the Irrigation Department accordingly undertook to endeavour to supply this extra water. Many men undoubtedly grew American cotton merely as a means to obtain extra water for their other crops.

(4) Our greatest difficulty was to secure what we thought might be a fair price for the small quantity of American cotton placed on the market. It was a most disheartening task as is usually the case at first with a new product. At one time, one or some of my specialists were strongly in favour of scrapping the experiment, being impressed by the reluctance of buyers to come forward and by the doubt as to whether the expansion in the area under American cotton was to be ascribed to the desire for the extra irrigation occasionally made available. I think I may claim that it was I who averted this calamity. I had a strong belief that American cotton was suited to the climate. In the course of my tours I had seen pure cultivated in small plots in many parts of the Province, this being the offspring of American cotton introduced at haphazard by Government some thirty years before. I was struck by its persistence. I felt that it should be possible to effect at least a small improvement in the staple as well as to develop the market, and that the ground gained should be held. Estimates of comparative profit on American cotton seemed to me to indicate that very little would turn the scale.

710. *Experiments with other exotic cotton.*—Egyptian cotton received an extended trial at the same time as American, but it was soon clear that it needs a very much milder cold weather in which to yield a satisfactory outturn. Tree culture also failed completely.

711. *Prospects of American cotton in Bahawalpur.*—I now proceed to the discussion of cotton in the States of the Agency in my charge. Bahawalpur has a culturable area of 899,331 acres. The area sown with cotton is, however, only 13,112 acres. The smallness of the cotton area is entirely due to the prevailing agricultural conditions. The total annual rainfall is about five inches, so that irrigation is indispensable. Irrigation is, at present, almost entirely by means of inundation canals which run very capriciously. They generally start when May is well advanced and they are liable to stop in September. The population is sparse and the heat is phenomenal and inimical to all effort in certain months. The result is that all the features of extensive cultivation are in evidence in a marked degree. Ploughings are few, and weeding is rare. By far the largest area is sown for the spring harvest on the heavy moisture left by canal floodings. With showers at Christmas, there is a fair or a good crop. If these fail, the outturn is very poor. Canal irrigation is supplemented by wells and the number of these is increasing steadily if slowly. These now number 19,748. There are three tube wells, two of which are successful. The failure of the third is ascribed to the neglect of the owners. Where there are wells, the standard of cultivation improves. In some tracts, particularly in the north-east, colonists, who are careful cultivators, have come in and these have made their influence felt to some extent.

(2) The *deshi* cotton sown is all of the ordinary short staple and calls for no remark. There are three ginning mills.

(3) A few colonists have sown small patches of American cotton, but generally they have kept the produce for their own use. As regards the suitability of American cotton to the soil and climate, I cannot do better than quote the opinion kindly furnished by the Hon'ble Khan Bahadur Sayyid Mehdi Shah, who owns land in the State. He was one of the pioneers in the Lyallpur tract in 1904, and he has made trials in Bahawalpur. He is a very reliable and experienced observer. He considers that American cotton will do as well in Bahawalpur as in Lyallpur, if not better, provided, of course, that it receives proper attention. And he opines that sowings can be somewhat later in Bahawalpur. I enclose a copy of his letter dated the 11th December 1917.

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Mr. W. C. RENOUF, I.C.S.

[Continued.]

(4) I have no personal experience of American cotton in Bahawalpur, but I should also expect it to do quite as well there, if not better than in Lyallpur. The soil is the same. The summer temperatures are a little higher, but the plant would probably not mind this much, if at all. The climatic conditions appear to be highly favourable at flowering time, the autumn rainfall being very light. The winter is mild, so that late flowerings would have a better chance of success.

(5) American cotton cannot, however, be expected to establish itself on a large or even on an appreciable area without reliable sources of irrigation, and the essential question is whether this is likely to be provided. It seems practically certain that in the next few years a perennial canal will be constructed to irrigate about two million acres of virgin soil in Bahawalpur, or in Bahawalpur and the adjoining part of Bikanir. The project is only held up at present by a dispute as to whether Bikanir is entitled to a share in this canal. This point is, however, being contested with great tenacity. On this canal, the usual proportion of the area would be under cotton, and it seems probable that it would be largely or entirely under American cotton. An estimate of area can be framed easily from the Punjab Season and Crop Report, by comparing similar tracts. I regret that this publication is not with me, and that I have been unable to obtain a copy. A further project is to regularise the supply of water in most of the inundation canals by constructing weirs across the Sutlej. This would also provide conditions, suitable for the cultivation of American cotton, and would, I consider, result in the production of American cotton on a large scale. At the present highly profitable rates, which will doubtless be maintained, there can, I think, be no doubt as regards what will take place with dependable means of irrigation.

712. *Prospects of cotton in Malerkotla and Faridkot.*—In Malerkotla, with an area of 101,539 acres, only 1,200 acres are under cotton, while the cotton area in Faridkot, total area 4,471,530 ghumaons, is only 512 ghumaons. Neither of these States is a cotton tract and, looking at the adjoining districts, there seems to be no likelihood of their becoming so.

ANNEXURE.

Letter dated the 11th December 1917, from the Hon'ble Khan Bahadur Sayyid Mehdi Shah, Gojra, District Lyallpur, to the Political Agent Bahawalpur Agency.

I am in receipt of your kind favour dated Bahawalpur, the 6th December 1917, and thank you very much for the same.

It is no doubt a fact that American cotton has become exceedingly popular here and the soil of the Chenab Colony and its climate have come to be regarded as most suitable for its cultivation. But I have got some land both in the Bahawalpur State and in the Chenab Colony and can institute a comparison. Therefore, on the ground of my own personal experience, I can safely say that the soil of the Bahawalpur State and its climate are as good for the cotton crop as that of Lyallpur, if not better.

I have been trying American cotton in my land in the Bahawalpur State for the last three years and the result of the two years have been quite satisfactory. The first year returns were poor indeed but that was our own fault and not the fault of the soil or of the climate. American cotton was quite a new thing there and therefore sowing was begun rather late. This year returns, however, show a marked improvement and make my experiment quite a success.

I am therefore quite convinced as to the congeniality of the Bahawalpur soil for the American cotton crop. I must say, however, that it is not so suitable for the *deshi* cotton.

In Lyallpur, cotton land is watered in the month of March but in Bahawalpur, if the land for the cotton may be watered in the month of May, the produce will be equally good.

I have also been asked by the Punjab Government to prepare my evidence for the Indian Cotton Committee and am writing it for the purpose, and as question 56 clause (a), (b), (c) and (d) have a special reference to the Bahawalpur State conditions, therefore I shall try to discuss them.

Mr. W. C. RENOUF, I.C.S., called and examined.

713. (*President.*) I have been very pleased indeed to see the way American cotton has flourished. There was no break in the work during the time I was Director of Agriculture. The operations went on on two lines: On the farm, we tried to improve the staple and at the same time we tried to get the cultivators to improve cultivation in their fields. In 1904, the area of American cotton grown outside the farm was twenty acres. In 1905, it was about 430 acres; in 1906, it was 1,700; in 1907, it was 2,142; in 1908, it was 587 (I will explain afterwards what happened); in 1909, 1,054 and in 1910, somewhat over a thousand. But, in the last two years, a very considerable area, of which we had no record, was sown by private people from their own seed, and not from seed obtained from the Department. The set-back to 587 acres in 1908 was due partly to our announcing that we would not in future give any special water facilities for growing American cotton. There had been a somewhat of a boom in 1907. That, unfortunately, turned out to be a bad year: there was a lot of plague and it was difficult to get labour: the cultivation was very bad and the crop was not looked after. Then the increase in cultivation meant that a lot of people who had taken it up could not be guided satisfactorily. The result was a bad crop and a set-back to 587 acres in 1908. There was, however, the encouraging feature that many people were growing American cotton without any encouragement at all and without any suggestion from the Department. It seemed to be taking root; that was the impression that I got. As to the variety which did best, we found that Dharwar American was the best thing to pass round and, for two or three years, we went on with the same Dharwar American from our own selected seed. In 1907 we found that the Dharwar seed had deteriorated, and, in 1908, we imported fresh seed and the result was much better. At that time, we had no selections of our own to distribute. But in 1910, Mr. Milne had some promising varieties. As to the question of wheat competing with cotton, if cotton pays sufficiently, it ought to hold its own.

714. As to auction sales, when they were first started, our greatest difficulty was how to get an enhanced price for the better staple. The British Cotton Trade Association and other Associations were always urging us to go on with long-staple cotton, but I am afraid that when it came to buying the cotton or giving us assistance in the disposal of it, they gave practically no help at all. We had a lot of trouble. The disposal of the cotton was a perfect nightmare every year. Year after year, we circularised all cotton concerns and associations in India, pointing out the promising features of the enterprise and soliciting their help, but with little or no result. Finally, we started the auctions in 1908, and they went on year by year. We at once obtained premiums varying from Rs. 1-5 to Rs. 1-9 a maund over *deshi* cotton. The auctions have gone on steadily ever since. Of course, they are only a stage and cannot be looked on as a final solution. I should

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Mr. W. C. RENOUF, I.C.S.

[Continued.]

hope that private enterprise will come in and take them over. The quantity of American cotton is getting large enough for that now.

715. The success of American cotton in the Bahawalpur State is entirely contingent on the irrigation scheme in the development of which there is unfortunately a serious hitch. The claim of Bikanir to have share in the water which the canal will bring is very hotly contested by Bahawalpur. The dispute has gone on for many years and we are apparently no nearer a solution than we were at the beginning. The present position is that the Government of India are examining the claims of the Bahawalpur Durbar to the exclusive right to the water. I think the prospects of the tract for American cotton are very promising, provided irrigation is forthcoming. The Hon'ble Mr. Medhi Shah has already successfully cultivated American cotton at Rahim Yar Khan, slightly to the south of Khanpur, where he has a large farm. He is very enthusiastic. He has a tube well there so that he has a sufficient supply of water. He had, this year, thirty acres under American cotton and his outturn was from five to thirteen maunds an acre. The larger outturns were from ground which was properly prepared and the smaller ones were due to bad cultivation. The soil was virgin soil. Mr. Mehdi Shah's opinion is that that tract is more suitable to American cotton than Lyallpur. The heavy rainfall in September did not affect the flowerings as much as in Lyallpur, and he will get another picking this month (January) which will not be the case at Lyallpur. This absolutely confirms the theory that I have put forward in my written evidence. Mr. Mehdi Shah thinks the quality of the Bahawalpur cotton is somewhat better than that at Lyallpur. He brought the seed from Lyallpur, as well as cultivators. If the irrigation problem is settled, Bahawalpur seems a very hopeful tract, but until you have irrigation there you won't get people to go there and cultivate. Once you get irrigation, the odds are that American cotton will be grown to the exclusion of any other cotton.

716. There is no agricultural staff in Bahawalpur.* There is nothing there at present which could come under the Agricultural Department of the Punjab. A start ought to be made and probably will be made. The Punjab Agricultural Department has nothing to do with the State, but its advice and assistance would be welcomed.

717. (Mr. Roberts.) The total area under American cotton in the Punjab in 1910, was large, possibly 10,000 acres. The area sown with seed from the Department was actually only a little over a thousand acres. But there were quite a lot of people who were growing American cotton without the cognisance of the Department. We learnt this as we saw the cotton coming in afterwards to the auctions. There was a good deal of it in Jhang and it was very hard to get an estimate of it. As to the arrangement for marketing in the early days, in 1905, Messrs. Mela Ram and Sons of Lahore bought 724 maunds, almost the whole of the produce, at a premium of Rs. 1-8 by arrangement. In that year all the cotton was brought into Lahore. In 1906, Messrs. Mela Ram again bought at Rs. 1-6 premium but they arranged to buy on the spot. There were, however, very many complaints that their agent was not always there and that people were kept waiting and so on. The cultivator could not wait at their agency indefinitely with his cotton. A man named Sabar Mal paid about Rs. 1-7 or Rs. 1-8 premium and bought quite a lot of cotton that year. In 1907, Messrs. Mela Ram bought again and there were the same unsatisfactory features in the arrangements. However, Messrs. Mela Ram, on the whole, gave us valuable help at a critical time, when no one else came forward. In 1908, we were tired of this and we went in for sales by auction. It was a daring step, of course, but the auction was really a success, although it gave no end of trouble. There was a rough classification and many bad sorts were rejected.

718. My observations while on tour before 1904-05 were that American cotton was found absolutely pure in small plots in some of the old districts such as Hoshiarpur and Jullunder where it was called 'narma'. It was unknown in the market. Seed of this Punjab *narma* was obtained in 1902, when somebody collected a few handfuls. We discarded Punjab *narma* at an early stage as it was very inferior compared with Dharwar. Work with American cotton was started at Hissar, but, after a year, was transferred to Lyallpur at Mr. Mollison's suggestion, in 1902.

719. (Mr. Henderson.) I should say that the conditions in Bahawalpur are very similar to those in northern Sind. The cultivation in Bahawalpur is absolutely the worst I have ever seen. I do not blame the cultivators in any way. They have no incentive to do better. They own large areas and both canal and rain water are very precarious. They take the chance of there being a crop and if there is no crop, they live very largely on the produce of their date palms and on their herds of milch cattle which find good grazing in extensive waste tracts. There is no certainty as to when the canals will begin running. This year, they did not begin till the 15th or 20th May. There is no water for the preliminary preparation of the soil for cotton cultivation: this is the difficulty as regards sowing cotton in May. When the river rises, the canal water comes down the channels. The irrigation system is still somewhat primitive, but it is being improved methodically. Water is very rarely available before the 20th of May. My experience of the canals in Multan and Bahawalpur is that they are tending to start later and later as time goes on, with extensions of canal irrigation in the Northern Punjab. Some twenty years back, they used to start earlier than now. The canals are fairly large. The whole place is a net work of them. There is lift irrigation at the head and rice is grown towards the tail. The old system was as to put a big *bund* at the head and flood the water all round. When the people served by this *bund* had taken all the water they wanted, they cut the *bund* and let the water go down to the tail. This system is being stopped. It means silting at the head of the canal.

720. Bahawalpur is thinly populated at present. I do not think that Marwaris could be got for picking. Pathans come in to do earth work in the winter but not in large numbers. A certain number of people also come from Bikanir but not very many. The labour difficulty will probably not be as serious as in Northern Sind. It is rather difficult to get tenants now from the Punjab. There are three ginning factories in Bahawalpur. There is not much cotton grown there. The population of the State is about 750,000. On the whole it is rather sparse. That is excluding the desert area which does not maintain anything. The desert or waste area is enormous.

721. (Mr. Wadia.) The difficulty in marketing that I mentioned was due to the small quantity of cotton. It was inevitable in the case of a new product. The crop was only about five to nine thousand maunds of unspinned cotton, i.e., about 250 bales of lint. It did not pay any big firm to come down and purchase it. I do not remember for what purpose Mela Ram bought the cotton, but my impression is that he used it for spinning. Prior to 1904, a few cultivators were growing Punjab *narma* in small patches. They did not market it at all. In a whole district, you would not find more than a dozen patches which caught your eye at once

* The Durbar has since taken steps to establish an agricultural station at Bahawalpur.

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Sardar JOGENDRA SINGH.

while rising. *Narma* was used for private consumption. The cultivator's wife worked it up for him into a special garment. This is still done in Bahawalpur.

722. As regards mixing, so far as the indigenous cotton was concerned, my impression is that it was all about the same quality. So far as American was concerned, the tendency was for some people to grow it and use it for mixing. They were not so careful with the seed as the Department was. This mixing was, of course, a drawback in the auctions. As to the methods by which mixing can be stopped, I should say that it can be stopped by discriminating purchasers making a careful examination and suitable deductions. This would make it to a man's interest to market a pure article. When each man brings in his lot of cotton, the only course is for the purchaser to look at it and, if, for example, there is twenty per cent. of short-staple cotton in it, to cut the price rather more than twenty per cent. Next time it would be to the cultivator's advantage to grow or market it pure. Buyers certainly ought to be able to form a rough idea of the percentage of admixture by taking a few handfuls of the cotton and looking at it. Unless some action of this kind is taken, people will go on mixing. I think the prevention of mixing is purely a business matter. The agents must be on the look out for it and penalise people so as to make it not worth their while to mix. This is the only course, I can think of. As the premium increases, the tendency will be to mix more and more and, unless the purchaser takes action, I do not think it can be stopped. I do not think that the Department can do very much. All that the Department can do is to issue pure seed. I cannot say where mixing is done. In my time it was due to the crop being grown from mixed seed. There were several ginneries in my time at Lyallpur. They were not properly equipped, for the handling of the American cotton and only dealt with *deshi* cotton.

723. (Mr. Hodgkinson.) My experiments with Egyptian cotton were a complete failure. The plants grew beautifully but the outturn was insignificant. A very little cold seems to have affected them.

724. (Mr. Roberts.) At the first auction sales, I think the local factory owners bought most of the cotton and they were the best buyers up to the fourth year. Messrs. Ralli Brothers bought some. Messrs. Rallis and Volkarts helped to organise the sales and made useful bids, but the factory owners secured most of the cotton.

725. We expect about 2,000,000 acres of irrigation if the Bahawalpur canal is sanctioned. It is a fertile tract and with the present high premium on American cotton it would surprise me if *deshi* cotton were grown on it. It is more suitable for American cotton than the Lower Bari Doab Canal Colony.

One-tenth of the area, i.e., about 200,000 acres, would probably be under cotton and the probability is that this would be American cotton rather than *deshi*, if the present premium is maintained. It would be essential to take steps to advise the people and help them with seed, etc.

Sardar JOGENDRA SINGH, of Iqbalnagar, Montgomery District, Punjab.

EXAMINED AT LAHORE, JANUARY 8th, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(c) Exotic cotton.

726. (20) Experience.—I have land in Gujranwala, Amritsar and Kheri (Oudh) but my direct experience of the cultivation of cotton is confined only to Iqbalnagar, Montgomery District. In Amritsar and Gujranwala, before the introduction of American cotton, only short stapled *deshi* cotton was grown. I have now been over three years in the Montgomery District and have grown 4 F. American cotton.

727. (21) Varieties.—The only variety grown here is 4 F. American.

728. (22) Size of holdings.—The average size of holding on the Lower Bari Doab Canal is 25 acres and the holder of 25 acres puts under cotton from four to six acres; one-fifth of the holding can be easily placed under cotton.

729. (23) Comparative returns.—The only exotic cotton which I have grown is 4 F. American. I have now, out of 2,000 acres, 500 acres under cotton and the average yields are from six to eight maunds an acre. If the average price be taken at Rs. 15 a maund, the net income from an acre ranges from Rs. 90 to Rs. 120 an acre. Sugarcane and indigo are the only two more paying crops. The yields on an average from *deshi* cotton are equal to that of American, but 4 F. scores in prices. Taking other crops, wheat, for instance, yields from thirteen maunds to fifteen maunds an acre and at Rs. 6-8-0 a maund gives Rs. 46 to Rs. 52. No other food crop in Montgomery District comes up to wheat.

730. (24) Rotations and manures.—I have not applied any manures and the ordinary rotation is to put cotton after some *kharij* crop and *toria* and follow it with wheat. Cotton is sometimes sown immediately after wheat.

731. (25) Conditions affecting increase in area.—So far as I can see, the better prices which are now obtained will help greatly the increase of the cultivation of the exotic cotton, and the increase will only be conditioned by seasons of heavy rainfall, want of irrigation facilities and the requirements of food crops and the need of rotation. The present year of heavy rainfall has shown that American 4 F. can stand heavy rain much better than *deshi* cotton.

732. (26) Suitabilities of existing varieties.—The Agricultural Department in the Punjab are pushing for all that they can, 4 F. which has proved the most suitable variety. Other varieties are said to be under trial. The Department has won the confidence of the people and large private farms can also assist the introduction of new crops greatly.

733. (27) Prevention of mixing of different varieties.—To prevent mixing:—

- Mixing in the fields can be prevented by distribution of pure seed and rooting out of the *deshi* plants after careful inspection.
- The local buyers purchase cotton without offering a better price for pure cotton. Once the producer gets a better price for pure American cotton, it will be the greatest incentive towards the growing of an exotic crop and keeping the crop pure.

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Sardar JOGENDRA SINGH.

[Continued.]

734. (28) **Importation of seed.**—I really cannot say much on this point. The Agricultural Department is the best judge. If our agricultural experts find that imported seed gives better results, it would be as well to get it, otherwise selected seed of varieties acclimatised has already proved a success.

735. (29) **General economic conditions.**—There is of course the great question of securing for the cultivator the full profits of his produce. He often loses more than 25 per cent. The only way that I can see so far as the Punjab is concerned, is in the organization of co-operative societies and co-operative gins so that cotton could be placed in the market in bales and bales marked according to market standards. The co-operative movement in the Punjab is slowly gaining in strength and is full of great possibilities for the future.

II.—COMMERCIAL ASPECT.

736. (30) **Local trade customs.**—Usually the village *bania* claims the first picking in satisfaction of advances made and at rates which are often fifty per cent. below the market rate and he goes on buying cotton as it comes. A fair proportion is also sold by women who pick and other members of the family of the farmer in small quantities. At the end of the season, the producer takes to the nearest market what remains and gets the price which is governed by the competition between the purchasers and the supply in the market on a particular day. If there is enough supply for all the purchasers, the prices rule low: if the supply is not equal to the demand, competition prices go up to the market level. There is not much of agency system, advances, forward buying, or contracts, in these parts.

737. (32) **Buying agencies.**—The best form of sales under present conditions is the system of auctions under the Agricultural Department. The seller can get the best price ruling on that day but it has the disadvantage that the seller has not the chance of watching the market and obtaining the best possible price of the season. There can be no doubt that co-operative urban selling agencies affiliated to village societies, if they can be organized, to collect and classify cottons and place them in the market at the right time will help the cultivator to get the proper price for his produce.

III.—STATISTICAL.

738. (33) **Improvement of cotton forecast.**—I am not aware of the system of compiling statistics in the Punjab but I have some experience of these compilations in United Provinces. The figures supplied by the Irrigation Department, as to the area actually under the crop are nearly correct. The forecast on unirrigated area is more or less guess work. The *girdawari* of the *patwari mal* is not very dependable. To appraise a standing crop before it has matured, and when this appraisal is carried out by different people in different parts with no co-ordination of methods, can at best be but a very rough estimate. What can be ascertained is the area under crop and its general condition. Very often a forecast before it is published is out-of-date.

739. (34) **Improvement of other statistical information.**—I am afraid I have no suggestion to offer, except this that the forecast may be published of each district separately and information collected by telegrams two or three days before the day of publication; much time is often lost in digesting the information collected and publishing it.

740. (35) **Publication of Liverpool and Bombay prices.**—I am strongly of opinion that Liverpool and Bombay cotton prices should be daily published in the local markets. I was much struck by the idea when late Lord Kitchener started the system in Egypt. To make the information really useful, the rate should be worked out to suit the weights and measures which prevail in different districts and smaller markets. For instance, 500 rupees for a *khandi* will convey little meaning to the peasant. What will help him is to know the price which it implies per maund for *kapas* at the market nearest to his village. It should be worked out carefully making allowances for freight, ginning, baling, etc.

V.—GENERAL.

741. (46) **Attitude of buyers to improved cottons.**—The buyers have done little to encourage the growth of improved cottons by offering higher prices.

742. (47) **Effect of water rates.**—The water rate counts with the cultivator and there can be no doubt that an easier rate will be an incentive to the increased cultivation of cotton.

VI.—IRRIGATION.

743. (50) **Experience.**—The Irrigation Department was under me in Patiala and I had some experience of assessment work. Here, in Iqbalnagar, I depend entirely on canal irrigation.

744. (51) **Wheat versus cotton.**—Wheat so far as I know in this district does not compete with cotton as an irrigated crop. The former is a *rabi* crop while the latter is a *kharif* crop.

745. (52) **Critical period in regard to water supply.**—The most critical period in regard to the water supply in this district is from the end of October right through winter to March. The cotton has to get its last watering in the beginning of October and land has to be watered for wheat about the end and then there is certain amount of competition for water. The ten days *warbandi* is started about the 21st October. It often happens that a particular area may not get its turn for a month. I don't see how increase of irrigated area of cotton would make any material difference to the existing conditions—of course a larger area under cotton would to a certain extent affect the growing of wheat.

746. (53) **Possibility of enlargement of canals and its effect.**—I am of opinion—and this opinion is shared by a large number of agriculturists—that the area under cotton can be doubled if the water in the rivers from April till September which is allowed to run to waste, is utilised. There are canals which are made to take at least 25 per cent. more water but are run below their capacity, because the minors that take from them are not modelled to take a larger supply. The canals should be enlarged, or another bank built alongside to take the extra supply available in the rains. It will need no major works and the remodelling of minors and heads and the strengthening and raising of banks will comparatively cost much less than the original work and yet the capital will earn almost equally. Then again water could be taken during the rain to areas which are not at present served, on the express condition that this supply is made available for the cultivation of cotton only.

The enlargement of canals would make little difference, to the area under wheat, as cotton does not compete with wheat and new areas which will come under irrigation will make up for any fall in the original wheat area.

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Sardar JOGENDRA SINGH.

[Continued.]

747. (54) **Improvement of duty by equalization of distribution.**—The additional area resulting from equalization of distribution of land will range between 25 and 50 per cent. according to the locality and the size of the holdings.

748. (56) **Wells and tube wells.**—The people will supplement canal irrigation by wells if water rate is assessed as per watering.

749. (57) **Effect on revenue of enlargement of canals.**—In considering the yields from water rate, the revenue which will come from the land should not be left out. Irrigated lands pay a higher rate than unirrigated lands.

750. (64) **Effect of water rates on cropping.**—I think it would help to increase the extension of exotic cotton if the water rate for exotic varieties were made equal to that charged for wheat.

Sardar JOGENDRA SINGH called and examined.

751. (President.) I am a large landholder. Some of my lands are in the Punjab and some in the United Provinces. Cotton is a more remunerative crop than wheat. In the Lower Bari Doab Colony especially, American cotton has proved to be the most paying crop. If I were a small cultivator, depending entirely on agriculture as a means of livelihood, I should try to put down as large an area under cotton as possible. I have been trying to arrange with the Irrigation Department to get a double supply of water for *kharij* so that I may be able to put double the area under cotton and to have only one-third under wheat. Of course on a small holding, one must grow wheat, or other food crops, for one's own requirements. The tendency of the cultivators in the Lower Bari Doab Colony is to put as large an area under American cotton as they can; they realise that it is an exceedingly valuable crop. It has given good yields this year and the price is very good. I had 500 acres under cotton. Next year, if water is available, I propose to put 1,000 acres under cotton and 500 acres under wheat, allowing the remaining area to lie fallow.

752. I have met with no difficulty in growing 4 R. It is a very easy crop to grow, especially if it is sown in lines. Sowing in lines permits interculture. The only difficulty with American cotton is that it requires frequent waterings. I think water could be given with advantage every fifteen days. This year sowings were very late and so we watered late, and that helped the crop very much and we continued to pick right to the end of December. The watering is generally stopped in October in order to mature the crop early, which to my mind is a mistake. Waterings, if continued, secure better yields and better quality. The rainfall we had this year was not very heavy, and the American cotton stood it better than any other crop.

753. To prevent mixing of seed in the field, it is absolutely essential that pure seed should be distributed either by Government or by large private farms where *deshi* plants are not allowed to grow.

754. It is very difficult to say anything about the cotton forecast. I think the only figures that can be depended upon are the irrigation figures. It is very difficult to tackle the unirrigated tracts. I have not much faith in the accuracy of the forecasts. I have had some experience of how these forecasts are prepared. It is all guess work from beginning to end. The *patwaris* (village accountants) and *kanungos* (subordinate revenue officers) and selected landholders are asked to supply estimates of crops. They make these estimates without much sense of responsibility and the information given is based on pure guess work, and it is from this data that the Director works out his forecasts. The only way to approximate to an appreciably correct estimate will be to make it the duty of the *patwari* to do an early field inspection and to give accurate figures for the crop. Those figures would be as accurate as you could get and then an estimate of yields could also be made. The February forecast is of no use as far as the Punjab is concerned. It comes too late, the pickings are generally over in December and by the time the forecast is published, the cotton is sold out.

755. I think the publication of prices in the local market is very helpful to the cultivator. It is being done in the Punjab this year and it has been a great help. I have suggested various modifications and I think the Punjab Agricultural Department is following them. The telegram giving the market prices is now exhibited in the market and a printed note gives all the necessary information to enable the cultivator to work out the price of *kapas* in his own market. I think any intelligent cultivator can work out the price from the data given. It does not help the cultivator to get the proper price, as the price of the day depends on local competition, but if he finds that he is offered a price that is much below that ruling in the Bombay market, he can hold back his cotton.

756. I have really no experience of pressing and ginning but it must be a very paying business. The other day a man came to me and said that he would pay me Rs. 25,000 annually if I would set up a ginning, factory for him. The factory according to him should contain sixty gins and would cost about a lakh and a quarter at Iqbalnagar, and on this capital he was willing to pay me a clear profit of Rs. 25,000 which is not bad.

757. I do not think that the water rate influences the cropping very much. A preferential water rate might lead to the extension of the cotton crop. It would be an ideal arrangement if the cultivator could purchase water by bulk. The Irrigation Department, however, will have to fix rates according to the average per cusec which it now gets. To charge a higher rate as an inducement to economy in the use of water is not business.

758. (Mr. Roberts.) I have been marketing my cotton through the Agricultural Department. This year I held a private auction on January 5th and I think it was a great success. The Agricultural Department is not able to continue its sales all through the season. It is only able to deal with the first pickings and a great deal of cotton is therefore left which the producer has to take to the market and sell for whatever price he can get. The ordinary bazaar rate for American cotton at Mian Channu on the date of my sale was Rs. 16 per maund. At the auction my own cotton (A class) fetched Rs. 19-8 per maund. I sold 1,000 maunds at this rate. Another five thousand with no *deshi* mixture fetched Rs. 18-8 per maund. This was not my own cotton. The total quantity sold was nine thousand maunds. About 1,500 maunds of B class were sold at Rs. 17-6 per maund. B class is cotton with up to one per cent. mixture of *deshi*. 500 maunds of C class cotton were sold at Rs. 16-6. In the C class, there is a mixture of *deshi* up to five per cent. C class is the third class cotton. The colour is also not good. The cotton was classified by the Agricultural Department and the classification was not disputed. I am sure this is a very good beginning and in future private auctions will help the producer greatly. It is impossible for the Agricultural Department to arrange at least two auctions in the cotton season in every cotton-growing area. The Agricultural Department might well employ a special staff to assist at the private auctions. There is no reason why the system of auctioning cotton should not be extended to wheat, oil seeds, etc. There should be at least three sales for cotton in each centre. Class A cotton at my auction was bought by the Japanese, the B class was bought

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748. (56) **Wells and tube wells.**—The people will supplement canal irrigation by wells if water rate is assessed as per watering.

749. (57) **Effect on revenue of enlargement of canals.**—In considering the yields from water rate, the revenue which will come from the land should not be left out. Irrigated lands pay a higher rate than unirrigated lands.

750. (64) **Effect of water rates on cropping.**—I think it would help to increase the extension of exotic cotton if the water rate for exotic varieties were made equal to that charged for wheat.

Sardar JOGENDRA SINGH called and examined.

751. (President.) I am a large landholder. Some of my lands are in the Punjab and some in the United Provinces. Cotton is a more remunerative crop than wheat. In the Lower Bari Doab Colony especially, American cotton has proved to be the most paying crop. If I were a small cultivator, depending entirely on agriculture as a means of livelihood, I should try to put down as large an area under cotton as possible. I have been trying to arrange with the Irrigation Department to get a double supply of water for *kharif* so that I may be able to put double the area under cotton and to have only one-third under wheat. Of course on a small holding, one must grow wheat, or other food crops, for one's own requirements. The tendency of the cultivators in the Lower Bari Doab Colony is to put as large an area under American cotton as they can; they realise that it is an exceedingly valuable crop. It has given good yields this year and the price is very good. I had 500 acres under cotton. Next year, if water is available, I propose to put 1,000 acres under cotton and 500 acres under wheat, allowing the remaining area to lie fallow.

752. I have met with no difficulty in growing 4 F. It is a very easy crop to grow, especially if it is sown in lines. Sowing in lines permits interculture. The only difficulty with American cotton is that it requires frequent waterings. I think water could be given with advantage every fifteen days. This year sowings were very late and so we watered late, and that helped the crop very much and we continued to pick right to the end of December. The watering is generally stopped in October in order to mature the crop early, which to my mind is a mistake. Waterings, if continued, secure better yields and better quality. The rainfall we had this year was not very heavy, and the American cotton stood it better than any other crop.

753. To prevent mixing of seed in the field, it is absolutely essential that pure seed should be distributed either by Government or by large private farms where *deshi* plants are not allowed to grow.

754. It is very difficult to say anything about the cotton forecast. I think the only figures that can be depended upon are the irrigation figures. It is very difficult to tackle the unirrigated tracts. I have not much faith in the accuracy of the forecasts. I have had some experience of how these forecasts are prepared. It is all guess work from beginning to end. The *patwaris* (village accountants) and *kanungos* (subordinate revenue officers) and selected landholders are asked to supply estimates of crops. They make these estimates without much sense of responsibility and the information given is based on pure guess work, and it is from this data that the Director works out his forecasts. The only way to approximate to an appreciably correct estimate will be to make it the duty of the *patwari* to do an early field inspection and to give accurate figures for the crop. Those figures would be as accurate as you could get and then an estimate of yields could also be made. The February forecast is of no use as far as the Punjab is concerned. It comes too late, the pickings are generally over in December and by the time the forecast is published, the cotton is sold out.

755. I think the publication of prices in the local market is very helpful to the cultivator. It is being done in the Punjab this year and it has been a great help. I have suggested various modifications and I think the Punjab Agricultural Department is following them. The telegram giving the market prices is now exhibited in the market and a printed note gives all the necessary information to enable the cultivator to work out the price of *kapas* in his own market. I think any intelligent cultivator can work out the price from the data given. It does not help the cultivator to get the proper price, as the price of the day depends on local competition, but if he finds that he is offered a price that is much below that ruling in the Bombay market, he can hold back his cotton.

756. I have really no experience of pressing and ginning but it must be a very paying business. The other day a man came to me and said that he would pay me Rs. 25,000 annually if I would set up a ginning, factory for him. The factory according to him should contain sixty gins and would cost about a lakh and a quarter at Iqbalnagar, and on this capital he was willing to pay me a clear profit of Rs. 25,000 which is not bad.

757. I do not think that the water rate influences the cropping very much. A preferential water rate might lead to the extension of the cotton crop. It would be an ideal arrangement if the cultivator could purchase water by bulk. The Irrigation Department, however, will have to fix rates according to the average per cusec which it now gets. To charge a higher rate as an inducement to economy in the use of water is not business.

758. (Mr. Roberts.) I have been marketing my cotton through the Agricultural Department. This year I held a private auction on January 5th and I think it was a great success. The Agricultural Department is not able to continue its sales all through the season. It is only able to deal with the first pickings and a great deal of cotton is therefore left which the producer has to take to the market and sell for whatever price he can get. The ordinary bazaar rate for American cotton at Mian Channu on the date of my sale was Rs. 16 per maund. At the auction my own cotton (A class) fetched Rs. 19-8 per maund. I sold 1,000 maunds at this rate. Another five thousand with no *deshi* mixture fetched Rs. 18-8 per maund. This was not my own cotton. The total quantity sold was nine thousand maunds. About 1,500 maunds of B class were sold at Rs. 17-6 per maund. B class is cotton with up to one per cent. mixture of *deshi*. 500 maunds of C class cotton were sold at Rs. 16-6. In the C class, there is a mixture of *deshi* up to five per cent. C class is the third class cotton. The colour is also not good. The cotton was classified by the Agricultural Department and the classification was not disputed. I am sure this is a very good beginning and in future private auctions will help the producer greatly. It is impossible for the Agricultural Department to arrange at least two auctions in the cotton season in every cotton-growing area. The Agricultural Department might well employ a special staff to assist at the private auctions. There is no reason why the system of auctioning cotton should not be extended to wheat, oil seeds, etc. There should be at least three sales for cotton in each centre. Class A cotton at my auction was bought by the Japanese, the B class was bought

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by Gulzari Mal and Kirparam who came from Lahore. Messrs. Ralli Brothers, and Forbes, Forbes, Campbell and Co. did not attend the auction. I think if we could offer godown facilities to the purchasers the competition would become greater and bring in higher prices. I had no facilities whatsoever. The auction was just held in the open fields. Labh Singh, the Agricultural Assistant, and Mr. Haverty arbitrated in cases of disputes. One special feature of this auction was that the seller was allowed to put a reserve on cotton. We got more than the reserve prices in all cases.

759. So far as my experience goes, cotton does not require more labour than wheat. If sown in lines, it is easier to grow and to intercultivate. We had no difficulty in arranging about picking this year. We gave the pickers one-tenth of the daily pickings. My total cultivation under cotton was 25 per cent. of the whole area; if I got more water I would grow more cotton. So far cotton has been quite a safe crop with me though it is a delicate plant. This was a very bad year for cotton as the rains in some areas spoilt the crop entirely. The average yield this year including what I have given to the pickers is about eight maunds an acre.

760. As to my proposal to buy water by bulk, I am offering the figure the Chief Engineer has worked out as the average which he gets per cusec. It is his own figure but he does not accept it. He wants more. The advantage of this system will be that I could indent for my supply, use it economically and shut it off when I don't want it. It will be an incentive to the economic use of water.

761. My enquiries from a number of people show that they would take thirty to forty per cent. more water for *kharif* if they could get it at a reasonable rate. It will lead to the extension of cotton cultivation. Cotton would then become the principal crop in *kharif* as wheat is in *rabi*. I think there is a certain amount of competition for labour between the harvesting of wheat and the sowing of American cotton. The harvesting of wheat begins about the 12th April and it is just the time when cotton sowings are in progress, though cotton can be sown as early as 15th March but the *rabi* supply in the canals has not been good and the water in March is used to give the last watering to wheat.

762. (Mr. Henderson.) I am cropping wheat and cotton only. I cannot say if the soil is likely to deteriorate. So far as I know, there should not be any reduction in the fertility of the soil, if rotations of crops is properly arranged and the soil is allowed to rest and recuperate. Next year I hope to have a thousand acres under cotton and 500 under wheat and that will allow the other 500 acres a rest for half the season. A quarter of the land is resting now. I am not growing any leguminous crops at present. Later on, I expect I shall have to green manure the land which is resting. In the Punjab, immediately after wheat, the land is ploughed up and cotton is sown and it gives fair yields. It is a very general practice in the Punjab to sow cotton in wheat land. At least thirty per cent. of the *deshi* cotton is sown in this way. I have not tried American cotton in the wheat land, but had nearly five acres under *roseum* cotton and it gave six maunds an acre. I begin the harvesting of wheat by the 12th of April. It takes about twenty days to harvest the crop on five hundred acres, so that harvesting goes on into May. They say the cotton land gives very good yields of wheat and that wheat land is good land for cotton. Cotton land is ready for ploughing in February when it is given a first winter ploughing, then kept fallow and ploughed for wheat in summer. Similarly, wheat land can be ploughed in July for cotton. I cannot say whether it is possible to go on indefinitely on a fixed rotation in this manner. It may be necessary to grow leguminous crops or green manure the land to obtain good results. We get good silt from the canal. I cannot say anything definite about the growing periods of *deshi* and American as I have not grown *deshi*. I like to begin the sowing of American cotton by the 15th March. I consider an average crop of fifteen maunds of wheat to the acre a good crop. I got only ten to thirteen maunds on an average so far, but I was never able to water my wheat crop properly. A crop of ten maunds an acre is not worth growing. I grow wheat on fallow land only at present.

763. (Mr. Ashton.) I have not taken *bhusa* (stalks of wheat) into account. *Bhusa* in an ordinary village away from the railway line, does not bring much profit. It has to be sold at 2½ maunds to the rupee. In the case of a large majority of cultivators it is required for the cattle. I have never suggested that the growing of wheat should be discouraged. Wheat is the main *rabi* crop and the staple food of the people.

764. I cannot say whether cultivators keep their watercourses as clear of silt in the *kharif* as they do in the *rabi*. Of course, if they keep the watercourses clean they can get a better supply. People in the villages are beginning to take a greater interest in these things than before. I think that the supply of water by bulk would be an incentive to keep the watercourses clean.

765. (Mr. Hodgkinson.) I sow my cotton in lines. There are very many people who are doing that now, but it is generally sown broadcast. People are beginning to discover the advantage of interculture. I don't think any compulsion is required to make the people sow their cotton in lines. The inducement of larger yields is the best incentive.

766. I would suggest that the report of the Agricultural Department should be printed in the vernacular so that people may know the results of careful and scientific cultivation of crops. The report is published in English and the people know nothing about it. The report of the results obtained at the Government Farms should be published in the language of the province and distributed free in the villages so that every one could read it.

767. As regards marketing, better arrangements should be made. At present there is no class above "A" which is just cotton that is free from *deshi*. We get no premium for a better class of cotton, in strength, staple, quality and yet if improved cotton is to be grown, superfine cottons ought to get a better price. Marketing is very unsatisfactory. I have no experience of 280 F. 3 F is not such a satisfactory cotton as 4 F.

768. (Mr. Wadia.) The price obtained at the auction at Khanewal was as high as Rs. 23 per maund, which was due to there being good competition. As regards my private auction, the people were not very confident about the success of an auction arranged by a private person. The sellers and purchasers held out for a long time. They were not sure of the success of the experiment. There was practically no competition. The Japanese and Lala Gulzari Mal were the only purchasers. No other buyers turned up. The main thing that kept the buyers away was that railway traffic was closed and there was no place at Iqbalnagar to godown the *kaps*. The auction at Khanewal was a greater success because there is a *mandi* there and purchasers, having confidence in the Agricultural Department, turned up.

769. I cannot work out local prices from the telegrams without the help of the tables published by the Agricultural Department. An eight maund yield of cotton per acre means at current prices something like Rs. 150 an acre, while wheat with an yield of fifteen maunds an acre at Rs. 4 a maund means Rs. 60 per acre.

770. The people of the Punjab prefer to grow wheat because it is the principal *rabi* crop. In *kharif* they grow less paying crops as a matter of habit. It is true in the Central Punjab, people concentrate on *rabi* rather than on *kharif*. Sugarcane, cotton, *juar* and *makki* are the principal *kharif* crops. *Taria*

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is also sown as a *kharif* crop. In the Lower Bari Doab Colony, the people are concentrating on cotton. The proportion of cotton is increasing but it varies from year to year. In a bad year when cotton has failed on account of excessive rain people lose confidence in cotton and grow some other crops.

771. If there were no auction sales, the sellers would be entirely at the mercy of the local purchasers. The seller takes his cart of cotton to the market, where he is met by the *aratyas* who are really acting on behalf of the purchasers and not the sellers. They try to knock the prices down as much as possible and as the villager, who takes his cart load of cotton to the market, has no facilities for storage in the way of godowns, he naturally parts with it at whatever price he can get. If there are too many carts in the bazaar, the prices go down and if there are a few only they go up. The Bombay prices influence local prices only when there is competition; if the *mandi* is full of carts, the level of prices is not allowed to go up. At the auctions there are always three or four large purchasers who are in touch with Bombay market and also the world prices and they bid against each other up to the fullest limit.

772. I have been told that the Bombay market does not want pure American cotton. They want a certain percentage of mixture and so they get it. I do not think mixing improves the look of cotton. In the Canal Colony, one could guarantee pure American without any mixture. The purchaser could reject it if he found the classification wrong. I do not know where mixing takes place but it is quite possible that it is in the ginning and pressing factories. They mix pure American with *deshi* as there is no quotation for pure American in the Bombay market and pure American commands no better price than the slightly impure. The cotton which is sold at the auctions is according to the classifications; class A cotton is pure American without any admixture. American cotton never reaches Bombay in a pure state. It is taken to the ginning factories and gets mixed there. I could give you 7,000 maunds of pure cotton to morrow. The Japanese purchased it at my auction and they are sending it as a special consignment to Japan. Messrs. Tata Sons and Company were the biggest purchasers at cotton auctions this year. To prevent mixing in the ginning factories, I am strongly in favour of co-operative ginning and pressing factories in the Punjab which would belong to the producers in the areas in which pure cotton is produced. The cotton would be ginned and baled and exported straight to the Bombay market. The co-operative banks could provide financing facilities. So far as the producer is concerned, I think the co-operative movement is the only solution. The Agricultural Department might start a pioneer factory till the market for pure American is established.

773. In the small *jangli* villages, the cotton went straight to the *bania*, it did not go to the house of the producer at all. The *bania* stored it for the producer and made advances of money and bought the cotton at rates which he fixed himself often very much below the market price. I do not think that in many places people got as much as Rs. 12 a maund for pure American.

774. The pickers' share came to at least 500 maunds of cotton from my own crop and they sold it at Rs. 12 a maund while I secured an average of Rs. 18 a maund. The pickers are generally women and if they could store their cotton and sell it they could earn much more than they do at present. The picker's share varies from one-sixth to one-tenth of the pickings. It depends on the kind of crop that is being picked. On heavy crops the share is less, on a light crop it is more. I hope to arrange a godown for the pickers to store their cotton and sell it for them with my own. It is quite true that, in many cases, the price, the *bania* will pay for the cotton is fixed by him when making advances even before the cotton is sown.

775. I think the cultivators on the Lower Bari Doab Canal could take fifty per cent. more water than they are taking at present for *kharif*. The canals are so constructed that the minors take the same quantity of water both for *kharif* and *rabi*. If more water in the *kharif* could be let into the canals, there is hardly any doubt that it could be used to great advantage for growing cotton and sugarcane. It would help both crops very much. There are no wells in my district for irrigation purposes. The water level is very low. If the rate for exotic cotton was reduced still further, it would undoubtedly encourage the growth of cotton. The present water rate for wheat is Rs. 5 and for cotton Rs. 4 per acre, as far as I can remember.

Sardar DARSHAN SINGH of Vahali, Deputy Director of Agriculture, Hansi, Punjab.

EXAMINED AT LAHORE, JANUARY 9TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a)—"Deshi" short-staple cotton.

776. (1) Experience.—I have been in charge of the Agricultural Farm for the past three years; and been constantly visiting the districts of Hissar, Rohtak, Karnal and Ferozepur. I was also stationed for a few months at Lyallpur. Besides the above I have, during the period of my studentship, often spent time in the Chenab Colony. During this time, I have been in actual touch with the cotton cultivators and their conditions.

777. (2) Varieties.—The cotton grown is a mixture of the four types, i.e., *Gossypium indicum* and *neglectum*, white and yellow flowered. The longest staple has never exceeded .9 inches in length, and that only in occasional plants of certain varieties; hence I class them all as short-staple.

(2) Distribution—Rohtak and Hissar.—In general the seed is obtained from factories and the cultivator is not particular about the proportion of various types; though he would seem to favour the white flowered varieties. As a rule the yellow flowered *indicum*, forms the major portion of the seed used.

Karnal.—Here the cultivator seems to be more particular in the choice of the seed; and *neglectum* white flowered is the predominating type; and very often one comes across fields of almost purely this type. *Indicum* white flowered comes a good second. Yellow flowered varieties are seldom grown.

Ferozepur.—Cotton is not an important crop in this district only about 5,000 acres being grown in the whole of the district, which are sown with factory seed.

778. (3) Size of holdings.—The area of holdings differs considerably over various tracts according to local conditions. For the Rohtak district, the average holding is shown in the Punjab Gazetteer as containing twelve acres of which ten acres are cultivated. But the average area per shareholder is ten acres, of which eight acres are cultivated. In Hissar, land has been usually plentiful and the distribution of land is on the

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bhaiachara and *pallidari* systems. The holdings on the whole are much larger than Rohtak and a tenant possessing one plough would cultivate from 20 to 25 acres of land under mixed canal and *barani* condition.

(2) A very good idea of the proportion of cotton is gained from the following figures obtained for three fairly large canal distributaries on the Delhi Branches and irrigating a typical cotton tract lying in Karnal district on the border of Rohtak district. The total commanded area of these distributaries is 102,765 acres with a cultivable area of 76,669 acres. The area proposed to be irrigated annually is 37,674 acres. The average irrigation done by these distributaries taken over a period of seven years from 1905-06 to 1911-12 has been 28,058 acres (*kharij* 13,755 and *rabi* 14,303 in acres). The area under cotton for these seven years averages 6,460 acres per *kharij* or 47 per cent. of the total *kharij* irrigation. (The remaining 53 per cent. is made up of 42 per cent. under sugarcane and 11 per cent. under miscellaneous *kharij* crops such as *juar*, rice, etc.)

(3) Analysis of an average plot of one hundred acres in this tract irrigated by canal water is given below :—

<i>Kharij</i> —	
Sugarcane	20.5
Cotton	23
<i>Kharij</i> fodder	2.5
<i>Kharij</i> food	3
	49
<i>Rabi</i> —	
Wheat	39.1
Barley	1.5
Gram	2.0
Other fodder <i>methi</i> crops	8.4
	51.0

(4) It would be safe to assume that in canal irrigated tracts, the cotton cultivation is 23 per cent. of the total area. Figures of various districts over the entire area are given in the statement attached to this note. (Annexure I.)

779. (4) **Yields and profits.**—The results of our crop experiments conducted, for the past two years in typical cultivator's land, with a view to arrive at average yields per acre of cotton in Hissar district are given in the statement attached to this note. (Annexure II.)

(2) In Rohtak and Karnal districts, no actual experiments of this nature were carried out by us; but figures taken from the Gazetteer show that $7\frac{1}{2}$ maunds per acre of cotton is a fair average for irrigated land and three to four maunds an acre on *barani* land. The cultivator's profits will depend on the market prices which he can get. The cotton of this quality has sold at Rs. 4 per maund in 1914, Rs. 8 in 1915, Rs. 9 in 1916 and is now selling between Rs. 12 and Rs. 13. If we apply a rate of Rs. 10 as the future normal rate, the gross income per acre would be Rs. 50 for Hissar district and between Rs. 40 to Rs. 75 for Rohtak district. If we deduct the value of seed, all labour and ploughings, hoeing, watering, picking, etc., at Rs. 25 to Rs. 30, the net profits will be between Rs. 20 to Rs. 25 per acre in Hissar district and Rs. 15 to Rs. 40 in Rohtak. This latter however, appears to be rather high.

780. (5) **Rotations and manures.**—The usual rotation is that cotton follows either wheat or gram after which the land is left fallow till the succeeding *rabi*, when it is again sown with either of the above named food grains, thus :—

Sown in October, cut in April.	Sown in May or June, cut in December.	From December to October of the following year.
Wheat or gram.	Cotton.	Fallow.

(2) Cotton also often follows cotton, the land having either been left fallow for the intermediate period December to May or June) or sometimes a leguminous fodder crop like *methi* being taken, e.g.—

Sown in May or June, cut in December.	Sown in May, cut in December.	December to October.	Sown in October, cut in April.
Cotton.	Cotton.	Fallow.	Wheat or gram.
<i>Senji</i> may be taken here.			

(3) In the Rohtak district, cotton is usually grown after harvest of gram. When it is grown after wheat some farmyard manure is applied if it is available.

(4) In the well irrigated tracts of the Karnal district, the following rotation is usually adopted :—

Wheat.	Cotton.	<i>Methi</i> in standing cotton.	Sugarcane.	Fallow.
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Sugarcane is also sometimes followed by cotton. In certain cases a double crop of sugarcane is taken and in such cases it is heavily manured. The ordinary rotation of—

Wheat	Cotton	Fallow
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is also quite common in the Karnal district.

781. (6) **Comparative returns.**—There are no *deshi* long-stapled cotton grown, nor are exotic cottons grown by the ordinary cultivator. For comparative returns of various *deshi* varieties as well as of American at our farm, please see the statement on valuation attached. (Annexure III.)

(2) Sugarcane and fodder crops are the only other *kharij* irrigated crops. Fodder crops they must grow to provide food for their cattle and the area under sugarcane is already very little in Hissar, besides its being more paying wherever it can be grown.

782. (7) **Conditions affecting increase in area.**—The area under cottons seems to fluctuate much in Hissar and Rohtak. Figures are given in the statement attached to this note. (Annexure I.) In Hissar,

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it is about 75,000 acres, in Rohtak it is about 70,000 acres. The canal supply chiefly controls this factor and timely rain as to what area may be grown with cotton. The grower usually awaits rains for his sowings. The cultivator considers cotton a paying crop. The water supply is the deciding factor as to the area that he can put under cotton. A study of the figures of irrigation on some of the channels mentioned in paragraph 778 shows that in five out of seven years (1905-11) the area under *barani* crop has varied between two to eight per cent. of the total area.

783. (8) **Uses of seed and seed selection.**—As in these districts cattle breeding is widely practised, seed is chiefly used for cattle food, the deficiency in the home supply being made up by importing from outside. Only about two per cent. to three per cent. seed goes back for seed purposes. No oil extraction is done.

(2) Seed selection is not practised at all. There is, however, in some villages of Panipat Tehsil some inclination of sowing white flowered varieties only. In Bhatla village of Hansi Tehsil, people used to go in for selection till a few years back, when they lost their entire standing crop on account of severe hailstorms. Since then they have been purchasing factory seed, and have taken no pains to select.

(3) Hand ginning is practised on a small scale, but not with a view of getting good seed, and merely because to sell cotton and then to buy lint from the factory would be more expensive than to gin one's own cotton at home, and also saves the worry of a double transaction, besides providing the cultivator's wife with occupation for her long winter nights when she usually gins enough to meet her household requirements.

784. (9) **General economic conditions.**—Both in the Hissar and Rohtak districts, the cultivators prefer white flowered varieties to the yellow flowered, and if pure seed was available, they would go in for it. It seems desirable that the Agricultural Department should endeavour to provide them with selected seed of *deshi* acclimatised varieties. There is no doubt, that it might pay a cultivator better to grow American cotton but at present there seem some obvious difficulties in his way.

785. **Difficulties in regard to the introduction of American cotton.** (a) **Rotations.**—As mentioned in paragraph 780, the usual practice is to grow cotton after wheat and this is not off the soil till quite late, sometimes the middle of May even, and thus the sowings of American cotton get much delayed. A cultivator can grow American cotton, only if he either (a) changes his present rotation or (b) sows cotton in fallow land. American cotton in colony areas usually follows *toria* but this crop is at present unknown in this tract. If the crop, were introduced after duly studying other aspects and its economic problems as to whether it would pay the cultivator to grow this at the sacrifice of some other crops he is now growing (because as will be seen from the analysis of a hundred acres of irrigated land given above, he is utilizing all his water either in growing his fodder which is absolutely incumbent on him, or in growing the valuable crops of wheat and cotton), then American cotton would follow a systematic rotation. As the area under sugarcane crop is very little in Hissar, therefore cotton area growing in rotation with this cannot be very large.

(2) (b) **Fallow land.**—The question of growing cotton on fallow land is also a difficult one for the cultivator, because though there is enough land, and the percentage of area at present cultivated would allow of such practice, he usually takes crops from such of his lands as are most handy for him to irrigate, and are nearest to his water outlets. He selects his fields for this purpose and this practice saves him extra expenditure of making and keeping up other *khals*, etc., and the bother of breaking other land, as also being near the water-supply, he can irrigate more. Thus one would often come across an area from which both *rabi* and *kharij* crops are taken, while the same *zamindar* has plenty of other land which has been lying fallow for quite a considerable period of time. To put it in other words, the following difficulties occur in largely breaking up new areas to take up fallow for American cotton :—

1. The allowance of water on the canal in this district is not quite so liberal as in other colony canals.
2. There is not enough tenantry or, to put it in another way, a larger area is required to produce enough crop for supporting him and his family.

The cultivator is thus forced to restrict his cultivation on land lying close to the source of his water-supply even at risk of double cropping. He has therefore very little encouragement to break his fallow land. On the other hand, he finds it much easier to work up his wheat fields after harvesting them. As I have mentioned above, the area dependent on each plough in Hissar district is very large and therefore the cultivator naturally tries to save work. The preparation of land for cotton sowing after the removal of a *rabi* crop is much simpler and requires much less labour. Here he usually gives one to two ploughings and then broadcasts his seed (the land after *rabi* crop is clean, that crop having choked off other weeds, etc.) while if he were to prepare a fallow land, he would have to give many more ploughings, and to prepare his seed bed with a larger amount of labour which, being too lethargic, he is not prepared to put in, besides the land being plentiful, he prefers to sow a larger area expecting that a small return per acre on this would bring him more than a small area with good cultivation.

(3) (c) **Shortage of water.**—The shortage of water has two aspects, viz., (i) the annual permissible irrigation on these canals is less and (ii) out of this there is very little to spare at the time of sowing American cotton. Last watering to wheat is usually given at the end of March and sometimes in the beginning of April while American cotton growers would require their *palewar* (first watering) at about the same time. This clashes with the interests of the standing *rabi* crop which is ready to be harvested and a cultivator cannot sacrifice his wheat crop to irrigate his fields for cotton. The period of drought or shortage in canals experienced during winter months, is not fully over by April and May; this coupled with the cultivator being engaged in harvesting his *rabi* crops, presents quite an unsurmountable difficulty in the way of introduction of American cotton. By June the supply in canals improves, and the cultivator, being more free, begins to sow his *deshi* cotton, which extends well into the time that the monsoon rains break and lend him a helping hand by drenching the soil for him. American cotton also requires its final watering in October and the canal supply in that month again becomes low, as well as water is needed for *rabi* sowings then. In the Karnal district, however, where the area under sugarcane is much larger, cotton mostly follows this crop. There is thus a fair chance of introducing American cotton here, as it can be sown well in time. In canal irrigated tracts, the extent of the area sown would depend on the supply of water. There are, however, already a good number of wells, which show prosperous cultivation and one feels hopeful of embarking on sinking new ones. The spring level is comparatively high, though it differs in the *bangar* and *khadar* tracts. These wells can serve the purpose of supplying water at the critical times. On this consideration also the cultivation of American cotton can be increased.

786. **Necessity for leguminous crops.**—As no manure is applied, and farmyard manure is being chiefly used in manufacturing "*uplas*" (dung cakes for fuel) the encouragement, as far as possible, of growing leguminous crops becomes highly desirable, and Government might well make suitable concessions to this

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end. The question might well be asked that remission of canal rate for green manuring has not resulted in making that system very popular with the cultivator. The ordinary cultivator is too ignorant and his horizon is very limited. He cannot bear to see the loss of his standing crop (which has to be ploughed in for the improvement of his land) which is almost ready to be harvested at the off-chance of getting better produce for his succeeding crop.

(2) The growing of leguminous crops, which even after natural maturing and removal, will leave the soil richer than before, is the obvious solution which gets over the cultivator's objection. Some of these leguminous crops which I propose to suggest for adoption have the added advantage of requiring comparatively less water. These crops will be in addition to the present cropping and do not take their place, and when grown, these will bring profits to the cultivator as a crop, and at the same time enrich the soil. Therefore the growth of these crops will, in themselves, be a source of additional revenue, and such excess receipts may either be waived, at least in early years, to encourage the cultivator adopting them, or a portion of these revenues reduced as allowance or concession.

(3) The following leguminous crops are suggested for adoption as needing less water and being very beneficial :—

1. Indigo, after wheat, sugarcane, or cotton in the fallow land before wheat (this land would otherwise remain fallow and bring nothing to the cultivator or to Government).
2. *Senji* or *methi*— in standing maize or cotton ; before growing sugarcane or cotton.
3. Grams after *juar*, etc., when ordinarily the land would remain fallow.

(4) As these crops will be sown mainly with a view to improve the soil conditions, it would be only right that the areas put under them do not count towards making up the permissible areas to be sown on any system of canals ; it will thus be a direct encouragement for growing them.

(c) Exotic cotton.

787. (20) **Experience.**—In the early part of my service, I spent about nine months in the Chenab Colony where besides the training and observations made at the Agricultural College Farm, Lyallpur, and inspections out in the district, I had great facility in watching and studying the actual field conditions in the large estates of my family in that colony, and this advantage has all along been very helpful to me in making comparison between actual field and farm experiments. In the beginning of 1915, when the Montgomery district formed a part of the Hansi agricultural circle, I had to distribute the seed of American cotton (4F) for the first sowings made in this colony and it is a happy result to see that it has proved such a great success ; more than was considered to be possible in so short a time.

788. (21) **Varieties.**—The exotic cotton now grown is chiefly 4F American. Before this Dharwar cotton commonly known as *narma*, was in favour.

789. (22) **Size of holdings.**—Each tenant with one plough as a rule cultivates about half a square, i.e., about 12½ to 13.9 acres. Where soil conditions and canal supply are particularly favourable, a tenant has enough to do on a small area of ten acres. Such a tenant generally has 2½ acres under cotton.

790. (23) **Comparative returns.**—The profits per acre of American as well as other varieties vary a good deal, depending upon season conditions. If, for instance, frost sets in early, and the late fruit of the crop is lost, the profits will be greatly reduced, and unfortunately American cotton suffers from this much more than the *deshi* does, as it fruits later. On the other hand, if heavy rains or east wind start at the time of flowering of *deshi* cotton, this crop suffers to a larger extent than does the crop of American cotton. The reason for this is that in the case of *deshi* cotton, almost all flowering is confined to a very short period of time, which in the case of American cotton extends over a considerable period. The prevalence of these adverse conditions, therefore, affects the latter less than it does the former.

(2) The average yield of American cotton per acre for a fairly good crop may be taken at seven to eight maunds per acre. Allowing Rs. 15 per maund as normal future rate, this would work out to Rs. 105 to Rs. 120 an acre. The average yield of *deshi* cotton may be taken at seven to eight maunds and allowing a rate of Rs. 10 as normal for the future, this would give Rs. 70 to 80 per acre. After deducting from these figures of gross produce value, the cost of growing the crop, which may be taken at Rs. 35 to Rs. 40 per acre, the net income will be between Rs. 35 to 45 for *deshi* and between Rs. 70 to Rs. 80 for American.

791. (24) **Rotations and manures.**—In the canal colony, cotton follows chiefly *toria* and also sugarcane to a small extent. It also follows *senji* or *methi* that has been sown in a standing maize crop. It seldom follows wheat or gram, because as said before, it becomes too late for sowing American cotton by the time that wheat harvesting is finished. In such cases the cotton sown would be any of the *deshi* varieties, *Mullani* or *sanguineum* being at present preferred in the colony. It may here be added that, whenever sowing is to be done after wheat, only *deshi* cotton can be grown, and hence it is necessary for our department to make the seed of selected *deshi* variety available to the cultivator, alongside with the American seed.

792. (25) **Conditions affecting increase in area.**—It would seem feasible that a working plan could be adopted to increase the area under American cotton by securing that the allowance of periodical supply in various canal systems be increased in case of those where American cotton sowing has been fairly established. The distribution of supplies will be fairly elastic, so that the backward canal gets its enhanced requirements when people begin to appreciate the advantage of growing American cotton there.

(2) In summer, the rivers have usually more water in them than the requirements of the canals. The outlets are designed to suit the winter supply, and if more water is available in summer, some method should be devised to take full advantage of the opportunity and as far as possible efforts should be made to make the maximum supply of water available to the *zamindar*.

793. (26) **Suitability of existing varieties.**—So far as we know, 4F American has been very successful in the Canal Colonies but there is little doubt there is a great scope for further improvements. For instance the lint of 280F given out by the Economic Botanist is of greater value per maund. Instances are not wanting already which indicate that the staple of American cotton 4F is likely to deteriorate tremendously in the cultivators' lands. It is therefore necessary to give more regard to selection of seed.

794. (27) **Prevention of mixing of different varieties.**—To avoid mixture in field and factory and to keep up the vitality of the seed, the Department should give out a certain amount of fresh seed every year, to so many mother seed farms where it can be multiplied on a much larger area. Here the Agricultural Assistant of the Department should go and weed out any foreign plants. Such cotton should be ginned under the departmental control and if possible at Department's own ginneries ; and then the seed should be distributed to the cultivators for the next year's sowings. Thus it would be possible to provide fresh

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seed from the agricultural station to these mother seed farms every year which, in the third succeeding crop will be available for the cultivator's use, and he will get a seed of good vitality and free of mixture. This process will soon become continuous and the supply of fresh seed steady.

795. (28) **Importation of seed.**—Experiments made at Lyallpur farm have shown that direct seed from America can be of no use, as until the seed is properly acclimatised we cannot give it out with any safety. At the Lyallpur farm in the Economic Botanist's sections, plants of certain varieties from fresh seed imported this year, growing side by side with the plants of the same varieties from seed imported a few years back present a very striking contrast, and go a good way to prove that unless seed is acclimatised, it will not do to extend it. And the distribution of such unacclimatised and directly imported seed cannot be done with any confidence ; and it will be very unfortunate if the adoption of such system were to result in any antipathy of the cultivator and a loss to the country's produce. However it is important that the Department should from time to time import fresh seed and acclimatise it, selections from which after several years' trials will suit the country's requirements.

II.—COMMERCIAL ASPECT.

796. (30) **Local trade customs.**—In the Hissar district, the cultivator brings his cotton to the town and sells it to the *banias* who in turn sell it to the factories. Very few cultivators deal with factories direct. The *bania* purchases the cotton right off, pays the cultivator the price in cash or credits it to his account (it the cultivator is the debtor of the *bania*) and then sells the cotton to the factories himself making a profit of eight annas to a rupee per maund in the bargain. Towards Hansi side, usually no money is advanced by the factories. In the Rohtak district, however, at about the time when the bolls begin to open in September or October, an advance of eight annas to a rupee per maund is often made by the factories as earnest money, with the promise, that the cultivator will sell so much cotton to them. In the Panipat and Gohana (the produce of this *tehsil* being also consumed in Panipat) *Tehsils* the factories sometime advance to cultivators in September or October the entire price of the cotton he stipulates to sell. But in these transactions, the rate is usually less by about one rupee per maund. No other future buying or stipulating is done by the cultivators. The *banias* or other business people go in for speculative transactions.

797. (35) **Publication of Liverpool and Bombay prices.**—The publication of prices at the up-country markets will help the cultivator a great deal, as there would be less chances of his being deceived. But there are still other difficulties to be overcome in this connection. For, even with the prices posted, it is possible that a buyer may force the hands of a cultivator seller at his own rates.

IV.—MANUFACTURE.

798. (36) **Type and number of gins and presses.**—In most of the factories Platt's gins, either single or double rollers, are used, single roller being more common.

799. (37) **Size of bale.**—The size of bales produced at Hansi is 18" × 18" × 50", the weight being 392 lbs. per bale, i.e., ninety cubic feet per ton.

VI.—IRRIGATION.

800. (51) **Wheat versus cotton.**—In the Hissar tract, with its large herds of cattle and need for fodder, the cultivator, though he thinks cotton a very good and paying crop, regards it more of a speculation than wheat, because even if wheat fails, he will get some grain and fodder, but in case of failure of cotton, he is quite undone. He cannot then even pay off his rents and water rate. Cotton is besides more liable to be damaged by natural calamities and seasonal effects than wheat is.

801. (52) (a) **Critical period in regard to water supply.**—The critical period in regard to the water supply on the Western Jumna Canal is in April and May and then October. Usually three to four waterings are given to cotton, very seldom if ever so many as five. More often the cultivator cannot afford to give more than three.

802. (52) (b) **Watering of cotton.**—The water consumed at the first watering is much more, say, five to six inches. The remaining two to three waterings are about four inches each. Thus about fourteen to eighteen inches of canal water is given, i.e., 1,400 to 1,800 tons per acre, the first watering being given at the end of May or beginning of June, the second in August and the third or last late in September.

ANNEXURE I.

Area under cotton in the Hansi Circle.

Name of district.	Year.	Area cropped in acres.	Cotton in acres.
Hissar	1906-07	2,508,153	85,110
	1907-08	2,242,430	104,137
	1908-09	2,569,794	67,270
	1909-10	2,453,158	71,532
	1910-11	1,956,911	64,774
	1911-12	1,064,740	74,886
	1912-13	1,566,696	46,037
	1913-14	1,216,906	84,831
	1914-15	2,498,582	73,291
	1915-16	3,981,957	43,731

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Area under cotton in the Hansi Circle.—contd.

Name of district.	Year.	Area cropped in ares.	Cotton in acres.
Rohtak	1906-07	1,013,237	89,004
	1907-08	262,017	94,191
	1908-09	757,241	72,547
	1909-10	983,631	103,050
	1910-11	970,362	72,317
	1911-12	875,607	37,442
	1912-13	339,202	61,190
	1913-14	531,175	109,587
Karnal	1914-15	1,291,197	71,666
	1915-16	577,684	29,061
	1906-07	1,071,072	85,951
	1907-08	473,682	79,833
	1908-09	815,926	71,075
	1909-10	1,019,759	81,880
	1910-11	1,065,216	67,452
	*1912-13	975,892	59,874
	1913-14	557,513	78,710
	1914-15	1,072,814	58,714
	1915-16	656,831	29,262

* Figures for Karnal district from year 1912-13 to year 1915-16 are excluding figures for *Kharaba* (i.e. area on which the crop failed to mature).

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ANNEXURE II.

Statement of Results of Crop Experiments for season 1915-16.

Serial No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Assessment Circle.	Chak Nahri No Had last 130	Sorkhi (Hansi Tahsil)	Pali (Hansi Tahsil)	Do.	5	6	7	8	9	10	11	12	13	14	15	16
Kind of crop.	Cotton	Cotton Nahri	Do.	Do.	Area sown with the crop.	Class of irrigation.	Status and resources of cultivator.	Detail of cultivation in three preceding seasons.	Detail of manure, water, and date of ploughing in present crop.	Name and rank of officer making the experiment.	Area cut.	Grain.	Straw.	Grain.	Straw.	REMARKS.
1	Nahri	Narnand (Hansi Tahsil)			Big. 4 Bis 17	Canal irrigation.	Ordinary cultivator good bullocks and own land; Jat by caste.	<i>Mulla Choti</i> Cotton, Wheat, Fallow.	Farm yard manure 200 mds. per acre. 10 ploughings after sowing 3 hoeings.	S. Darshan Singh, D.D.A. Hansi, 12-16 15 to 22-15 15.	Big. Bis. 0 15	Sr. ch. 0 9 Lint.	Seed Sr. ch. 21 5	Lint. Sr. ch. 61 6	Seed Sr. ch. 136 5	Crop average. The land was meant for sugarcane, which was not growing owing to want of rains. (Crop suffered from drought.
4	Chak Nahri	Sorkhi (Hansi Tahsil)			10 14	Nahri	Cultivator a Lambardar; No. of cattle 5; Family men 609; bishas. 1500; bishas; not in debt. Jat by caste.	Fallow, Wheat, Fallow, Cotton.	No manure; 4 ploughings before sowing 4 hoeings, 3 waterings.	Galendar Singh, Acting Assistant 8-12-16.	1 7	21 0 Lint.	Mds. Sr. ch. 1 33 8 Cotton seed.	Mds. Sr. ch. 34 11 Lint.	Mds. Sr. ch. 32 15 Cotton seed.	Neither late crop; clay soil; no drainage; season suitable.
5	Do.	Pali (Hansi Tahsil)			5 14	Do.	Ordinary cultivator; No. of cattle 8; No. of family members 5; cultivates about 90 bishas of land; in debt; Mali by caste.	Wheat, Chari, Fallow, Fallow, Fallow.	100 mds. of Farm Yard manure, 3 waterings, 2 ploughings, 3 hoeings.	Do. 2-2-16	1 8	34 8 Lint.	Mds. Sr. ch. 1 33 8 Cotton seed.	Mds. Sr. ch. 34 11 Lint.	Mds. Sr. ch. 6 11 12 Cotton seed.	Good, loam soil early sown; rains favourable, the crop was good; yields above average.

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ANNEXURE III.

Statement showing valuation of lint of cotton grown at Hansi Agricultural Station in 1916.

Serial No.	Name of Variety.	Weight of cotton.	Weight of lint.	Percentage of lint to cotton.	Valuation of cotton lint per maund.	Net amount.
		Md. srs. chs.	Mds. srs. chs.		Rs. A. P.	Rs. A. P.
1	Neglectum white flowered Bh. S.	11 10 8	3 37 4	34.9	31 10 0	124 5 3
2	Neglectum yellow flowered Bh. S.	8 19 1	2 27 12	31.8	31 2 0	83 13 6
3	Indicum white flowered Bh. S.	10 34 10	3 38 2	35.09	30 6 0	120 1 2
4	Indicum yellow flowered Bh. S.	6 10 3½	2 3 4	33.3	30 10 0	63 11 9
5	Local Bhatla	10 35 5½	3 24 4	33.08	30 2 0	108 10 0
6	Indicum 135A	7 17 0	2 4 15	28.6	32 2 0	67 11 5
7	Roseum 87.	8 39 10½	3 2 10	34.1	31 10 0	96 15 2
8	Mollisoni 24	7 3 4	2 21 1	35.7	32 0 0	80 13 7
9	Roseum 132	10 25 1	3 36 6	36.8	31 2 0	121 10 10
10	4F	8 8 15½	2 27 4	32.6	37 10 0	100 14 1
11	280F	9 36 13	3 14 2	33.8	41 10 0	139 9 1
12	161 AF	5 3 1	1 24 15	32.0	41 10 0	67 9 3
13	275 F	8 8 15	2 28 8	33.0	39 10 0	107 7 8

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803. (Mr. Roberts.) American cotton has done very well whenever it was grown in time and properly cultivated, but it is rather difficult to sow American cotton early in my districts, owing to the various reasons I have mentioned in my written evidence. It did very well on the farm and sometimes gave very good outturns—from twelve to thirteen maunds. We have tried it with the *zamindars* for two years. The first year it did not do very well for the reason that it was not sown in time. In the second year, the trial was more complete. There were difficulties as to irrigation in time last year. Near Jhind at Rajthal the water supply was pretty good but the outturns were not so good as those of *deshi*. I think, in all cases, the *zamindars* sowed American cotton after gram or wheat. Lack of land is not a difficulty in regard to sowing in time. The chief rotation is cotton after wheat and that accounts for cotton being sown late. If it is sown in fallow lands, the cultivators have to go to longer distances and probably have to irrigate the land as well and the canal supply is very limited. They like to irrigate, as far as possible, the lands nearest the outlets. Again the cultivators are not so active as in the canal colonies and the preparation of land after wheat is much simpler. They can therefore put more land under cotton than would be possible if they were to prepare fallow land with the same amount of labour. They sow their *deshi* cotton very late, until June, and sow on until the monsoon breaks so that part of the irrigation is done by the natural rains that come about that time. Thus all these things combined result in more favourable conditions for *deshi*. If they were to sow American cotton, they would not be able to sow the same large area under American as they are at present doing with *deshi*. The competing crop against irrigated American cotton sown in early April would be wheat for which the last watering comes about the end of March. The deficiency of canal water supply that is experienced during the winter is not quite over until the middle of May. There are three canals and each canal only gets supplies for ten days during the month so that those people who cannot get water at the beginning of March will have to wait till their turn comes. It might be quite late in March or in the beginning of April. If they get their turn from 10th March to 20th March, they won't get another turn until the 10th to 20th April. If they get water at the end of April, they begin to prepare the land for *deshi* cotton and sugarcane. They begin to sow sugarcane as soon as they get water. If they can get water early enough, they sow it in March. I should not say that sugarcane competes against cotton in Hissar because the area under sugarcane is very small. It is greater in Karnal and much greater in Rohtak. My experience is that there is no water for American cotton. Lack of water supply is the only reason against it.

804. We did not give out any American cotton in my districts this year except to two *zamindars*, one in the Rohtak district and the other in Karnal. Both of them got very poor returns. It was not more than a maund an acre. In the case of *deshi* cotton, they got two maunds to the acre. I have not got the exact figures for the farm but the average was about 26 seers. I have never been able to obtain the proper premium for American cotton. The highest premium obtained was Rs. 1-8. If we got a premium of Rs. 4 to Rs. 5, I think that it would have a good effect upon its cultivation. I do not think that there are any natural disabilities about American cotton. Frost affects it a good deal because it fruits quite late. If it suits the canal colony, I do not see why it should not suit us in Haryana. A certain amount of persistence with the experiments is necessary. I do not think that leaf roller affects the yields very much.

805. (Mr. Henderson.) The yield of cotton in the Hissar District is fair. Our crop experiments show that it is, on an average, five maunds an acre on *zamindars'* land, but there are villages in which it is much higher, for instance the villages of Bhatla and Narnaud which are famous for cotton, where some of the best

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zamindars go up to an average of ten, eleven or twelve maunds. The maximum outturn so far on our farm of Bhatla cotton was about fourteen maunds per acre. The district average is about five to six maunds but as a matter of fact the pool returns show a little less, but that is probably because some of the cotton is ginned at home and does not come to the factories. The average yield for wheat in Hissar district in the irrigated tracts is about fourteen to sixteen maunds on an average. The two main crops are cotton and wheat. Hissar is one of the very oldest districts. I have not formed any opinion as to whether the yields are going down. The average is fair but it does not compare very favourably with that in the new canal colonies. I think the land in the colonies is of a different type and that the *zamindars* there are much more active than they are in the Hissar district. The *zamindari* conditions of the Hissar district are very backward. They have not got so much capital to put in their land so that their labour and implements are not up-to-date. There are indications to show that the land has been gradually deteriorating under cotton and wheat, but I have not sufficient experience to give a definite opinion.

806. I have carried out experiments with green manure crops in the case of wheat and sugarcane but not in that of cotton. We are not certain enough about this to make recommendations to the *zamindars*. I have been trying to find the effects of different rotations. I have tried cotton, fallow, wheat, fallow. The disadvantage of this is that it gives only two crops in three years, otherwise American cotton could come in very suitably indeed in this rotation. It gives plenty of time for preparation of land for the cotton crop. Another rotation tried in Karnal is wheat, then cotton, then a catch leguminous crop and after that, sugarcane. The third rotation I have started is cotton and after it a green leguminous crop of *guar* and then, after that, cotton. I have not been long enough at this but I am going to carry it out. I am going to cut the *guar* and feed the cattle on the grain. I have not considered the possibility of feeding the cattle on the land on which green fodder is grown after removing the crop.

807. (President.) On account of this abnormal year, the results obtained on the Hansi farm have proved nothing in regard to American cotton. The farm was swamped this year. The farm has only just been started. Everything is in the initial stage and we have not begun the distribution of seed of 4F. I gave some out in the first two years to a few interested *zamindars* to try on a couple of acres each, but the results were not very encouraging and I decided not to go on with it until I got some definite results on the farm. If it proved a success, the probable area on which we should be able to introduce it in Hansi would depend upon the irrigation that is available. At present as I have mentioned, people sometimes wait till the monsoon breaks to sow their cotton and part of the land is probably partly irrigated and partly dependent upon *barani* (rain) conditions. Again the area sown is greater because the cultivation which has to be done is less owing to the land being pretty clean after wheat. If they had to cultivate fallow land, I think the area would go down tremendously unless of course they grew partly *deshi* and partly American. If American only were grown, I do not think we should have the same large area as there is at present under *deshi*. All the cotton seed is fed to cattle in Hissar as it is a cattle district. As a matter of fact, more seed has to be imported from outside as the produce of the district is not quite enough for home consumption. I have considered the reasons for the excessive popularity of wheat very often. The *zamindar* considers that if cotton fails, he will not get any produce but if wheat fails, he will probably still get a fair amount of *bhusa* (fodder from the stalks), and Hissar being a cattle producing district, he prefers wheat for this reason.

808. (Mr. Wadia.) The pool figures that I mentioned just now are not very complete. I got them from the Hansi ginning factories. According to them, the output of *deshi* cotton from the factories was in:—

	Maunds.
1908-09	119,000
1909-10	434,000
1910-11	271,000
1911-12	151,000
1912-13	254,000
1913-14	400,000
1914-15	291,000
1915-16	158,000

The total for eight years was therefore two million seventy eight thousand maunds which gives an average of 261,000 maunds. On an average acreage of 70,000 acres, this works out to 3.7 maunds to an acre. Though there was a big drop in 1915-16, I do not think that the acreage dropped very much. I have no experience of the working of the pools in my districts.

809. As regards the system of advances mentioned in my written evidence, this is more common in Rohtak than in Hansi itself. At the time the advance is made, the price to be paid for the cotton is not fixed, but it is made a condition that the *zamindar* shall sell so much cotton to the *bania* according to the acreage he is growing and the prices are fixed later according to the rates prevailing at the time. The cultivator does not get the proper price. He wants money to pay the land revenue assessment and so has to sell his cotton at less than the full price. The co-operative movement ought to help him in getting out of this difficulty. In Hissar except in the Sirsa Tahsil, there are not many villages which have co-operative credit societies. There is plenty of scope for increase in co-operative societies in the Hissar district.

810. The view stated in my written evidence in regard to the deterioration of the length of the staple of 4F in cultivator's lands is based on personal observation. I have seen the cotton growing on land in my father's estate. I have also attended some sales in Montgomery lately and I find that the length of staple is not the same in all cases. The difference is due to salt conditions in soil and to bad cultivation. There is no sowing in lines in Hissar; it is all broadcast.

811. (Mr. Hodgkinson.) The valuation of the lint of 280F last year was about Rs. 4 per maund above that of 4F. We only grew 280F last year and sent it for valuation whereas we have been growing 4F since we started the farm. On an average, the staple of 280F is .2 inch more than that of 4F. The staple of 4F is from .9 inch to 1.1 inch and that of 280F is from 1.1 inch to 1.3 inch.

812. (Mr. Ashton.) I do not think that the statement that there is plenty of labour available in Hissar is correct. There would be difficulties in having the two operations, i.e., the harvesting of wheat and the sowing of cotton going on at the same time.

813. (President.) Whenever cultivation is not given properly to American cotton, the staple deteriorates. I have noticed it in Lyallpur district and also at the sales in Montgomery. The staple has gone down in certain cases. I do not think it has gone down to .7 or .8 inch.

Punjab.]

Mr. R. D. THOMSON, I.C.S.

Mr. R. D. THOMSON, I.C.S., Colonization Officer, Lower Bari Doab Canal Colony, Montgomery.

EXAMINED AT LAHORE, JANUARY 9TH, 1918.

Written statement.

814. (20) Experience.—I regret that I am not in a position to give to the Committee such full and definite evidence as they may desire. I may explain that such evidence as I give concerns the area known as the Lower Bari Doab Colony, and that this colony is a very new one. I was posted to it in the end of 1913, and there was then practically no cultivation of any kind in the colony area; and from April 1916 until May 1917, I was not in India.

815. Prospects of cotton in the Lower Bari Doab Colony.—The original programme contemplated an area of about a million acres being brought under cultivation, but, for reasons which I need not specify, this total will probably not be reached; and at present the colony is very far from being fully developed. When however, it becomes fully developed there may perhaps be some 700,000 acres of allotted land, on a fairly conservative estimate. Most of this land is and will be well suited to the cultivation of cotton; variations of quality of the soil and of irrigational facilities there must be, but, speaking broadly, the conditions of climate and soil should generally favour the cultivation of cotton. Not all of this allotted area will be available, however, for cultivation; there are certain areas such as the irrigated plantations or the cattle farms where there can be no cultivation or only restricted cultivation, and the basis of the scheme of the distribution of canal water is that only 66 per cent. of the allotted land can claim irrigation. Further, of this percentage two-fifths are to be watered in the *kharif* or summer season and three-fifths in the *rabi* or winter season. Thus allowing for, say, 660,000 acres of cultivated land only some two-thirds of that area will be irrigated in the year, i.e., about 440,000 acres; and of this area, only some 176,000 acres will be under summer crops.

(2) What proportion of this area will be under cotton it is not easy to suggest, for, in a colony especially, the price obtainable for any crop is the chief determining factor. The greater extent of cotton cultivation this summer (1917) has been due without doubt to the good prices realized by cotton, and more especially by the long staple American cotton, or, as the colonist commonly terms it, *narma*. [The figures this year of acres sown are 80,000 acres of *narma* and 50,000 acres of *deshi*.] The question may be considered in another way; the average or standard holding is one of 25 acres. There are plenty of exceptions to this statement, as, for instance, the oat hay farm of 20,000 acres and the village menial's plot of two acres, but roughly speaking 25 acres represent the size of the average holding. Of this holding some sixteen or seventeen acres should receive irrigation, six or seven in the summer and nine or ten in the winter. Of the seven acres irrigated in the summer, as large an area as possible, while the market prices remain good, will be under cotton; not all long staple *narma* though, for the *zamindar* often prefers to grow some *deshi* short-staple cotton. The reasons are that (i) *deshi* need not be sown so exactly at the right moment as *narma* has to be; (ii) *deshi* is said to need less water; (iii) *deshi* produces more maunds of *kapas* to the acre; (iv) *deshi* is easier picked, and (v) is more easily treated by the existing methods and implements. Thus of the seven acres, prices remaining good, perhaps five would be under cotton (four *narma* and one *deshi*), and two under fodder crops with a little maize or perhaps sugarcane. But probably, unless some unforeseen trouble occurs, the proportion under *deshi* will sink and that under *narma* will rise; for, once again, the price is the governing factor, and if *narma* continues to fetch three or four rupees more per maund than *deshi*, then more *narma* will be cultivated; and the *zamindar* will forget the advantages attaching to *deshi* which he at present remembers.

(3) Thus the proportion of a holding under cotton is governed by the prices obtainable for cotton and by the irrigational considerations mentioned above. It may be worth while to revert for a moment to the latter, and to point out that though three-fifths of the area irrigated are supposed to be irrigated in the winter (chiefly, I believe, because a given amount of water can do more irrigation or at any rate produce more matured acreage in the cold weather than in the hot), and though the Punjabi tends, I think, to regard the wheat crop as the crop of the year yet in this colony the water charge for wheat is higher than it is elsewhere (Rs. 5 per acre), and that hitherto (it is too early to speak about the conditions of the present winter 1917-18) the supply of water in the winter in this colony has not been what was expected and desired; thus it might be possible even yet to take advantage of the favourable position afforded by present prices of cotton and to alter the supplies so as to allow a higher proportion of water in the *kharif* than in the *rabi*. I have not consulted the irrigation authorities as to the possibility of such an alteration, but if it be possible, then this is the time to make the change. Whether the colonist would approve, it is hard to say; the smaller man probably would not, the bigger man might.

(4) Again, it is not easy to quote figures of outturn per acre; the land varies much in quality and is still so to speak virgin soil, and irrigational advantages are greater in some quarters than in others. One grantee who did not cultivate or reside on his land himself told me he had got on an average ten maunds per acre of *narma* and regarded that result as gratifying. Thus if the soil be good, irrigation (and rain) favourable and the grantee cultivates himself, probably for another year or two he would get twelve maunds per acre of *kapas narma*; but where other conditions prevailed, he probably would not obtain much more than five maunds per acre. In future years too, as the soil grows older, yields will sink somewhat, though some of the lands which now give low returns will perhaps improve. Thus it would perhaps be fair to take an average yield as one of seven maunds *kapas* to the acre; this refers to American long-staple or *narma*. The yield of *deshi* short-staple is probably higher; I have made no experiments and simply state what cultivators have told me, on which authority the average yield of *deshi* short-staple might be quoted at eight maunds *kapas* per acre. This result, if it be correct, naturally reduces the apparently higher profit obtainable on *narma*. Moreover for some years to come, unless the restoration of peace makes a very sudden difference, the shortage of labour in the more distant parts of the colony is bound to affect the profit made; for instance, in some more distant villages early in November, I found that there was actually no one to pick the cotton, and that in some cases the remuneration offered to the picker was one-fourth instead of the more usual one-tenth share. But regarding such a phenomenon as a distinctly temporary one it is fair to say, I think, that at present prices there is no *kharif* crop to touch *narma* as a profit producer, unless it be sugarcane. But cane needs good soil, good water and careful attention even more perhaps than the *narma* does; and I doubt whether the climate and country are really suited to it.

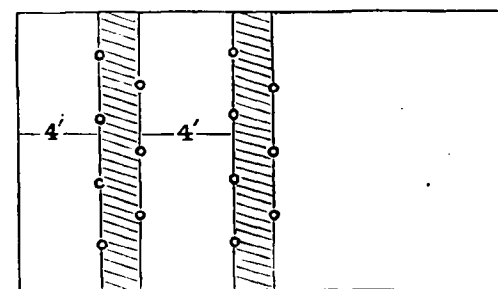
Punjab.]

Mr. R. D. THOMSON, I.C.S.

[Continued.]

(5) In this colony, it is too early still to attempt to generalize about rotations and manures; the average cultivator does not, I fancy, think about them much yet. But he has begun to think about the desirability of having pure selected seed if possible; and most would now prefer to obtain the Agricultural Department's seed, and will only buy the local shopkeeper's American seed when they cannot obtain the former. And I am of opinion that the best plan is for Government to sell pure seed in increasing quantities through the Agricultural Department. The average cultivator here is not as a rule energetic enough or skilled enough to maintain a high standard of purity. (I may mention perhaps that a representative of a big firm told me that when it came to ginning the American *kapas* sold at auction as containing not more than one per cent. *deshi* admixture and classified as such by the Agricultural Department it showed admixture sometimes as high as twelve per cent.) There is too, I believe, a danger, that unless it is carefully watched, the American long-staple variety may tend to deteriorate and approximate more and more to *deshi*. I have no experience of such deterioration and merely write from hearsay. But should there in fact be such a danger it is all the more desirable that the issue of seed should be as far as possible in the hands of those who have the knowledge, i.e., of the Agricultural Department. For the same reason, I should incline to the view that it was preferable to rely upon standardized and acclimatized seed grown in India rather than on seed imported from America or Egypt. Such seed might do well in favourable soil or under other favourable circumstances or in the hands of experts, when the average cultivator would never get the same result. But I would not for this reason have experiments cease. I believe that the best long-staple Indian cotton is never classed as better than middling American, and it yet remains to produce an *Indian grown* seed which will produce better results. To prevent possible mixing in the field, the only way is to show that it pays not to mix; and probably the cotton auctions now held by the Agricultural Department afford the best proof of the value of purity. But it would, I think, be well to have more of such auctions, if that be possible. The prevention of mixing in the factory is a separate problem about which I have no knowledge.

816. Possibility of saving water.—It has been suggested to me that with existing supplies of canal water



it might be possible to save water and so increase the area under cultivation by growing the cotton in twin lines, i.e., by digging a series of little water courses and planting the cotton on either bank of the water course vide the sketch in the margin. In this way, the only parts of, say, a one-acre field needing irrigation would be the channels (shaded in the sketch) which would be about one foot broad and perhaps nine inches deep; and I asked the Agricultural Assistant, if he approved, to try this method on the seed farm at Montgomery and discover whether he could thus on the same allowance of water grow an increased area and secure an increased yield.

Mr. R. D. THOMSON, I.C.S., called and examined.

817. (Mr. Robert's.) In the Colonies, the general opinion is in favour of American cotton. The *zamindar* prefers American cotton because it fetches him more. It entirely depends upon the profits that he gets. It is the opinion of some *zamindars* that the outturn of *deshi* is greater. There have been no experiments on the point made in the colony. In this bad year of excessive rain, American has done better than *deshi*. In the Colony, the amount of cotton grown per square may vary a great deal. That is due to the fact that the colony is not fully developed. In one case, a man holding only a rectangle had seventeen out of 25 acres growing nothing but cotton. That was, of course, a special case. The man held the land under temporary cultivation and had put in as much cotton as he could. I see no objection to a high proportion of cotton if water is available. I would not object to a man putting eight or nine *killas* under cotton as compared with four which is the average in the Lyallpur district. It is simply a question of rupees, annas and pias. As long as the cultivator gets his price, he has no objection. He has no special preference for wheat. If he put eight or nine *killas* under cotton, that would leave him enough wheat land for his needs. There would be no tendency to do away with wheat altogether. I think the Punjabi will always grow wheat if he gets a chance but at present prices, he will try to get a little more land under cotton. There was a slump in cotton prices in 1914, and it was in 1915-16 that a big recovery began. If the supply of water in the Lower Bari Doab Canal is large in the summer and comparatively small in winter, the tendency will be, as far as area is concerned, to grow a lot of cotton and comparatively little wheat; in fact the Lower Bari Doab will be a cotton colony as Lyallpur is a wheat colony. I do not think that at the present moment the people would object to that system of cropping although, of course, they will always want to have good wheat crops, with a little surplus for sale.

818. As to the question of increasing the cropping per rectangle, that is a matter for the Irrigation Department. The amount of water Government proposes to give is enough to mature the crops on two-thirds of the land each year, of which two-fifths would be in *kharif* and three-fifths in *rabi*. I do not think it matters much now if you increase the cultivation to one hundred per cent. The land, such as it is, is virgin soil and full of natural fertility on the reverse. Later on, I do not know whether it would be a sound thing to crop a hundred per cent. At present manure is hardly used at all.

819. As time goes on, you may get water logging in the lower parts. The colony has a steep bank especially marked in the south, and it is conceivable that water logging may increase as years go in the area below this bank if you have excessive cropping, i.e., one hundred per cent. That would tend to aggravate it, but it is really a question of irrigation policy.

820. The help of the Colonization Department in regard to seed distribution has been given in a very informal way. We get the Tahsildar and selected men who are keen on the business and get them to guarantee to give out so much seed, keep the accounts for it and collect the money. Judging from what I have seen hitherto, I do not think that help given by these *zamindars* and leading men who are interested is very extensive. In a new colony, Government assistance is essential as you cannot rely on other agents such as shopkeepers at present. Most of the shopkeepers are out for money. I do not think you can use them or trust them yet. The present organization is very informal. It is very difficult to find out who can help and who cannot. Some give real help and others only nominal. It is very difficult to get anything done far away from the railway. The agency of the irrigation staff is the most promising in this tract. They have

Punjab.] The Hon'ble Mr. MAYNARD, C.S.I., I.C.S. and the Hon'ble Mr. FAGAN, C.S.I., I.C.S.,

bungalows all over the place, and fairly *pukka* places in which seed could be stored. The Sub-overseer or the Sub-Divisional Officer could easily be employed for the purpose of seed distribution. The difficulty is that unless you have a special man touring round like the Sub-Assistant Surgeons who distribute quinine and drugs, the work of distribution of seed cannot be satisfactorily done. I am speaking of the early days. As the seed becomes more popular, people will try to keep their own private seed supply and some have already begun to do so.

821. I think that the auction sales have been of material help. I was talking only yesterday to a man from Khanewal where there have been no Agricultural Department auction sales. At present there is no ginning factory and he was saying, rightly or wrongly, that the people there were not getting nearly as good a price as elsewhere. They cannot send their cotton away as the goods traffic has all been stopped by the railway authorities. The cotton is bought locally and as the *zamindar* wants money, especially about the time the revenue falls due, he sells it at whatever price he can get. I have not got any record of the actual price at which he has been selling but think it is quoted generally at Rs. 16 or Rs. 17 when he should get about Rs. 20 or at any rate, Rs. 18 or Rs. 19 per maund.

822. I have not seen the system of posting of prices in the *mandis* actually working yet. I have heard varying accounts about it, i.e., that sometimes the telegram is held up by the telegraph master and so on if the prices have gone up too much. I think it is very desirable to have some such system to keep the people in touch with outside prices. It is a very sound thing and local opinion supports the plan.

823. It would be a good thing if auctions could be organised by the people themselves, if this could be done. I have heard accounts of the private auction that was held at Iqbalnagar. I heard that Sardar Jogen-dra Singh got very good prices. Some people are inclined to say that unless you have a Government assessor to settle disputes and determine classes of cotton the auctions are not likely to be satisfactory. You want an impartial arbitrator.

824. The total area under cotton last year was 130,000 acres, viz., 80,000 acres of American and 50,000 acres of *deshi*. It is almost certain to be bigger this year but I do not know whether it will be as big as 160,000 acres. It all depends on the people getting seed. Even if they can get seed, 120,000 acres is rather a generous estimate for the area under American. 100,000 acres would be about right. I heard that there was some difficulty in getting seed of American cotton last year.

825. (Mr. Henderson.) I have had no auctions of land in the Lower Bari Doab Colony since last March. Another one is coming on next March. The average price at the last auction was about Rs. 229. In the first year, the price was very high, probably excessive; in the second year it sank; in the third year it was lower still but in the fourth year it showed signs of improvement*. Anybody can bid except people in Government service. Once the man has paid the full price he is the owner of the land and Government has no further hold on it. The full price can be paid at once or, if preferred, it can be paid in six instalments.

826. There is a question of the quality of the land in this Colony. Certain recommendations have been made to Government but orders have not issued yet. One of the points pending between the Government of India and the Punjab Government is the area that will be auctioned. I should say that, regard being had to other commitments, most of the land of better quality has already been auctioned. I cannot say off hand what area has been auctioned in the past but it is roughly 8,000 acres every year. There have been at least four auctions, and we have auctioned about 52,786 acres in the past.† There is a fair amount of land to be auctioned. The point at present in discussion between the Punjab Government and the Government of India is, I understand, how much more land should be auctioned. The outturn varies enormously with the quality of the land. We have land which has been given out on rent for 500 rupees for 25 acres per annum. The average would be round about Rs. 300 for 25 acres per annum.

827. (Mr. Wadia.) I have stated in my written evidence that a representative of a big firm told me that when it came to ginning the American *kapas* sold at auction as containing not more than one per cent. *deshi* admixture and classified as such by the Agricultural Department, it showed an admixture sometimes as high as twelve per cent. I cannot explain it, but that is what I was told by the representative of the firm. I gathered that there was much more admixture when it came to ginning than there was said to be at the time of the actual sale, i.e., than was certified by the Agricultural Department. My informant did not want his name mentioned. I was told that one man's cotton would not be looked at when put up to auction this year as he mixed last year.

The Hon'ble Mr. H. J. MAYNARD, C.S.I., I.C.S., and the Hon'ble Mr. P. J. FAGAN, C.S.I., I.C.S., Financial Commissioners, Punjab.

EXAMINED AT LAHORE, JANUARY 10TH, 1918.

(No written statement was submitted by the witnesses.)

828. (President.) The Hon'ble Mr. Maynard.—As to the question of linking up the work of the Agricultural Department with the cotton trade as a means of exploiting American cotton, we had a Conference last year at Lyallpur at which several members of exporting firms and their agents were present and we talked matters over with them. There is already pretty close co-operation, but I think it might be improved. I am not quite sure whether we should not have a new section of the Agricultural Department dealing more with the trade aspect than with the actual agricultural aspect. We really want some one who would deal with the transport and commercial aspect of the question. We do not deal with them now. This might expand in time into a trade bureau which would not be limited to cotton but would be a sort of exploitation bureau. I think it should be provincial and should consist of members of the Agricultural Department and representatives of the trade in its different aspects. What I had immediately in view was rather some one member of the Department who should be especially concerned with transport and commerce, who would place himself in close touch with the trade and who could put his finger on any point connected with that side of the question.

* Since then, i.e., in the sale of March 1918, the average price was Rs. 330 odd; a remarkable advance probably due partly to cotton profits and partly to a desire to put money in a "safe" place.
† 8,978 acres were auctioned in March, 1918.

Punjab.] The Hon'ble Mr. MAYNARD, C.S.I., I.C.S. and the Hon'ble Mr. FAGAN, C.S.I., I.C.S. [Continued.]

829. (The Hon'ble Mr. Fagan.) I think that what Mr. Maynard says is very sound. I think that every member of the Department engaged in work of this nature should be in touch with the trade to some extent. The criticism that the Department is not in touch with the trade has been brought forward both in this and in other provinces. The difficulty is that we do not know what the trade wants. The trade at home and in foreign countries is as a rule concerned with Karachi and Bombay and we are not in touch with it. Are Karachi and Bombay in touch with the trade at home? We are not in touch with Karachi and Bombay, except perhaps very indirectly. The Agricultural Department must evolve and develop some commercial side of itself if it is to work to the fullest advantage to the cultivator, the person with whom the Agricultural Department is more directly concerned. It is part of the functions of the Agricultural Department to put the producer in the closest possible touch with the consumer. This can only be done if the Agricultural Department evolves some kind of commercial organization.

830. (The Hon'ble Mr. Maynard.) Then your commercial organization would be in touch with the railways in connexion with such questions as freight and so on as well as being in touch with the trade. I should call it the commercial and transporting side and the marketing side. It is no doubt true that every member of the Agricultural Department is necessarily to some degree in touch with the trade but the principal business of the Department is some thing different. Some special arrangement which would bring the whole Department in touch with the trade is wanted.

831. As to the preference of the Punjab people for wheat against cotton, I should say that the *Punjabi* is now just passing out of the stage in which he grew things to eat into the stage of the economic man. Wheat is a thing which he can eat and cotton is a thing which he cannot. He is passing into the stage of the economic man but he has not quite reached it yet except to some extent in the Colonies. He is reaching it, particularly in the colonies.

832. (The Hon'ble Mr. Fagan.) I have read some of the evidence given by irrigation officers before the Committee and I think that there is a good deal in what they say in regard to the cultivator's preference for wheat. Wheat is a surer crop than cotton. Questions of disease, insect pests and watering weigh with the cultivators a good deal. In the East Punjab, there has not yet been time for the new faith in cotton to gain ground. There is a large demand for labour for the harvesting of wheat. I think the two crops are bound to clash to some extent at the beginning of the cotton season and at the end of the wheat season both in the matter of labour and probably in the matter of water too. If the price of wheat were reduced by ten per cent. and that of cotton went up by ten per cent. it would be bound to have an appreciable effect on wheat. The harvesting of wheat starts about the 10th or 15th April. In the latter part of April and May, the canals are not at present using all the water that they carry or can carry. As far as irrigation is concerned, the Irrigation Department would only be too glad if there were a keener demand for the *kharij* in the first part and in the middle of the season. The difficulty is at the end of the season. The crux comes in September and the early part of October when water is wanted simultaneously for ripening *kharij* and for sowing *rabi*, especially in years when the rains have been deficient.

833. (The Hon'ble Mr. Maynard.) As to the question of licensing gins and presses to prevent the adulteration of cotton and mixing of seed, I should say that the question really falls under two heads; there is the case of Crown land which Government is, in any case, bound to regulate to some extent, and there is the case of ordinary private land in which Government would not naturally interfere. In the case of Crown land, Government has to make up its mind whether it should try to limit the number of ginneries to the actual amount of cotton so far as it can be calculated or whether a free hand should be given. If Government decides that it is going to limit the number of ginneries, then, in order to protect the producer from the effects of a practical monopoly, it has to regulate the ginneries to a very considerable extent not only as regards plans but also as regards the charges which they are permitted to make. That applies to the new colonies where Government has complete control of land. The case is not so strong outside the colonies where the land is not Government land. One might leave ginneries to grow up just as they have grown up in some places like Multan. Multan has fifty or sixty ginneries although there is not enough cotton available for more than twenty. That has resulted in a fearful waste of capital. Money was really thrown away. It also resulted in the formation of pools. As regards the methods by which pools can be broken up, one fairly hopeful line seems to be that it is a question whether a pool, unless registered, in some form has a legal existence and whether the agreement is enforceable in consequence. I think one would naturally say that it would be better to prevent the growth of an excessive number of ginneries than to trust to breaking up a pool. Even with a limited number of ginneries, you might, however, have the same sort of agreement which could very well develop into a pool. You might, for instance, limit the number of ginneries in a colony to half a dozen just sufficient for the cotton to be ginned and then find that they united together. After all, they would be practically using the same sort of power that monopolies have against the producer.

834. (Mr. Wadia.) I would not regulate prices unless forced into that position. I have thought a good deal about this question but I am rather in the state of mind of one who wants advice rather than of one who is prepared to give it. As to the excessive profits derived by the pools, I think that, in the long run, the consumer has to pay this extra profit as, theoretically, at all events, such charges all fall upon the man who buys the cotton. I suppose that the cultivator and the middlemen are the persons who between them share the immediate loss. I mean that, as the world's price is in no way affected by the charges of any particular pool but by something outside, the people who are immediately concerned, the cultivator and the middleman, everybody who is concerned in getting the crop to Bombay, have to share the loss which results from the pool charge. It is either the cultivator or the middleman to whom the cultivator sells, who are concerned in producing the cotton and in getting it down to Bombay where the world's price can be got for it, and they have to bear the loss between them.

835. (The Hon'ble Mr. Fagan.) The producer is in the weakest economic position so that the greater part of the loss would fall on the actual producer. He is in the least favourable position in the whole chain to make his weight felt. That is to say, economically, he is the weakest link in the chain.

836. (The Hon'ble Mr. Maynard.) I think it is very possible that the cultivator does not lose by the pool charge but supposing that there were fewer factories and those succeeded in making a combination, it would be easy for such a combination to raise its charges even higher than the additional pool charge is now. As to the fixing of maximum prices by a controlling body, my view is that one does not want to regulate things more than is absolutely necessary or unless the position is such that one is forced to do it. I object on principle to regulation if it can be avoided. I want first to see if there is any possibility of getting out of

Punjab.] The Hon'ble Mr. MAYNARD, C.S.I., I.C.S. and the Hon'ble Mr. FAGAN, C.S.I., I.C.S. [Continued.]

it. There were one or two suggestions made at the Lyallpur conference which was held last year for putting the cultivator in a better position as against the ginner. For instance, it was pointed out that, at present the cultivator is bound to take his cotton to a factory because the factory is the only place where there is storage room. He cannot take his cotton to a storage place and then take it away again if he does not get the proper price for it, so he takes it to the factory. It was suggested in connexion with the difficulty that special cotton markets should be built in which there would be storage room. Mr. Kitchin, the Deputy Commissioner of Lyallpur, said that he would try to build a cotton market at Jaranwala but I do not know whether he has done anything further. The question of co-operative ginning is one of practical difficulty: whether it could be arranged, I cannot say but I think it ought to be tried. It is rather difficult to get the cultivators to agree together in a matter of that kind which is outside the range of their ordinary experience. It means a large capital and a bigger development of the co-operative idea.

837. (The Hon'ble Mr. Fagan.) It comes at a somewhat later stage in the co-operative movement. There are two points: one is the provision of controlled markets with plenty of accommodation, and the other is co-operative ginning. I am not inclined to legislate in regard to pools if we can possibly do without it. That is the general feeling. Legislation to control charges would be an absolutely new departure and very difficult to enforce. It is only justified by war conditions and the real difficulty would be to enforce your regulations when you had made them. If two people agree together, it is very difficult for the law to protect the cultivator against them. I should look upon legislation as a last resort.

838. (The Hon'ble Mr. Maynard.) Since the appointment of a Factory Inspector, Deputy Commissioners have practically ceased to be inspectors and the factories are very seldom inspected. Our Inspector has just gone off on military duty and the Deputy Commissioner of Lyallpur has taken up factory inspection with considerable vigour. The excise staff, inspectors and sub-inspectors are in fairly close touch with the revenue administration. Perhaps Mr. Kitchin's suggestion that they should do factory inspection was made on the supposition that they have not much to do. They take up petty local offences connected with excise, and look after illicit distillation. Apart from the technical inspection which only the Inspector of Factories could do, inspection by the Deputy Commissioner does seem desirable but the truth is that whilst some of the Deputy Commissioners, for instance the Deputy Commissioner of Lyallpur, would do it very well indeed, others would perhaps find it rather difficult to find leisure to do it and would not do it particularly well. In the old days, it varied very much: one man would do it very well and another would not do it at all.

839. (Mr. Henderson.) It would not be feasible to give powers to the Agricultural Department. It is very remote from their real functions.

840. (Mr. Roberts.) I hesitate to suggest that representatives of the trade should be honorary inspectors. It might be a case of setting a thief to catch a thief. Of course, one advantage would be that they would know the real conditions and would know where the shoe pinches.

841. (Mr. Henderson.) As to the prevention of adulteration of cotton, we recently discussed the question of preventing damping but I do not think we came to any definite conclusions about it. I do not know of any other form of adulteration except damping. As regards the mixing of long and short staple cotton, I think it is partly involuntary and as to that, I think the model factories which we have begun to introduce in the Lower Bari Doab Canal Colony at Okara, Minchannu and Chichawatni would prevent any involuntary mixing in the factories. These factories have been put up on Crown lands. They have just been finished.

842. (Mr. Hodgekinson.) As regards careless mixing by cultivators, I think there is nothing so effective in preventing it as the good prices which pure American is actually getting at the Government auctions which have been held. I do not see how an increased demand would encourage mixing as the buyers are pretty wide awake. All the American cotton is not sold at the Government auctions. It is by their presence at the auctions that the people realise what high prices can be obtained for their cotton. The auctions are auctions of *kapas*. The cotton is mixed afterwards. I understand that there has been some deliberate mixing. I have seen some correspondence in regard to deliberate mixing after the stage at which the cotton leaves the hands of the cultivator. The particular correspondence I saw was a letter written by a selling agent at Bombay to a rather prominent grower in the Punjab, Rai Bahadur Lala Ganga Ram, and this letter said very definitely that he and his son Lala Sewak Ram had got a reputation for sending pure cotton to Bombay and for that reason their cotton always commanded a better price. There has been an idea of a system of control by which you would have a particular body of cultivators, i.e., a co-operative society, which would enter into certain engagements that cotton should not be mixed. They would be placed in correspondence with the buyers in Bombay who would buy on the fact of the reputation of the particular society. That has not, I think, been arranged yet but the idea is that it might be arranged.

843. As to the control of ginning factories by a system of licenses, one would rather like to avoid legislative control if one can see one's way to do so. No one can say whether there is a mixture of fifteen or twenty per cent. of *deshi* cotton in American until the cotton goes through the spinning machinery. The fact that one particular body of sellers or an individual seller is mixing, whether carelessly or intentionally, must destroy the reputation of that body or individual and must in the long run do them an injury. Of course, the seller is out to make his profit and he stands to lose if he destroys the reputation of the article which he sells. I suppose mixing is due to failure to understand the real advantage of not mixing or because one man feels that he gains nothing by being honest and careful if other people are not careful. There must be common honesty otherwise if a man produces a good thing, it won't help him. That is perhaps the difficulty. It is the lack of combination on the part of the trader and the lack of common responsibility. If you cannot arrange to organize societies which would undertake that their cotton should come up to a certain standard and should be kept at that standard, then legislation might be necessary to prevent mixing.

844. (The Hon'ble Mr. Fagan.) If spinners at home had representatives out here in close touch with the factories and there were co-operation among producers out here, that would very probably, in my opinion, tend to improve matters. It seems to me that you have got to work from both ends. The spinner must be here or must send somebody here to see how things are going on. That would exercise a very great influence. Assuming that good cotton cannot be grown here, the whole thing falls to the ground but, on the other hand, assuming that you can grow good cotton in the Punjab and that Lancashire can use it with advantage, if Lancashire had its own representative out here in close touch not only with the trade in Bombay but with the ginners upcountry, I think he would be in a position to understand the real position. If you are going to have a large development, it seems to me that the organization must grow from both

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ends. Lancashire should be able to help in the intermediate stages. She cannot merely wait to come in after all arrangements have been made without her.

845. (The Hon'ble Mr. Maynard.) The idea was that the British Cotton Growing Association should have a cotton farm of 7,500 acres in one of the new colonies and that this would have the effect of bringing the home cotton buyer into close contact with the producer here. If the British Cotton Growing Association were reconstructed as a popular trust with Government assistance and under Government control, I suppose that would mean representatives or agents out here who would be able to put ginneries in close contact with the producer at home. I have been on the proposed farm and I am going to report very favourably in regard to it. It seems to me that something of that sort could be arranged.

846. (The Hon'ble Mr. Fagan.) As far as the cultivator out here is concerned, I think that a very great deal could be done for him by co-operation. I am of opinion that co-operative marketing is the natural thing and that as far as the cultivator is concerned, it would probably help a great deal at this end.

847. As to control of ginneries, my position is very much that of Mr. Maynard. I should like to avoid legislation as far as possible. Unfortunately once legislation is introduced, there is always a tendency to make it permanent.

848. (Mr. Henderson.) I believe that Japanese have their buying agents in many places. I was at Mian Channu a short time ago and there I saw one of their agents who was buying very heavily.

849. (Mr. Wadia.) As to the transport of cotton, if you are going to impose a prohibition on the transport of long staple cotton from one district to another, then the railway station masters would have to be experts in cotton. I should not care to give additional powers to the railway staff; they are pretty corrupt at present. I think it is very likely that it is only within the limits of the same district or from a short distance that cotton is brought to be mixed. About one-third of the cotton is long staple and the difficulties begin when it is grown on a commercial scale. A differential railway rate on unbaled cotton might have a good effect on stopping transport of cotton for purposes of mixing.

850. (The Hon'ble Mr. Maynard.) To speak frankly, one does not like regulations unless one sees where they are going to lead, and what the effect of them is going to be. The people who are most familiar with the working of the law are the most unwilling to widen the scope of it. They know the unsatisfactory nature of the agencies through which it has to be worked.

851. (President.) The Hon'ble Mr. Fagan.—The Thal irrigable area is roughly estimated at two million acres. It is in contemplation only to irrigate about 1½ million acres. I cannot say at present what the cotton area would be but a good deal of the land would be adapted to cotton. There is a great deal of lightish sandy soil but also a considerable area of loam. Much of the latter would be land that would grow cotton. We have not made any specific estimate of the cotton area. The land is being surveyed; rectangulation is going on as a preliminary to soil survey. When we get the details, we shall have to work out a rough cropping scheme with reference to occupier's rates and land revenue.

852. I should doubt whether there is very much room for an increase in the intensity of irrigation or for expansion. More land could be put under *kharif* irrigation by enlarging the channels but then you would get difficulties in the *rabi* when there would probably not be sufficient water to fill the channels properly. We have had a Conference recently on the subject of water-logging and we came to the conclusion that actual irrigation, that is to say, the spreading of the water over the fields was not the primary cause of water-logging but that the chief cause was actual percolation from the channels, very largely from the main channels. I do not think that water-logging is likely to result from any increase in the intensity of irrigation.

853. (The Hon'ble Mr. Maynard.) The fear of water logging was the original reason for the low intensity.

854. (The Hon'ble Mr. Fagan.) At a recent conference, we discussed the question of selling water by bulk and came to the conclusion that charging for irrigation at so much for each watering was impracticable owing to certain difficulties but that charging on a volumetric system was, on the whole, more practicable than the other. There are certain difficulties in regard to that too, of course, but we purpose to experiment with it. If any system of that kind could be devised which it would be practicable to work it would tend to a considerable economy of water.

855. As to the allegations of deterioration of the fertility of the soil in the Punjab, especially in the Chenab Colony generally, I suppose that what really happens is that a virgin soil starts at a fairly high level of productivity but that after a certain number of years there is a slight reduction in the outturn and then things become fairly permanent. It depends a good deal on the quality of the silt brought down by the particular river concerned. I do not think it has been a crying evil so far. It is very hard to get reliable evidence in regard to it.

Mr. H. CALVERT, I.C.S., Registrar of Co-operative Societies, Punjab.

EXAMINED AT LAHORE, JANUARY 10TH, 1918.

Written statement.

856. Preamble.—I should like to confine my written evidence to two aspects—(a) the need for wide study of rural economics and (b) the application of the co-operative principles to the problems connected with the production and marketing of cotton.

857. The need for wider study of rural economics.—The Committee is attempting to solve a series of problems in rural economics and it seems to me that there is danger in concentrating on problems relating to cotton when our knowledge of the wider subject is not sufficient to enable us to preserve a proper perspective. It may be that another crop would pay our cultivators better profits than cotton can; it may be that it is a mistake for the Punjab to grow wheat when cotton or some other crops will pay better even after allowing for the extra cost of living on imported wheat. We are too near the period when agriculture was confined to supplying home requirements to be able to foresee the full effects of its transition to an industry supplying

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[Continued.]

the world markets; and we are not yet in a position to guide the development of the new agricultural commerce. We are very much in the position of the manufacturer who does not know what to manufacture. The object of these remarks is to give weight to a suggestion that the Committee should press for the systematic study of agricultural economies on an adequate scale.

858. *Application of co-operation principles to the production and marketing of cotton.*—With reference to the application of the principles of co-operation, I think there is ground for the opinion that the position is not always properly understood. If agriculture or any branch of agriculture is to progress, if agriculturists are to be prosperous, organisation is absolutely essential. The organised middleman will beat the unorganised producer, and the organised manufacture of agricultural requirements will beat the unorganised cultivators. In a country of peasant proprietors like the Punjab, there is no room for both agricultural prosperity and capitalistic organisation. It is the peasants who must be organised. They own the essential capital in the form of land, they supply the major part of the labour, and they have to run the business of agriculture. What we have in this province is a multitude of capitalists, a multitude of labours and a multitude of business men and, speaking generally, our Punjabi cultivator is very far from being an expert in any of these capacities. Organisation is essential if any permanent improvement is to be effected and so far only one system of organisation has yet proved successful and that is the system known as Co-operation. Occasionally one hears persons discussing this question as if there were an alternative system but so far as I am aware there is none—certainly none that promises to be both permanent and successful. We may have a purely Government controlled system, a combination of Government control and co-operation, and a purely co-operative system. The last must be the goal in view. The first promises quick results but tends to become unwieldy as the work to be done expands. The second method is the one I advocate for adoption until pure co-operation becomes possible. At present, I understand the auctions of American cotton in the Punjab are entirely Government controlled but I do not think anyone desires to see this retained as a permanent feature of the work of the agricultural department and already we are trying to organise societies for the sale of cotton. We are trying to pass on to the second method.

(2) We are not yet in a position to employ skilled inspectors to grade the cotton. The present practice whereby the agricultural department certifies certain cotton to be grown from certain seed is open to the objection that it does not extend to equally good cotton from equally good seed. It seems to me that the co-operative method of organisation must be looked to for a remedy against impurity and adulteration. I append an extract describing how a system of control actually works and consider that we should try to organise a system on similar lines for preventing the marketing of impure cotton. I would have a trademark registered under cover of which only cotton of a certain standard could be sold. If we could organise the growers, the growers would own the trademark. If the growers organisation was sufficiently strong, it could exercise close scrutiny over the ginners and the trademark would then cover the baled cotton. The purchaser would have the guarantee of the trademark and the value to be attached to that guarantee would be settled by experience. I understand that we do not contemplate classification into seven or eight grades above and seven or eight grades below "middling," as I believe is done in America. At present we are trying to secure for pure cotton the full price which pure cotton should command. If our organisation increases in numbers, power and influence, it should be able to support its trademark with a substantial guarantee and so provide for the purchasers a defendant who could be sued for damages in case of infringement. I think it will be agreed that the time which the officers of the agricultural department can devote to supervising marketing is limited, and the only method of relieving them that suggests itself to me is one on the lines adumbrated above.

(3) I may add that I would advocate legislation rendering infringement of the trademark by others punishable with imprisonment with or without a fine. A fine alone has very little deterrent effect and if imprisonment were compulsory on a conviction, the protection accorded would be greatly enhanced.

ANNEXURE I.

Note by Mr. C. F. Strickland, I.C.S., Assistant Registrar of Co-operative Societies.

One objection to American cotton (a serious one in Sangla area for instance) is that it cannot be spun on the ordinary village-wheel by women: it breaks. The zamindar to please his women sows a *killa* or two of *deshi*, and the seed is intentionally or carelessly mixed before sale.

Zamindars in irrigated areas will now sow as much American cotton as they can obtain seed: but if the water supply is insufficient, American fails. And water is needed earlier for sowing it before wheat waterings are finished.

They will not usually sow in lines, because they and their tenants are ignorant and lazy. A specimen *killa* sown in lines would convince them, but it must be under their eyes from sowing to harvest, or they will think you have faked it or had extra water.

ANNEXURE II.

Extract from "War Time and Peace in Holland" by Robertson Scott.

The Boter Controle.—As already mentioned, this system, which is the best in Europe, was not initiated by the Government. It was invented by the co-operative creameries in order to guarantee the purity of their butter. When the system got past its early difficulties and was seen to be as certain as those who devised it declared it to be, the Government threw over it the aegis of an Act of Parliament. The system is still in the hands of eight associations of butter producers. It is for them to deal with undesirable producers; they admit or refuse admission to the benefits of the system, as they like. At the head of each of the eight departments of the Control—Assen (Drenthe), Deventer (Overijssel), Eindhoven (N. Brabant), The Hague (S. Holland), Groningen (Groningen), Leeuwarden (Friesland), and Middleburg (Zeeland)—is a qualified chemist as director, with a staff of analysts and one or more Inspectors. The Inspectors of the associations are on the road daily, paying unexpected visits to the dairies where butter is made or sold by persons in the Control or to places where butter made or sold by them is on sale. Wherever the Inspectors go they take samples not only of butter but of the materials used in its manufacture. Sometimes they are present when the butter sample is being made.

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[Continued.]

The analysis of the various samples obtained are carefully registered. The result is, obviously, that the officials of the Control now know what the composition of the butter of each producer is at any time of the year.

The Control stations are under Government supervision, and the members controlled are allowed to use the remarkable Government butter-mark—of which some particulars in a moment—provided always—

- (1) That the inspection of the creameries is always and in every respect satisfactory, and the creameries are always open to investigation.
- (2) That every parcel of butter made or bought is registered as to origin and destination. The name of the buyer of the smallest quantity of butter must be entered.
- (3) That members are neither directly nor indirectly connected with the trade in margarine or edible fats or oils.
- (4) That the moisture in the butter does not exceed sixteen per cent.

An ingenious label.—The Government mark is printed in blue ink on thin, tough paper by the Government printer. A re-print of it is re-produced here, but the reproduction does not show an essential part of the label—the perforation marks. When the thin piece of perforated paper is pressed on the butter by a special wooden stamp it seems in no way damaged, but if an attempt is made to remove the label it infallibly comes into separate pieces. It is absolutely impossible to take off a label whole and use it again. Apart from the general protection given by the arrangement as so far described, there is the fact that each label has stamped on it a letter which indicates the name of the Control station issuing it, that it also bears a separate number which makes it possible to trace the precise origin of the parcel of butter bearing the label and the date on which it was made, and that, finally, there are labels of different sizes for different weights of butter. It should be added that there is in force at all the Control stations a compulsory system of book-keeping in reference to the labels issued.



Under Rijkstodezicht.
Label ingeniously impressed on Dutch Butter.

The history of a firkin of butter.—Let us follow up an actual firkin of butter which on being opened is found to have impressed on its contents a label numbered E 37222.

We find—

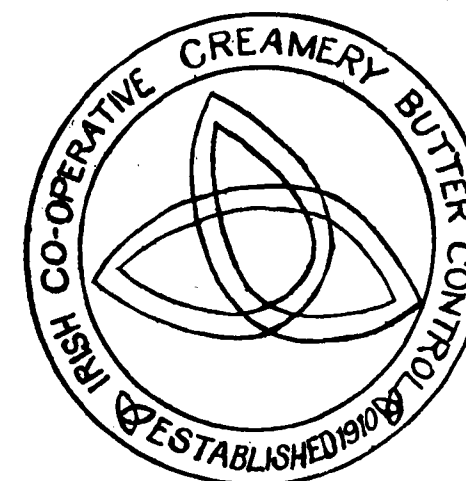
- (1) E is the letter of a parcel of 38 kilos.
- (2) Books of Leeuwarden Control station show receipt of labels 30,001—50,000 from Government dairy stations June 5, and despatch of 35,701—37,400 to creamery at Deinum, June 15.
- (3) Book of sales at Deinum creamery shows sale to Mr. Beck, on July 5, of a cask of butter bearing the number 37,222.
- (4) Register of Leeuwarden Control station shows following record of analysis of a sample of butter taken at Deinum Control station June 23—July 8: volatile acids, 28.9—29.5; refractometer, 44.5—44.7; water, 13.6—15.7.

Therefore a sample of butter of July 5 must give, if analysed, figures lying between the figures named. That is to say, that if the sample had only twenty-six per cent. volatile acids it could not be pure.

Result of the system.—The Control system has done more than any Margarine Act to stamp out butter adulteration. The value of the Government mark having been realised, the adulterators have been beaten in the foreign market without any direct assault whatever.

It is an offence punishable, not by fine, but by imprisonment only to use the official butter guaranteed improperly. In 1910, 43,405 tons of butter were made under the Control.

The Irish Butter Control.—The Irish Agricultural Organisation Society had a co-operative creamery Butter



Irish Butter Control Label.

Control, based in some degree on the Dutch model, working satisfactorily last year. The number of participating creameries was 32 and a considerable addition is expected during 1912. The label in use is as shown. It guarantees that the butter to which it is affixed is pure Irish Creamery butter made from pasturised cream under conditions of absolute cleanliness, and that it contains less than sixteen per cent. of moisture. The label can only be affixed on conditions laid down by the Control, which provide for the recording of quantities made and packed, for inspection and for weekly consignments of samples to the Control, etc.*

* For further particulars see regulations of Control Committee, The Plunkett House, Dublin.

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[Continued.]

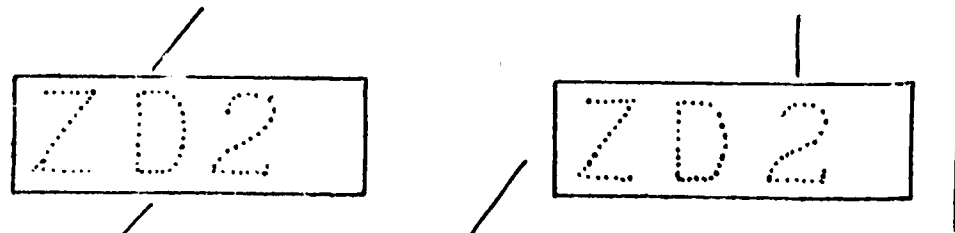
The Cheese Control.—The Dutch Cheese Control is as ingenious as the Butter Control. There are two marks: (1) a standard mark and (2) a changeable mark. The standard mark is the same design in two sizes, a big one for large Goundas and a smaller one for the Goundas a little more than 3½ lbs. This is the standard mark.



The Needle-Pricked Control Mark on Dutch Cheese.

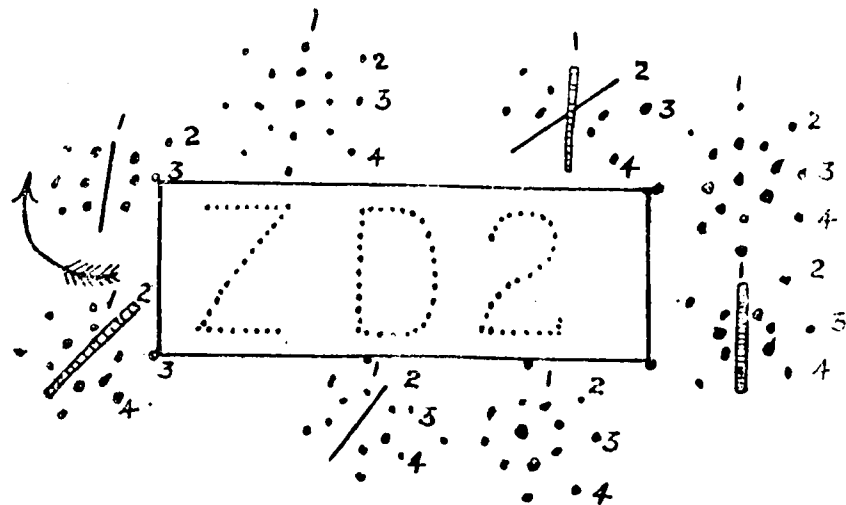
The changeable mark is the mark which is adapted to indicate the factory which has made the cheese. The standard mark is a C inside V surrounded by the words "Ryks Control" in dots. The changeable mark consists of two letters and a figure in dots, all inside a rectangle, and outside that three straight lines in positions varying according to a code.

How the system works. Assuming now that the standard mark reproduced above is on the cheese, so showing it to be a—big or little—genuine Gounda, we have to take account of the changeable mark of the factory which made it. If it is factory No. 1's or factory No. 2's produce, it will bear one of the following imprints:



Signs on Dutch Cheese.

The code with which to decipher either of these mysteries is as follows:—



Key to the Signs on Dutch Cheese.

KEY TO THE SIGNS ON DUTCH CHEESE.

It will be seen that the strokes on the No. 1 and No. 2 cheeses are in some of the eight possible positions shown in the code. Let us take cheese No. 1 first. You begin to count from the stroke on the left hand. At the top of the stroke is "1." Put down "1." Then follows an arrow.

The next stroke is not in the next dotted circle but in the one after, the second one. Count "0" for the blank and "2" for the stroke because it is so numbered. The three next circles are blanks. Add three "0's." Then "2" for the stroke with a "2" to it. Finally an "0" for the blank circle. And the result is

1 0 2 0 0 2 0.

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[Continued.]

The reader can try the mark of cheese factory No. 2 for himself or herself and will find it comes out as

0 0 1 0 1 0 0 2.

But the letters inside the rectangles: "ZD2"? Z is the key to the name of the Control station with which the factory which made the cheese is affiliated; D reveals the month the cheese was made; 2 tells the very week. Z stands for the Zuid (South) Holland Control Station, N for the Noord Holland Control Station. Here are possible combinations:—

Z2B Cheese made in the 1st week of the 1st month (January 1910) at a dairy or factory affiliated to to the Zuid-Holland Control Station.

Z2B, the 1st week of the 7th month of 1910.

ZC3, the 2nd week of the 2nd month of 1910.

Z3C, the 2nd week of the 8th month of 1910.

CZ3, the 2nd week of the 2nd month of 1911.

3ZC, the 2nd week of the 8th month of 1911.

C3Z, the 2nd week of the 2nd month of 1912.

3CZ, the 2nd week of the 8th month of 1912.

The marks are made by means of a stamp studded with needle-points on the crust of the cheeses immediately after they have been pressed and rounded and shortly before they are put into pickle. Keys to the codes are in the hands of those concerned in importation of Dutch cheese, but those who find the marking of the cheeses too hard to spell out can send a copy of the marking or a thin slice from the crust of the cheese to the Government station at Leyden and a solution will be returned.

Factories may, if they please, put an additional mark of three groups of two dots outside the circular inscription "RYKS CONTROLE."

Cheese Controls.—The Agricultural Society of Holland established in 1906 a Cheese Control at the Hague (S. Holland) and at Hoorn (N. Holland) for the protection of Gounda and Edam cheese. As is well known, quite new skim cheese may be made to counterfeit fat cheese. Half meat or half fat cheese, from which a part of the cream has been taken away, is no doubt an excellent food, but it should not be substituted for the full cream article. Therefore the cheesemakers and merchants—the producers again, it should be noted, not the Government—have started the Control stations, the guarantee of which is good for whole milk and not less than 45 per cent. of butter fat in the dry matter. A Bill in Parliament promises the same support for the Cheese Control as the Boter Controle.

I have already referred to the rapidity of the development of Cheshire cheese-making in the Netherlands. By a voluntary undertaking of nearly all the Dutch makers of Cheshire, their produce is now—"very honourably," says our Cheshire Dairy Farmers' Association—marked "Dutch produce." The Association of Co-operative Creameries in Friesland has organised a system by which members are bound, first, to make no cheese of the Cheddar and Cheshire shape containing less than half the fat in the milk, and second, to mark full-cream and half cream cheeses with a different mark. With each consignment a written guarantee of the Association is also given testifying that the cheese is full-cream or that it is the other thing containing not less than 1·5 per cent. of fat. Half meat Cheddar or Cheshire from the Netherlands contains therefore from about thirteen to twenty per cent. of butter fat.

To return to Gounda and Edam, the Federation of Associations of Co-operative Creameries is working with the Association of Private Creamery Owners, first, to stop the making of Goundas and Edams with less than a certain minimum of fat, and, second, to have each cheese marked according to the real amount of fat in the milk from which it was made.

There can be no doubt that as a result of the establishment of the Butter and Cheese Controls, the Ministerial infliction of a heavy penalty when butter contains more than 15½ per cent. of water, and the action of the cheese-makers in the direction of establishing marks of quality for cheeses, the reputation of Dutch butter and cheese has been enormously enhanced.

Mr. H. CALVERT, I.C.S., called and examined.

859. (President) My general impression is that the economic side of agriculture is not studied in India. It is entirely ignored even in the Universities. All our colonization schemes in the Punjab are against all the principles of agricultural economics. This is an important point. I do not think that it has been sufficiently recognized that up till quite recently, the average cultivator in the Punjab cultivated for his own home requirements. He never looked outside his village. Now the Punjab has been linked up with the world's markets. The average village still grows its little crops for its actual requirements. The absence of a study of agricultural economics is a serious defect in the administration. If one had available any good literature on the general aspect of the question, then one could tackle the particular problem. We are now tackling the particular problem without reference to the general question. The introduction of the co-operative movement is merely a side issue of the general economic question.

860. As to the extent to which co-operative agency has been helping the cotton movement, we are only now organizing cotton growers' societies which are intended to take over the cotton auctions. A big one is being organized at Montgomery and small ones at Lyallpur. I think the ultimate goal to aim at is that we should organize the whole of the cotton growers into sale societies. We should not sell our unginned cotton, but should pay the ginner their fee for ginning and baling, and sell our baled cotton. The societies would have a special market. I understand that the American growers are all organized into a co-operative union of about three million members. We do not contemplate co-operative ginneries if we can get existing ginneries to take our cotton and gin it on commission.

861. As to whether the village trade or even co-operative trade has developed to such an extent as to be able to work the system of the trade marks which I have suggested in my written evidence, we must make a beginning. It seems to me that we shall find no difficulty in organizing producers into societies and the next thing will be to organize those societies into large trade unions with a trade mark. The trade mark will then find its own value. This development of cotton supply societies will carry on the existing auctions. It will take them out of the hands of Government and get a stage forward in that development. The cotton auctions will be merely auctions supervised by myself and the Agricultural Department. In a way perhaps, co-operation is pretty strong in the cotton tracts. Hitherto we have been going in for credit and credit is not very much needed in the big canal colonies. We have a large number of societies in Lyallpur and, Sargodha: we are starting in Montgomery. We are now going level with colonization.

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Major VANRENEN.

862. (Mr. Wadia.) We are not yet in a position to employ skilled inspectors to grade cotton. They would have to be trained. The grading of cotton is not done in the primary markets but is done in the secondary markets. If we sell on agreement that our cotton is fine or is within one per cent. of pure American and it is found that any particular cotton is not up to that standard, then there would be a breach of agreement. If our organization sold under an agreement under its various trade marks, and if the article was not up to the standard, the purchaser could sue it. As to how the difficulty of distinguishing between the first and the second pickings could be overcome, I understand that the finer grading is not done in the primary markets at all. We would not attempt fine grading. All the fine grading is done in the secondary markets. The big producers' association in America have nothing to do with grading. The grading is done in the secondary markets of New York and New Orleans prior to export to Liverpool. The future sales are done in the secondary markets in America. Our primary market will have spot sales only as at present. We shall sell here: the Bombay purchaser will come to the Punjab. He will buy on inspection and he will pay on the basis of the article that he is going to get. If he wants to re-sell, he would regrade himself as in America.

863. In the last paragraph of my written evidence, I have suggested legislation rendering infringement of a trade mark by others punishable with imprisonment with or without fine. It is punishable now but only with fine. In Holland in order to control the adulteration of butter, they have abolished the imposition of fine and have made imprisonment compulsory. That has had a very excellent effect.

864. (Mr. Henderson.) Inspectors would be paid by our own organization. These inspectors will not be Imperial men. Presumably you are bound to have a provincial boundary. We are only concerned, at present and in the near future, with trying to place a reasonably high standard of pure American cotton on the market in the Punjab. It must be left to the purchasers to arrange the rest. The inspectors will be paid by co-operative societies. We are just beginning to help in regard to the distribution of seed. Wherever we have a strong society we are trying to persuade the whole village to sow nothing but American cotton 4F and Pusa No. 12 wheat. We have succeeded to a great extent.

865. (President.)—We are trying to take up this question of seed by having seed godowns attached to societies. We have our ordinary banking unions and they are going to have seed godowns at the headquarters of the union. I am not quite sure whether the Co-operative Department has commenced registering seed unions in the Central Provinces. I think some of them are registered.

Major VANRENEN of Renala Khurd, Montgomery District.

EXAMINED AT LAHORE, JANUARY 10TH, 1918.

(No written statement was submitted by the witness.)

866. (Mr. Henderson.) I have been growing 4F cotton for the last four years. The average yield is about seven maunds an acre. At present prices, it is very much more paying than wheat. I do not think that I shall be able to increase the area under cotton much more than at present. The necessity for maintaining rotations is the limiting factor. I have got 7,500 acres permanently and 6,000 acres on a three years' lease. About 2,000 acres of the permanent land are under wheat and 1,700 acres under cotton. These areas could not be altered very much. I have only just taken over the 6,000 acres. Wheat and cotton are my main crops. I grow leguminous crops. I have gram on 500 acres with a view to sowing cotton after it. Of the 7,500 acres 6,000 are cultivated by tenants and I am farming 1,500 myself. I have no difficulty in getting labour and tenants as a rule, but there is some difficulty in getting labour at present. I have to import labour from the Gujrat district which has been supplying a large number of recruits to the army and consequently labour is getting scarce.

867. The staple of 4F is longer than it was four years ago, particularly this year. I have had no trials with any other variety. The tenants consider 4F harder than *deshi*. It is not so liable to disease and it is not so affected by excessive rainfall but the objection to it is that it matures so late and that it is difficult to sow it early on account of the lack of water during March and April. It takes longer to mature than *deshi* and the yield is reduced if it is sown late. *Deshi* will stand being sown late. If *deshi* were sown early, it might be an advantage to a certain extent: the picking season would be earlier. This year I had only 150 acres on my estate as compared with 1,600 acres of American.

868. (Mr. Wadia.) I have been selling my cotton for the last two years at the auctions held by the Agricultural Department but we are now starting a co-operative agency for selling our produce and are going to hold an auction on the 21st of this month at Okara. I sold 2,000 maunds of my cotton at the last Government auction at Rs. 20 per maund and I hope to get even better prices at the coming auction. Cotton pays much better than wheat at this price. At this price the outturn is worth Rs. 140 an acre as against Rs. 60 to Rs. 80 an acre for wheat. Our co-operative association is not registered. I am drafting the by-laws now and we hope to get it registered very shortly.

869. If the market value of cotton fell to Rs. 10 and the price of wheat fell to Rs. 3 a maund, it would still be advantageous to grow cotton. The cotton would be worth about Rs. 70 an acre and the wheat about Rs. 45 to Rs. 65 an acre. I would still prefer to grow cotton. The tenants prefer to grow wheat because it is a more reliable crop to grow, and is not so susceptible to damage. They also obtain a certain amount of food stuff for their cattle in the shape of *bhusa* (stalks used for fodder). They have not yet come to realize the benefit of growing cotton as owing to selling it to the village *banias* they never realize the full value. The village *bania* is cutting down the price in a shameless manner. If the co-operative society that we propose is started, that difficulty will be obviated. The tenants would come into it as we are establishing this agency for ourselves and our tenants.

870. There is a difficulty about getting water for early waterings. During the sowing season last April, we were unable to get any water at all for preparing the land for sowing and the winter rains had failed. The consequence was that we were not able to sow American cotton at all until after the wheat had been harvested. The cotton suffered on that account and matured very late. This year's crop is four maunds per acre on an average against the usual average of seven maunds. The late rains damaged it as well but the late sowing was more responsible for the short outturn. The canal supplies were very short in the spring of 1917. The

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river was exceptionally low. All that the Canal Department could do was to supply sufficient water for maturing wheat and other winter crops.

871. I do not send my cotton to Bombay. I have an idea of getting the cotton ginned locally and sending it down to Bombay for sale but we are not encouraged to do so by the local ginners. There are two gineries at Okara, ten miles from Renala Khurd. I thought about starting a ginery of my own and I also thought of starting a co-operative ginery but the difficulties about management would be very great.

872. I cannot give the total area under cotton this year in all the estates but I know approximately that the outturn of three estates has come to about 35,000 maunds of *kapas* including the tenants' shares. The three estates are my own, Colonel Cole's and the Oat hay farm. There are several other big estates of about two or three thousand acres each in the vicinity of Okara. The total outturn may be about 4,000 bales in a favourable year.

873. At present my estate is having a good deal of difficulty about labour. The labour difficulty is always greater after a good monsoon. I have a steam plough but I have not been able to use it very much as I have not been on my estate owing to military duties. I am laying out my fields with a view to using the steam tackle. The length of the ordinary field is too small to use the tackle in.

874. (Mr. Hodgkinson.) We did a great deal of sowing this year in lines, I should say about 400 to 500 acres. We hope to sow it all in lines eventually. I have about three years' experience of *deshi*. American is certainly becoming more popular on account of the high prices. The cultivators are particularly glad this year that they sowed American on account of its having fetched so big a price and not having suffered so much as *deshi*. The ginning factories do not like the idea of cotton being sent to Bombay, so they put on a prohibitive price for ginning it and put all kinds of difficulties in the way because they wanted to buy it themselves.

Mr. H. T. CONVILLE, Zamindar, Montgomery.

EXAMINED AT LAHORE, JANUARY 10TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

875. Preamble.—The oldest cotton producing country and after America, the most extensive cotton producing country in the world is India, which is all the more reason for particular attention being devoted to cotton, both as regards quality and quantity of production.

876 (1) Experience.—I have been stationed for about ten years in the Multan district, for about ten years in the Lyallpur district and for the past three years in the Montgomery district and have been directly in touch with cotton cultivators.

877 (2), (11) and (21) Varieties.—In the three districts the varieties grown are—

Short-staple *deshi*, known as "thillar," "bagar," and "poni," long-staple *deshi*, known as "Multani" and "Hansi" and long-staple exotic cotton, 4F American, in which is included "narma."

878 (3) (12) and (22) Size of holdings.—The average size of holdings in well-lands is about six acres and in irrigated lands about twelve acres, and the proportion of the holding under cotton is about two to four acres.

879 (13) Yields and profits and comparative returns.—Short-staple *deshi* and long-staple *deshi* yield about six to seven maunds per acre, but the profit on the former variety is a little more than the profit on the latter variety, because the middleman buyer purchases not on staple, but on *kan* or ginning outturn. The ginning outturn of the short-staple variety being about 33 per cent. it commands a proportionately higher price over the long-staple variety, which has a ginning outturn of only about 31 per cent. 4 F. American yields about eight maunds per acre, but the profit is better on this variety of cotton than any *deshi* variety, owing to its commanding a better price, even though the ginning outturn is only about 31 per cent.

880 (5) (14) and (24) Rotations and manures.—The rotations are wheat, *toria* and cotton and in a good many instances only wheat and cotton. This latter rotation is the more common custom for all *deshi* varieties, because the sowing time for *deshi* is later than that of American. Farm manure is used at times in well-lands, but not in irrigated lands, although the preceding crop may be manured.

881 (7) (15) and (25) Conditions affecting increase in area.—In my opinion, the ginning season and climatic conditions are the same for all three varieties, but the irrigation available is more suitable for *deshi* than for American because *deshi* requires only five waterings whereas American requires seven waterings and moreover, at time of sowing American, water is necessary for wheat and at time of maturing, water is also required for *toria*. If the cotton acreage is to be increased, it will be necessary to prohibit the cultivation of rice and sugarcane. The labour supply is more suitable for *deshi* than for American, as at time of sowing American, labour is necessary for the wheat harvest.

882 (16) and (26) Suitability of existing varieties.—In my opinion "Multani" or "Hansi" *deshi* variety should be cultivated in preference to other *deshi* varieties, when it is a selection of purely *deshi* types, but 4 F American is preferable to any *deshi* variety, owing to its better yield and command of better price, in irrigated lands, if sufficient and timely water is guaranteed.

883 (17) and (27) Prevention of mixing of different varieties.—The only way of preventing mixing of the different varieties is—

In the field, by a careful plant selection by each individual cultivator, so that he may have sufficient seed for the coming season, for his own requirements.

In the factory, by licensing factories and by buyers being particularly strict in the selection of their purchases and penalising all mixtures heavily.

884 (28) Importation of seed.—I am of opinion that selected seed grown in India is preferable to seed imported direct from either America or Egypt.

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[Continued.]

885 (8) and (18) **Uses of seed and seed selection.**—Seed is generally used for the feeding of cattle.

(2) The system of seed selection among intelligent cultivators at present is, that they select only *phul* or large *kapas*, regardless of any type variety and this is done in their godowns and not in the field, whereas plant selection in the field is absolutely necessary and the only means of keeping up types true to variety.

(3) Seed is usually hand-ginned, which is required for sowing purposes.

(4) The careless or unintelligent cultivator pays no attention to type or selection and merely sows what he can buy from the local *bania*. This seed may be any type or variety and not necessarily hand-ginned.

II.—COMMERCIAL ASPECT.

886 (30) **Local trade customs.**—The usual custom is for the cultivator to sell his *kapas* to the village *bania*, who has very often already advanced him money. This *kapas*, if carelessly picked, will contain a good portion of peppery leaf, especially of a dark colour, which is a great drawback. If pickers could be taught to pick out the lint from the plant neatly, avoiding as much as possible to touch the dry chalice, which crumples under the slightest touch, much would be gained. Cultivators should learn not to leave *kapas* on the plant until it drops and gets dirty on the ground, but always pick it from the plant. Clean cotton commands a premium in the market, which certainly makes it worth while to bestow a little extra trouble on the picking.

(2) The *bania* then sells his *kapas* to an *aratya* in the *mandi*. This *kapas* is not necessarily the pure variety he purchased from the cultivator, as he mixes all good and damaged *kapas* and some also increase the weight by damping the *kapas*.

(3) The *manli aratya* then sells his *kapas* to the ginning factory, where also good and damaged *kapas* are mixed up indiscriminately, thus producing a cotton well spotted with yellow stains, one of the most conspicuous drawbacks of Punjab cottons. It is in the interest of the ginner and the cotton trade generally, if the ginner would gin good and damaged *kapas* separately, as is done in some provinces. The ginner should also learn to prevent the unusually large percentages of seed which is allowed to go into the ginned cotton. Another defect tending in this direction is the damping of cotton.

(4) The exporters' agents or the spinners' agents then purchase ginned cotton from the ginning factory and endeavour to purchase on type or class, suitable for their requirements. Exporters' agents and spinners' agents are now also purchasing *kapas* direct in *mandis* and having it ginned at factories, which they have leased.

(5) The Department of Agriculture has assisted considerably in helping these buyers to obtain pure and good types of 4 F American but there are still some buyers, who not only mix all classes of American, but are also mixing with their American, good percentages of *deshi*. I am of opinion that, if spinners were to be very strict in accepting all cotton tendered and penalising all mixtures and inferior qualities, the buyer, the ginner, the middle-man and the cultivator would naturally regulate their respective interests, by being more particular in the handling of all cottons. Under present conditions, there are too many middle men between the cultivator and the spinner, who are all out to make their profits and when such profits are not legitimate, it tends to depreciate the quality of all cotton handled.

887 (31) **Standardization of commercial names.**—The cottons from Multan, Lyallpur and Montgomery are known as Sind Punjab, Bengals and American Dharwars. Each type consists of grade known as "extra fine," "fine," "fully good" to "fine" and "fully good." This classification is suitable, provided these grades were standardized as is the custom in the Bombay Presidency.

III.—STATISTICAL.

888 (33) **Improvement of cotton forecast.**—Government forecasts are not quite satisfactory considering that such forecasts are made up from statistics provided by subordinate officials, who are not fully acquainted with a complete knowledge of the appraising of crops, hence it is very necessary that cotton press returns should also be published regularly.

889 (35) **Publication of Liverpool and Bombay prices.**—The publication of Bombay cotton prices is an advantage to the cotton trade.

IV.—GENERAL.

890 (46) **Attitude of buyers to improved cottons.**—I am of opinion that buyers generally do encourage the growth of improved cotton, by paying a premium for them, but there are also some buyers who, when the opportunity affords itself, combine and offer no premiums.

891 (47) **Effect of water rate.**—The water rate has effect on cultivators' preference for growing either wheat or cotton in preference to either rice or sugarcane.

892 (49) **Effect of tenure of land.**—The tenure, on which land is held at present, has the tendency to affect the extension of cotton cultivation.

Mr. H. T. CONVILLE called and examined.

893. (Mr. Henderson.) My cotton has turned out very poor this year owing to its being badly affected by late rain and untimely water at the time of sowing. The yield is only $4\frac{1}{2}$ maunds to the acre. That is $3\frac{1}{2}$ maunds less than the average of other years. I had 900 acres under cotton, and 850 under wheat. That is roughly the proportion that intend to keep if I can do so. The total size of my estate is 3,000 acres. There are other crops as well, e.g., maize, *toria* and fodder crops. There are 200 to 400 acres of other crops. I do not consider the rotation of wheat with cotton a good one. I would suggest the rotation of wheat, *toria* and cotton. That is the rotation I am going on with. At the outset I tried wheat and cotton but found that wheat, *toria* and cotton gave better results. There was no timely water in the canal last year. When water is late, wheat harvesting clashes with the sowing of cotton. We are busy threshing wheat and so have to sow cotton late.

894. I have considered the feasibility of having small threshing machines and intend to take them up. I have some experience of Marshall's threshing machines. There is a future for them in the Punjab but not on small holdings. Implements are very essential and have been taken up by people who have once come in contact with them. The most important implement in the Punjab is the Raja plough. Although the price

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[Continued.]

which was Rs. 27 has gone up to Rs. 30 owing to the war, it has been proved by my own experience, and that of farmers in the neighbourhood that, in the long run, it pays us to buy it in preference to the *deshi* plough which costs Rs. 6-8 to Rs. 7. People on the Lower Bari Doab who ploughed with the Raja plough had better results as far as cotton and wheat were concerned than with the ordinary *deshi* plough. Then there is the Planet Junior horse hoe for interculture. Next to that comes the bar harrow introduced by the Agricultural Department, which is both cheap and convenient. In this respect it suits the pocket of the *abadkar* or small landlord, and is used both for hoeing cotton and wheat with very very good results. The Raja reaper has been found to be a very useful implement but unfortunately since the war, it is very difficult to obtain. There is a considerable demand for it and I think it is largely used in the canal colonies on irrigated lands. The use of the Raja reaper is profitable to the cultivator as it saves him Rs. 3 per acre. It also effects a great saving of labour at a time when it is very scarce. There is a considerable danger of unscrupulous instrument makers exploiting the cultivators. Big *zamindars* sometimes go one better than the Agricultural Department and buy expensive machinery. Demonstration by the Agricultural Department is the only satisfactory method of pushing machinery.

895. I think the whole question of the improvement of staple cotton in India is dependent purely on the question of seed selection. In my opinion, there are two main points which have to be considered: one is to maintain the purity of the strain and the second is to introduce a superior variety displacing a variety already widely cultivated. Organisation is very necessary for this. Selection for seed purposes by the cultivators is at present out of the question. Government should create such an organisation as would make the two objects I have mentioned absolutely possible. This could be done by the following method:—

The establishment in every cotton growing district of seed farms capable of supplying an amount of seed which multiplied once would cover the whole area of that district.

Cotton from these farms should be separately ginned and distributed amongst the villages, each village to receive seed which, if multiplied once, would suffice for the whole area of that village. This should be given to men who are responsible and reliable. The seed farms should be controlled by Government but may be run by private enterprise or attached to Government farms.

Take my own district, the Lower Bari Doab Canal Colony. The requirements there are about 16,000 maunds of seed. That will suffice for that part of the country. It is impossible for the Agricultural Department to supply this seed either from Lyallpur or from any other farm. It is only possible for the Agricultural Department to get it from seed farms under their influence. In the Lower Bari Doab Canal, in order to obtain 16,000 maunds of seed, you would require 48,000 maunds of *kapas*. Taking the yield roughly at even five maunds to the acre, that means that 9,000 acres would be the area necessary to produce that amount. In the Lower Bari Doab Canal Colony you have Major Vanrenen's farm of 7,500 acres, the Oathay farm of 20,000 acres, Col. Cole's farm of 7,500 acres and my farm of 3,000 acres. There is a small Government seed farm of about 500 acres and Sardar Jogendra Singh's farm which is about 2,000 acres. Out of this large area of about 40,000 acres in all, it should be possible to control 18,000 acres which would produce sufficient seed for the whole district. Such control is absolutely essential. It is the only means by which you can keep up the seed. Seed should be issued by Government to these farms. Some concession should be given them and they should be called up to produce a certain amount of seed, not necessarily the whole production of the farm, which Government should issue from them to the cultivator. If they were to work on the lines that I am doing on my farm, it would be possible. Other farms could do the same.

896. There is great difficulty in getting money about harvesting time for harvesting crops except from co-operative banks which afford a considerable amount of assistance to *zamindars*. The majority of the people have to sell their cotton at a poor price before the crop matures in order to raise money to meet their current expenditure. They do not necessarily sell their crop in advance. The man advances the money on the security of the crop standing on the ground. That is the general custom even with big *zamindars*. The big *zamindar* is always in want of implements and so on and is always in need of money. I think the great difficulty both with the big and the small *zamindar* is the want of knowledge of what finance means, i.e., what liability he lets himself in for. He borrows money regardless of interest, i.e., at 25 to 30 per cent. and when the time for payment arrives, and the *bania* tells him that he owes say Rs. 50 he does not realise how the Rs. 50 is made up. The *bania* brings out his book and shows the items nearly all of which are for interest due. The price the *bania* fixes for cotton is the price which he thinks is ruling in the market. That price is purely his own and is not a genuine price. There is a big demand for co-operative banks.

897. (Mr. Roberts.) I believe in sowing cotton in lines. Fifty per cent. of the cotton on my estate is sown in lines. Interculture is done by the bar harrow. I am also using the Planet Junior horse hoe. At times when I have not enough hoes to go round, I use the ordinary *deshi* plough. I have tried the Lyallpur hoe. My tenants now see the advantage of interculture and I do not think that I shall have any trouble next year in getting them to do it as I have had in former years.

898. The reason for my saying that the American cotton required much watering is that I maintain that the soil wants to be opened up in February for American cotton. I am including that watering as well. Water is also required in February for wheat. I opened out my cottonland in February, sowed it in March and watered it in June. That gave me better results both as regards outturn and staple as against land not opened up in February but sown at the end of April or after wheat. Land can often be ploughed on rain at that time of year.

899. I think wheat requires more thorough preparation than cotton before sowing. I do not think that the question of labour really affects the question whether a man would sow two or three acres of cotton. When cotton is sown behind the plough, an acre a day can be sown easily. With a drill it can be sown in half the time. The argument has always been that the wheat harvest affects cotton. That is not true in present conditions. It is merely a question which crop pays the cultivator best.

900. As to yield, American cotton yields better than *deshi*. This year the yield of *deshi* was half that of American. I am of opinion that the damage to American this year was eight annas and that to *deshi* was twelve annas.

901. I had a good deal of experience as a buyer of cotton in the Punjab when I was with Messrs. Volkarts. My experience which extended over twenty years was that the greatest difficulty that one had to contend against was what may be called ignorant competition, by which I mean that a man buys an article of which he does not understand the quality is and therefore probably pays a better price for that quality merely to fulfil an order from Liverpool, Bombay or Karachi. As a matter of fact, up till five years ago, buying up-country was done on no class or standard or type. The Bombay exporter or seller to the spinner took his chance on the quality that he got in Bombay. His agent up-country simply bought the quality in that

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[Continued.]

district. The orders he received merely were "Buy Lyallpur cotton" or "Buy Multan cotton." Those particular stations were famous for certain types which the more experienced buyer knew. With the closer competition from Germany and Japan, the prices became very fine, and the exporter had to do upcountry what he used to do at Bombay or Karachi. The agents of the buyers in the Punjab were given orders to buy at certain rates for certain classes at certain places. That is, supposing a man was given orders to buy Lyallpur cotton or Lahore cotton at a rate of Rs. 20, he was empowered to pay say Rs. 20.8-0 for extra fine quality, Rs. 20 for fine, and Rs. 19-8-0 for fully good quality. The ginneries had no idea of classification. They simply bought *kapas* and ginned it, but when they found that buyers were paying a premium for Multan and Lyallpur cotton as compared with Amritsar, they naturally found that it paid them to introduce *kapas* from intermediate stations and take it to Multan. The result was that Multan cotton, which had a very great reputation twenty years ago and up to say about eight years ago, has now not the same quality as it is all mixed. Yet there are buyers who come along even now and go by what happened in the old days. In trying to find out the quality of the cotton, three or four firms burnt their fingers very badly and have gone away. The result was that firms who knew their business well, Messrs. Rallis and Volkarts, could buy the genuine article on a standard against ignorant buyers who did not understand the quality. There has been a considerable improvement in recent years. There is now a premium for quality: there is a premium also for staple. It was not so formerly. Messrs. Volkart Bros. buy on class, otherwise they could not be in the market. Anywhere staple is found, you will find that Messrs. Volkarts and Rallis will pay a premium for it. Peshawar cotton, for instance, commands a better price on account of its staple, as also the cotton from Dera Ghazi Khan. Messrs. Volkart Bros. sell at home on arbitration. Owing to this premium on class and staple, there has been a distinct improvement in the quality of the cotton shipped from the Punjab. In my opinion, it would be a good thing if spinners were to be very strict in accepting all cotton tendered and in penalising all mixtures and inferior qualities. This naturally would affect the ginner, *zamindar* and the buyer. What I mean to convey is this that, at the present moment there are great complaints from the Lancashire and the Bombay people that the Punjab cotton contains a certain amount of mixed qualities. Those qualities are mixed but still they have an outlet and are still sold in Bombay. If *A* does not buy, *B* will and if *B* will not, *C* will, but if *A*, *B*, and *C* were not to buy it, the producer and the ginner would not have an outlet. As long as they find there is a market for mixtures, they will keep on mixing. The only remedy that can be suggested is to alter the conditions under which they work in Bombay. All cotton should be seen and should be sold on that basis if that could possibly be arranged.

902. I have seen the ginning factories at Chichawatni and at Okara. These factories, which are now being put up, are most suitable and are on the lines on which ginning ought to be done. In old factories, the platforms are narrow and the width between the gins is very limited. There is only one outlet and one inlet. Seed cotton comes in by the same door as the ginned cotton goes out. The result is that the *kapas* falls on the ground and the man taking out the ginned cotton picks it up. In the new factories, the entrance and exit are distinct and wide apart. They are a decided improvement on the old ones.

903. (Mr. Wadia.) I have not been in touch with the Bombay rules for a number of years. The old Rs. 5 allowance rule still holds good. I have seen cotton which as a buyer I would not have accepted with Rs. 10 allowance. That cotton has been sent to Bombay and has been passed. A certain agent bought some cotton of mine which I would consider as Rs. 10 fully "off." He told me that he had to fulfil his contract or otherwise pay a considerable difference. He sent the cotton down to Bombay, paid an allowance of Rs. 4 and had it passed. I have always been under the impression that Punjab-American fetches Rs. 30 above Broach. The only quotation of Punjab-American I received from my agent in Bombay was Rs. 30 over Broach. Broach at that time was Rs. 600. I have not heard of any actual transactions lately.

904. As to the method by which 4F can be marketed in Bombay, I would suggest that there should be some standardisation. There should be some system by which a particular mark should be established for this particular type as suggested by Mr. Calvert and that mark should be worked on. It could be done only if buyers in Bombay would pay for that mark.

905. Now that the Agricultural Department has got pure cotton two or three buyers come up and combine and think that is fair to producer and organizer. Bombay does not encourage the producer to produce superior cotton. At the first auction that was held in the Punjab, the buyers did not pay any premium. If Messrs. Rallis and Volkarts were to pay a premium, the other buyers would wake up. Rallis' and Volkarts' quotations in Bombay are always higher than those in the Bombay market. Punjab-American is quoted at Bombay but if you go to Rallis and Volkarts, you will find that they are asking Rs. 5 or Rs. 10 higher. They take an average sample. They cannot depend on what they get out of the ginners and so they work on lines of their own. The whole fault is that of the ginners. I think the ginners are very much to blame. When Rallis and Volkarts buy from ginners, they do not get pure stuff. If a ginner finds a firm coming along and paying a price which is higher than he can pay, it is natural that he should refuse to gin for it and allow it to put money into its pockets. In both cases it is a question of self interest. As to a way of meeting the situation, I should say first that there are a considerable number of middlemen between the purchaser and the spinner. I think the spinner would pay a proper price if he could get his quality. The producer would produce the best cotton if there were a demand for it. My idea is that if it were possible for Government to have gineries at convenient centres, to which the cultivator might simply bring his cotton to have it ginned, that would be a great advantage. There are more buyers of ginned cotton than of *kapas*. As to the argument that Government are not traders, I would point out that they sell canal water and I do not see why they cannot establish ginning factories and sell ginned cotton. It depends entirely where you differentiate between trading and helping an industry.

906. I tried experiments with Cambodia but it was a failure. I think it was not suitable for the Punjab. It must be sown early. I think it goes on much later than other cottons and that the cold affects it.

907. I would suggest licensing of gineries by law to stop pools. I put in my evidence before the Industrial Commission on this point. Pools as existing at present are detrimental to the interests of the industry in general and I think that they should be discouraged. I would have no objection to making it a condition of the license that the number of factories in each district should be dependent on the amount of cotton available. For instance, take the case of Multan, where the total crop is enough for four or five factories, but where there are at present 42 ginning factories. Eight are actually working when there is sufficient work. There are 34 factories lying idle. They simply exist for sharing in the profits of the pool. The machineries and the factories are lying idle. They might be utilised for other purposes or for other industries. As to whether some concessions might be given to the factory owners to remove their factories

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[Continued.]

to places where they are really required, I think that a good number of them would be prepared to have their factories valued and sold because there is always a chance that a pool may not last. The factory-owners might sell to people who own factories in other parts. I do not think that the building are expensive. They could sell the bricks and the land. There have been some pools which fixed the price at which cotton was purchased. They have not lasted very long as some capitalist stepped in.

908. (Mr. Hodgkinson.) I could not detect five per cent. of *deshi* in 4F. *kapas* with absolute correctness. I should not like to base my sales on that. If I want to classify, I should take a fair proportion and have it ginned. The best test that you can make is by taking the actual proportion of the seed. You would not be able to tell the proportion of *deshi* very well without seeing the seed. In the auction sales, the Agricultural Department classifies the cotton as A. B. C. and D., i.e., according to the percentage of mixture. But I do not think that by looking at the carts they can classify exactly to a five per cent. limit.

909. As to *kapas* taken away by the rats to their holes and left outside the holes after the seed has been eaten, it is picked up by the women who pick the cotton. My idea is that it forms about two or three per cent. of the whole. I am inclined to think that it does affect the outturn. If rats eat the seed, there is a slight improvement in the ginning percentage of the cotton. The pickers in order to increase their share pick up this cotton, throw it in with the rest of their pickings to get a bigger weight. Some of it goes to market.

ANNEXURE

Written Evidence of Mr. H. T. Conville before the Industrial Commission.

910. Preamble.—I desire to give evidence on—

(1) The agricultural industry, and (2) The cotton ginning and pressing industry only.

911. *Agricultural industry.*—Agriculture being the most important industry in the Punjab, Government is not likely to find a more profitable way of spending money than by encouraging it and providing more scientific workers and practical men to solve the many questions in cultivation, introduction of implements, rotation of crops, watering and the handling of the produce advantageously in order to obtain the best market prices.

(2) The cultivator is not unwilling to change his traditional methods of cultivation in favour of new ones provided he has the advice of experts and has the opportunity of seeing experiments and practical demonstrations at convenient centres carried out by Government, which he cannot afford to do, that he is assisted in every possible manner by Government subordinate officials, *zaildars* and *lambardars* in the execution of their duties, so that he does not spend more time and labour than is actually necessary and compensated for in carrying out their orders, and that the local co-operative societies help him financially so that he may not be forced into the hands of the *bania* for his financial requirements at exorbitant rates of interest.

(3) This could be brought about by Government increasing the number of experts in the Department of Agriculture and Industry and by spending more money on experimental work, so that each district would have suitable experts, with the necessary subordinate staffs for controlling the work in each district.

(4) The increasing of the Agricultural Departmental staff will mean increased expenditure on the part of Government, and create a demand for trained men. So far as the men are concerned, the various districts might be manned gradually in accordance with the men available and as regards the increased expenditure Government will be compensated by increased revenue, when outturn and qualities are improved and better prices obtained.

912. *Cotton ginning factories and presses.*—A considerable amount of capital has been raised and machinery purchased for this industry, but, in my opinion, fully three-fourths of that capital has been handled to the detriment of capitalists and the cotton industry. There are more ginning factories and presses erected than are really necessary for the amount of cotton available, with the result that there is a large amount of capital locked up, good machinery lying idle and inefficient handling of the industry. For instance, in the Multan and Muzaffargarh Districts alone, there are 41 ginning factories and eight presses, representing the capital outlay of about 20 to 25 lakhs of rupees, whereas for the amount of cotton available, there is only a necessity for eight ginning factories and four presses, which is proved by the conditions prevailing there. These surplus factories and presses have only been erected for the purpose of sharing in a pool, which is established in those districts. The amount of cotton (*kapas*) available in those districts amounts to about three to four lakhs of maunds, which means the outturn of about one lakh to one lakh thirty thousand maunds of ginned cotton. This amount of cotton will be profitably and advantageously ginned by eight ginning factories and pressed by four presses, yet there are 33 surplus factories and four surplus presses in those districts, simply because they and the working factories share in a pool of about one lakh of rupees annually, i.e., a profit of little more than Rs. 2,500 for each factory, and a pool of about Rs. 80,000 for the presses, i.e., a profit of a little over Rs. 10,000 for each press. Without the surplus factories or presses, the factories would earn about Rs. 12,000 or more each and the presses about Rs. 20,000 or more each. The pool system for the factories is that each working factory pays into a pool Re. 1 per maund on every maund of cotton ginned and buys *kapas* at the market rate current. In this manner one lakh of rupees is collected in the pool when one lakh of maunds of cotton is ginned in the district. The amount in the pool is then distributed among the 41 factories, in proportion to the number of gins in each factory, each gin being entitled to one and half pies per gin in the factory. Similarly the pool system for the presses is, that each working press pays Rs. 2-4-0 on every bale of cotton or wool pressed into a common pool and when 25,000 bales of cotton and about 10,000 bales of wool are pressed, about Rs. 80,000 is collected in the pool for distribution among the eight presses, which amount they divide equally. For the sake of this distribution, there are a matter of about ten lakhs worth of ginning machinery and about three to four lakhs worth of pressing machinery lying idle in those districts alone. This pooling system is established in the Multan District and in a few other districts and it enables the idle factory or press to receive some income, but in the districts, where no pooling exists, there is no income whatever for the idle factories and presses. The only way of helping the capitalists to stop this unnecessary locking up of capital and keeping machinery idle, is for Government to limit the number of factories and presses in every district, so as to work efficiently the amount of cotton available. One ginning factory of about forty gins should be allowed for every 50,000 maunds *kapas* available for ginning and one press for every 10,000 or 12,000 bales available for pressing. I am of opinion that no financial aid is necessary on the part of Government, but what is really necessary is Government advisory control over all industrial concerns. I am also of opinion that Government should establish ginning factories, at suitable centres for

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the special ginning of long staple cotton, not only by way of demonstration, but in the interests of the industry itself, such factories could be handed over to private capitalists or companies, when Government was satisfied that the system of ginning had been established and that the industry itself would in no way suffer.

Maulvi FATEH-UD-DIN, B.A., Officiating Deputy Director of Agriculture, Punjab.

EXAMINED AT LYALLPUR JANUARY 11TH, 1918.

Written statement.

AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

913. (1) **Experience.**—I am supposed to be in charge of the most of the districts of the province, but agricultural work of any importance is going on in only seven of them. I shall accordingly deal in these notes with seven districts only as I have been in actual touch with the cultivators in these places for over six years. These are:—

(i) Hoshiarpur, (ii) Jullundur, (iii) Gurdaspur, (iv) Amritsar, (v) Sialkot, (vi) Gujrat, (vii) Shahpur.

All these grow cotton but excepting the district of Shahpur, the Taran Taran *tehsil* of the Amritsar district and part of the Gujrat district which has only recently come under the Upper Jhelum Canal, this crop is not of very great importance and is grown more or less for local consumption.

914. (2) **Varieties.**—In these districts, *Gossypium indicum*, *Gossypium neglectum* and *Gossypium sanguineum* varieties are grown, but nowhere is a pure crop of any of these seen. They are always found in mixtures though a certain variety predominates in certain parts and the other in other places. *Gossypium indicum* is perhaps more extensively grown than any other. Nos. 1 and 2 are largely grown in the central districts of the province and Nos. 1 and 3 in the western districts.

915. (3) **Size of holdings.**—The size of holdings vary in various districts. In the central districts (Hoshiarpur, Jullundur, Gurdaspur, Amritsar and Sialkot) the holdings are not very large and vary between three acres in Jullundur to six acres in the Sialkot and Amritsar districts and one hundred and fifty acres in greater part of the Shahpur district, but the average area per plough would be eight acres in the central districts and fourteen in the Shahpur district. Of this, in places where cotton is grown, it forms not more than only one-sixteenth of this acreage in the central districts and one-tenth in the Shahpur district.

916. (4) and (6) **Yields and profits and comparative returns.**—The outturn per acre also varies from 2½ maunds in the *barani* of the Gurdaspur and Gujrat districts to seven maunds in the irrigated areas of the Sialkot and Amritsar districts. In almost all these districts cotton is generally grown in mixture with *moth* (*Physalis aconitifolia*), *guara* (*Cyanopsis psoralioides*), melons, etc., and in *barani* areas ratoon crops are also taken. It is, therefore, rather difficult to work out very definite figures of profit per acre from this crop alone and also no accurate estimate could be made of cultivators' own labour; for his daily wages are only what he eats which is nearly three annas a day. The profits per acre are, therefore, very rough estimates and vary from Rs. 6 per acre in the *barani* areas to Rs. 21 in the irrigated areas. This compares with the other main crops of the same districts in the profits per acre as follows:—

	Rs.
Rice	65 profit per acre.
Wheat (irrigated)	20 " " "
Wheat (<i>barani</i>)	6 " " "
Sugarcane	40 " " "
Maize	20 " " "

It will be seen, therefore, that cotton is not so very paying a crop in these district as compared with other staple crops, for they not only give the cultivator grain to eat but also provide fodder for cattle and except sugarcane appeal to him in quick returns.

917. (5) **Rotation and manures.**—Manures are seldom applied to cotton. The residual effects of manures applied to sugarcane and residue of *senji* are the only manuring done to it. In some places cattle are penned in cotton fields and very often *senji* is fed in the very fields, where it is grown, and this goes under cotton afterwards.

(2) Owing to paucity of holdings, no fixed rotation is practised; for the *zamindars* look to the season, i.e., if it is favourable or not for certain crops at their sowing time, market demand and their own convenience to grow any particular crop. An idea of the sequence of the crops is below:—

Irrigated areas:—

- Wheat, cotton, *senji*, sugarcane.
- Cotton, *senji*, maize, wheat.
- Cotton, *senji*, sugarcane.
- Maize, *senji*, sugarcane, wheat, cotton, *senji*.

Barani areas:—

- Cotton, cotton.
- Wheat, fallow, cotton.
- Maize, fallow, cotton.
- Ratoon cottons.

918. (7) **Conditions affecting increase in area.**—The area under this cotton in these districts fluctuates considerably owing to the variations in the season, the market prices and any unusual attacks of pests; e.g., in 1914 there were early rains in March and April and the prices the year before were good; the area under cotton in Amritsar district in that year was over 67,000 acres. But, when this crop ripened, the market was low, there were no early rains and consequently the area in that district in 1915 went down

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to 24,700 acres. The prices were again up, also there were good rains in April, so the area in that very district in 1916 went up to 51,196 acres. In 1905, there was a bad attack of bollworm, the area in the same district fell from 54,526 to 31,315 acres in 1906. Similarly the prices of 1910 crop were high and the area in 1911 in the Jullundur district rose from 27,977 to 32,832 acres, which year there was again an attack of bollworm and the area in 1912 fell to 28,334 acres. This was a year free from any pest and the prices were good and the area again rose to 39,382 acres.

(2) There is no possibility of any increase in the area under *deshi* short staple cotton in the central districts except perhaps the Tarn Taran *tehsil* of the Amritsar district. I, however, think that in these districts, even including the Tarn Taran *tehsil*, there is every likelihood of cotton decreasing considerably rather than increasing. Cotton here comes in competition with sugarcane, which too has gone up in prices in these days and pays better. It not only pays the grower in money returns but provides him with work during the slack season and with green fodder for his cattle at a time when no other green fodder is available. Sugarcane, moreover, is a more sure crop and has even to be grown against the occasional visits of fodder famines. In the Shahpur district, the area will go up if the market demand does not go down. But in such places the increased area will probably be more under American cotton rather than under *deshi* owing to the great premium the latter fetches and some immunity from pests.

919. (8) **Uses of seed and seed selection.**—The seed is fed to cattle, especially milch cattle. The *zamindars* generally select their seeds (in the irrigated areas for certain). Big well developed well opened bolls are selected in the middle pickings. *Tillars* (Three lobes, i.e., three loculi) *neglectum* or *indicum* is generally preferred as it gives high lint percentage. Seed selected for sowing is always hand ginned.

(b) "Deshi" long staple cotton.

920. (11) **Varieties.**—No long staple *deshi* cotton is grown in this province.

(c) Exotic cotton.

921. (20) **Experience.**—The Lower Jhelum colony only of the Shahpur District grows exotic cotton in my circle. This year it was also grown for the first time in a part of the Gujrat District, which had come under the new Upper Jhelum Canal. I have been in charge of this colony for over four years and have been in actual touch with the cotton cultivators.

922. (21) **Varieties.**—The American variety only of exotic cottons is grown here. Of this the seed recommended by the Department, type No. 4F., is predominating, next comes the Dharwar American and Punjab *narma* and, last, khaki lint *narma* (*Gossypium hirsutum*, var. *rufa*). The last named is found in very small quantities, mostly in old *jangli* villages.

923. (22) **Size of holdings.**—This District of Shahpur can be divided into:—

- Barani* areas,—where no cotton is grown.
- Old *abadi*,—partly irrigated by wells and private canals and partly by the Government inundation and perennial canals.
- New *abadi* (colony) irrigated by Lower Jhelum Canal.

(2) In No. (ii) the holdings are pretty large. There are few villages where holdings are as small as ten acres, while at the same time some of the holdings are as large as 20,000 acres and even more. The average holdings in this tract would be some 150 acres, but the holding per plough is about sixteen. One-tenth of the holdings comes under cotton, but the area under cotton in this tract is going up and it will go up to one-fifth in another ten years, if the market continues good. All the same in this tract, *deshi* cotton is mostly grown and very little American. The reason is that on the inundation canals water is not available at sowing time and also in October. Cotton here is generally sown late and follows wheat. Secondly, the tenants there are very conservative and not very sportive. They are far away from any ginning factory and cotton market and are quite content to go on as they have been doing in the past. Further and it is very important with them that they keep a large number of milch cattle and should, therefore, have a lot of fodder for them. With *deshi* cotton they can grow fodders *moth*, *guar*, *guara*, etc., in mixtures, which, if the cotton were American, cannot be grown without seriously affecting the outturn of the cotton crop. Lastly they almost in all cases deal with the village *banias* and very seldom come to know of actual market prices and consequently they do not get any encouragement for growing better kinds of crops. All the same, the area, which is irrigated by the Lower Jhelum canal in this *abadi*, is now largely taking up the cultivation of American cotton.

(3) In number (iii), the holdings are on an average 58 acres. One-sixth of this goes under cotton. But this year's prices, if the season is favourable and water at sowing time enough, will induce the growers to put more area under cotton next year, the area may go up to one-fifth of the holdings.

924. **Possibilities of American cotton in the Lower Jhelum Canal Colony.**—It should not be understood that all the Lower Jhelum Canal Colony grows American cotton alone, but it is spreading and replacing *deshi* cotton, and with good prices in a few years, most of this area would grow American cotton. It is spreading and rapidly too, but the extension of area under pure and improved types would depend upon the establishment of our seed farms and how soon the Department can push on and advertise its cultivation by having more trained men. Moreover there is a great scope to increase the outturns of cotton in this colony by demonstrating and teaching better methods of tillage. The cultivation mostly is primitive. The cultivators generally give a couple of ploughings and broadcast the seed. The after cultivation is very rough and not of much use.

925. **Necessity for seed farms.**—I think a great number of seed farms, with gins of their own, which could also serve as demonstration farms to show better methods of cultivation and tillage, should be established in the cotton growing tracts. Each of these farms should have a radius of ten to fifteen miles under its influence. They will not only supply pure seeds but also push on the work of the introduction of improved varieties as well as the improved methods of cultivation and all other things concerned with the cotton cultivation as picking, storing and marketing, besides bringing to their notice other activities of the department. The man in charge having a controllable circle will be able to have a kindly influence with all the cultivators within his range and command their confidence. The supply of pure seed and his frequent visits will not only stop altogether any mixing in the field but will also help to secure good prices to the growers in his constituency. He can also persuade them to do away with the middle men or whosoever makes an undue profit at the grower's expense and mars his reputation by mixing and bad storage, etc. There will only be the initial cost of starting these farms. Afterwards they will not only pay their own way but bring in a good profit. Wherever there

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are cavalry breeding farms, these could very well serve this purpose, if put in charge of departmental trained men instead of having an Indian officer of the cavalry who knows little about cultivation and perhaps as little about horse breeding. An experienced Agricultural Assistant with Veterinary Assistant to help him in breeding, as he does at present on these farms, could do the same work more efficiently besides supplying the neighbourhood with good seed and demonstrating better methods of cultivation and tillage.

926. (23) **Comparative returns.**—The average yield of American cotton in this colony is 4½ maunds per acre. Taking an average of the last five years' prices, the price per maund comes to Rs. 12. This means Rs. 54 gross income. The cost of cultivation is roughly Rs. 24. The profit per acre comes to Rs. 30. The *deshi* cotton on an average gives four maunds per acre. The price of this cotton for the last five years on an average has been Rs. 8 per maund. The gross income from an acre is Rs. 32. The cost of cultivation is less and can be put at Rs. 20. The profit per acre is therefore Rs. 12. The most important crop in this tract is wheat which yields on an average thirteen maunds. The prices are generally Rs. 3-4-0 per maund and taking Rs. 5 as price of *bhusa* per acre, it gives Rs. 47-4-0 per acre. The cost of production is Rs. 28, and the profit per acre is Rs. 19-4-0 (the price of *bhusa* has gone up considerably recently).

927. (24) **Rotations and manures.**—The rotations followed are :—

- (a) Wheat, wheat, *toria* or turnips, cotton.
- (b) Wheat, *toria* or turnips, cotton.
- (c) Wheat, *toria* or turnips, cotton, sugarcane.
- (d) Wheat, *bajra* or *juar* or *guara*, cotton.

Nos. (a) and (b) are the common rotations.

(2) Manure is rarely applied. The previous crop of turnips is generally manured or where cotton follows sugarcane, it gets the residual effects of heavy manuring to that crop.

928. (25) **Conditions affecting increase in area.**—If plenty of water is available in March and April and also in September and October, the area under cotton will go up by another ten per cent. without any serious competition with food crops: the increase in the area under American cotton will affect *toria* sugarcane, wheat, melons and early fodders. I do not think the area will ever go up any more than this; for

- (i) Canal Department guarantees 25 per cent. of *kharij*.
- (ii) The increase will affect other crops.
- (iii) It is more or less a speculative and not a very sure crop.
- (iv) The cultivator must have at least forty per cent. of his area under wheat, which is more sure as a crop and provides him with grain for his own consumption and fodder for his live stock, also he must have at least sixteen per cent. under fodder crops, especially in this colony, where a mare must be kept as a condition of tenure, and where also the cultivator looks upon his cattle, more especially milch cattle as a great asset. The rising prices of *ghee* are also another inducement to these people to grow more fodder to keep more milch cattle, especially buffaloes.

929. (26) **Suitability of existing varieties.**—I think the 4 F. type of American cotton, the cultivation of which this Department is at present pushing on, is so far the right variety to be spread. But futurity might produce any better types or varieties for future introduction. The Economic Botanist must continue his work of breeding, hybridisation and selection. The last must also be in progress at experimental stations. The selection work is as important or even more in the improvement of plant in cotton as anything else.

930. (27) **Prevention of mixing of different varieties.**—Growers have come to realize the value of bringing pure stuff in the market by the better prices they get for it and no intentional mixing is ever done by them. All the same, some *deshi* plants do find their way into American cotton fields. The reason is that *zamindars* do grow and will continue to grow for some time to come some *deshi* cotton for their own use and if the pickings and storing have not been carefully done, some mixing takes place. But there are a few places where no other cotton except American is grown. Mixtures in such places come from the seed. The mixing in the field can be stopped by supply of pure seed from any agency supervised by the Department. The supply of pure seed will remove largely this complaint about mixing in the field. There should also be enough supervising staff, who should take upon them to get *deshi* plants rogued out from the fields of American cotton. This will have to be done for a few years only.

(2) The establishment of seed farm in each locality and seed agencies managed by co-operative credit societies would help to stop mixing in the field, for few growers will select their own seed in the case of American cotton as they do with *deshi*. The reason is that the lint of the American cotton is no use to them. It can not be spun and handled in the local method. It pays the grower even to buy *deshi* cotton for his own use and sell his American.

(3) I think that buyers also can help a good deal to stop this mixing in the field if they would pay better prices for pure stuff and fix their prices according to impurity percentage. They don't make much difference up to five per cent if the quality is good.

(4) The mixing in the factory can only be stopped by legislation and having separate ginning factories for *deshi* and American cotton.

931. (28) **Importation of seed.**—So far this is a moot point. Seed should, however, be imported from America and acclimatised at the Government central farms and compared with the seed at present recommended for distribution. So far there are no evident signs of degeneration in the seed, but later on it may appear necessary to import fresh blood to keep up the strain. Selection of seed, of course, is very necessary every year and this should be continued on Government farms.

II.—COMMERCIAL ASPECT.

932. (30) **Local trade customs.**—The cultivator has seldom a free hand with his produce. In nine cases out of every ten, he is under obligation to somebody, the village *bania*, the commission agent, etc., etc. His produce, therefore, naturally goes to his creditors in most cases. Most of the *kapas* in villages at a distance from market places is bought by the village *bania* or through him. I have collected some figures of cotton coming to the market in November and December this year. Over 85 per cent. of the *kapas* that came into Sargodha belonged to the village *banias*.

(2) Those who are near big towns owe something to commission agents and their produce passes through the latter's hands. There are very few to go to a factory direct.

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(3) In the Jhelum Colony, forward contracts are not an uncommon thing. Sometimes standing crops are sold, which is a more speculative form of buying cotton than the other in which a grower agrees to sell to a buyer all his produce of cotton at a rate fixed at the time. In both cases, advances are made, but it is not very common. When standing crops are purchased, pickings are done by the buyer at his own expense. In cases, where the village *bania* buys the stuff, he markets it at his own expense, but in other cases, it is brought to the factory by the grower.

(4) The commission agents too, in many cases, play the buyer. Factories too buy in the villages. This is especially the case when a factory owner has also a commission agency. The exporting firms too buy in the villages.

933. (32) **Buying agencies.**—It is very difficult to decide upon any form of buying agency. The *zamindar* wants money at once and whosoever gives him least trouble and pays him at once is the best buyer for his purposes. This is where the middlemen and commission agents really come in. The grower should sell his stuff direct to the exporting firm or ginning factory, but he cannot afford it. He wants money at various times of the year and these middle-men provide him with it and put him under an obligation to deal with them and none else. Perhaps the best form of selling agency would be co-operative sales, if they can be introduced; or there should be cotton markets at various centres where stuff, as it comes in, should be classified and stored and auctioned every fortnight. Some thing of this kind will be much appreciated by the growers and will insure the best of prices for their stuff. The staff employed for this organisation could help in demonstrating improved methods of cultivation, etc. If there were co-operative credit societies in every village, I think the grower will always manage to sell his stuff at a good price in the market without any special form of buying agency as long as he can learn the ruling market rate.

III.—STATISTICAL.

934. (35) **Publication of Liverpool and Bombay prices.**—The daily publication of Liverpool and Bombay prices is very useful, as it gives the sellers an idea of the ruling market rates. These publications should be more widely circulated.

IV.—GENERAL.

935. (46) **Attitude of buyers to improved cottons.**—The buyers have been offering a premium for improved cottons but not as much as they should do. They have been keeping a greater margin of profits for themselves as is apparent by the auctions the Department holds annually at various places, where prices are always much higher than the bazaar rates. In fact, this system of auction sale had to be introduced owing to the buyers' indifference to pay the grower any premium for improved cottons.

936. (49) **Effect of tenure of land.**—In the Sargodha Colony, the horse breeding condition on which the land is held affects the extension of American cotton. The area under fodder otherwise would surely go under cotton.

Maulvi FATEH-UD-DIN called and examined.

937. (Mr. Henderson.) The average yield of cotton per acre in the Sargodha Colony is about four to five maunds. This year the yield of *deshi* is much less than that. The average yield of *deshi* and American in normal years is about equal. This applies generally to Sargodha. Of course, good cultivators get much higher yields than that and the highest yield obtained so far has been 22 maunds of *kapas* per acre. That is where the land is good, the cultivation is good and manure is used. It is only an exceptional case. Yields are going down slightly all over the colony as a general thing, as in the Sargodha colony, the people are very backward; if there were good cultivation and manuring, it would stop the yields going down. Sargodha is divided into two *abadis* one of which is irrigated by the Lower Jhelum Canal and the other of which is irrigated by inundation canals and wells.

938. We are following the usual rotation, i.e., wheat, *toria*, cotton, wheat, wheat, *toria*, cotton. If people were to leave out *toria*, they would get better yields but it pays them to grow *toria* and it is not on the ground for a long time. The yields could be increased by a couple of maunds if *toria* were left out. *Toria* gives on an average ten maunds to the acre and it fetches from Rs. 4 to Rs. 5 per maund. So an acre pays at least from Rs. 40 to Rs. 50. I do not advocate it but the people prefer to grow it and will continue to do so, because it pays them.

939. The proportion of cotton is at present four *killas* to a square, i.e., about one-sixth. It is about half of the *kharij*. I think cotton is on the increase. I think it will go up a little more on account of the present high prices. It might go up to sixty per cent of the *kharij*. I should think that is the limit under existing conditions. I have not yet found any difficulty in regard to seed supplies. So far we have been meeting all demands. We are putting it out through our own people and through no body else. The canal people do help in advertising about such seeds, etc., but not in actual sale of seeds. I do not get my seeds from the Lyallpur College for distribution as there is a separate seed farm in the Lower Jhelum Colony. We got selected seed from Lyallpur to grow on that farm as we started seed selection at Sargodha only last year.

940. (Mr. Roberts.) Buyers pay a small premium for American cotton but I do not think they pay the proper price. We get higher prices at the auctions. There has only been one auction this season but there will be another shortly. The total quantity of American cotton sold at the auction was over ten thousand maunds. The highest price was Rs. 21-6-0. The average was about Rs. 20. We got better prices in all cases than the ordinary rates offered in the local market to the individual sellers.

941. Last year we distributed about 1,400 maunds of seed and this year we shall be able to dispose of about 5,000 maunds at least of seed. That is enough for 50,000 acres. Some people buy their own seed from the factories. The total area in the Lower Jhelum Colony under American cotton this season is 35,000 acres out of which, 14,000 acres are from seed supplied direct by us. The other seed came from the factories. Some people, not very many, kept their own seed. I have not formed any estimate of the total acreage under American cotton for next year but I expect that it will be between 65,000 to 75,000 acres. The seed we expect to sell will grow about 50,000 acres. The arrangement we made last season in regard to our seed was this. The A class cotton was sold to Messrs. Tata and Sons on the condition that they should keep it separate from the remainder and that it should be ginned under departmental supervision and the seed given back to us. The seed was good and the germination quite satisfactory. The five thousand maunds

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of seed I mentioned includes the seed for the Upper Jhelum Colony also. There were only 1,000 acres under 4 F. in the Upper Jhelum Colony last year. I cannot give the estimate of the area that will be put under cotton next year, but a greater part of the cotton area in that colony on that canal would be under American cotton. A good many people on the Upper Jhelum Canal have come from the Sargodha Colony and they will all grow American cotton.

942. My estimate of the yield of American cotton in the Lower Jhelum Colony this year is 4½ maunds. That for *deshi* is less, about three maunds. *Deshi* has suffered much more than American. I formed this estimate after the sales in December. The outturn in the Lower Jhelum Colony is rather poor in comparison with Lyallpur and other places. The cultivation is poor and a mixed crop is almost always grown. Cotton is grown mixed with fodder and I have seen even American cotton grown in mixture with fodders.

943. If enough water were given in February, it would be used for preparing land for sugarcane and cotton. The area under both would go up. For sugarcane, water is wanted in the end of February. On inundation canals, if we got water in the beginning of April, it would do for American cotton. Almost all the land on the Lower Jhelum is given out on horse breeding conditions. I think that if the cultivators get more water in *kharij*, the conditions would improve in regard to the growing of fodders. *Juar* in *kharij* and *shaftal* in *rabi* would be grown.

944. It would be a sound thing to have Agricultural Assistants in charge of the Cavalry farms on the Lower Jhelum Canal. The farms would then be able to influence agriculture; and would serve as a sort of seed farm. The people, who are just round about Sargodha, are taking an interest in cultivation because they have got some confidence in us and we have thus a sort of influence over them and also the presence of the seed farm helps by offering a practical demonstration of what is advocated. Further away the cultivation is bad.

945. I am supposed to be in charge of 22 districts in the province. There are 29 districts in all. I have got one experimental farm at Gurdaspur, one seed-farm at Sargodha, three demonstration farms, one in Sialkot, one in Amritsar and one in Gujrat. There is also a seed-farm at Chillianwala in the Gujrat district. In addition, agricultural work is going on in the Jullundur and Hoshiarpur districts. I have got six assistants in these districts—two under District Boards and four under the Department, and one Farm Manager. So that, out of 22 districts, sixteen have no staff at all. Sargodha, I visit once a month. I seldom visit six of these districts. I am on tour over 200 days in the year.

946. In the central districts, the cultivators prefer wheat and sugarcane to cotton. In fact, in all the districts they prefer wheat to cotton.

947. Insect pests have not been a serious pest lately. Bollworm is a serious pest occasionally. There may be a danger of its appearance this year as the winter was very cold. The bollworm parasite is killed in such a cold season.

948. There should be at least one seed farm in each district on which improved methods of agriculture would also be demonstrated. I am also in favour of separate ginning on these seed-farms. The best prices for cotton can be obtained at the auctions when there is competition. We shall secure control of the seed as well as give the cultivators an idea of what the prices that year are. I cannot say whether private enterprise will take the place of this in course of time. I am not hopeful about it. Perhaps it would be better if the co-operative movement were to take it over.

949. (Mr. Wadia.) There are some tracts where people will continue growing *deshi* cotton, i.e., (1) on the inundation canals, (2) on wells in the central districts, (3) where cotton follows wheat. In some districts, there are tracts which are far away from the large centres and the people do not know about prices and are in the hands of the village *banias*. They grow fodder mixed with cotton, and are quite content to get two or three maunds of cotton. They cannot grow a good fodder crop with American but they can with *deshi*.

950. (Mr. Hodgkinson.) The harvesting of wheat does not interfere at all with the sowing of cotton. Most of the cotton is sown before wheat is harvested. Cotton is sown from the 15th March to about the end of April. Wheat harvesting begins about the 15th April. That even would be early wheat and people really begin about the 20th. Only a small proportion of cotton is sown in lines at present. I am advocating sowing in lines and think this practice will be taken up very largely next year. Some *deshi* cotton is also sown after wheat is harvested. The ordinary period for sowing *deshi* is the same as that for American but it can be sown later whereas American cannot.

951. (Mr. Ashton.) I cannot say what the demand is in *kharij* compared with the capacity of the canal. The people generally complain that they do not get enough water to irrigate their crops.

Mr. O. T. FAULKNER, Deputy Director of Agriculture, Lyallpur.

EXAMINED AT LYALLPUR, JANUARY 11TH, 1918.

Written statement.

952. *History of introduction of American cotton in the Punjab.*—Although some previous attempts had been made, the history of the introduction of American cotton in the Punjab really starts with the experiments initiated at Hissar at the instance of Mr. Mollison, then Agricultural Adviser to the Government of India, in 1902, and subsequently transferred to Lyallpur. From that date the work has been more or less consecutive and can be followed in departmental files so far as the efforts of the Agricultural Department are concerned. This is unfortunately not the case with regard to the even more interesting spread of this cotton in certain parts of the Canal Colonies—notably Jhang—apart from the efforts of the Agricultural Department. And for information on the point I have been able to rely on nothing more than enquiries made by our assistants among old *zamindars*.

(2) It appears that prior to the colonization in the new canals (i.e., before 1895), acclimatized American cotton was growing, though generally much mixed with country varieties, in various "old" districts, notably Shahpur and Jullundur. Various colonists brought such seed with them, and the local *janglis* obtained it from these new settlers. It was chiefly in Jhang district that cotton crops were grown in which American constituted any large percentage, but such fields were extremely rare until after the bad "bollworm" years, 1905 and 1911. For a long while (probably up till about 1908), American *kapas* is said to have fetched a few annas less in the market than *deshi*.

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(3) Until 1906, the experiments at the farm did not seem to advance matters much. Many varieties were tried, some were rejected, and the Dharwar and Cawnpore acclimatized American seem to have been regarded as rather more hopeful than others. It seems to have been largely due to Mr. Renouf's faith in the possibilities of long staple cotton that the experiments were persisted with. In 1906, Mr. Dobbs took charge of the farm work. He seems immediately to have recognized the hopefulness of the acclimatized American and its superiority over any other varieties. He also recognized that a very large number of types and crosses were included in the varieties grown at the farm under the names of "Dharwar" and *narma* American. He started the experimental work on sound lines. In 1908, he handed over to the Economic Botanist a large and varied collection of strains and pointed out the type of plant likely to succeed here (rough leaved and early). In 1909 and 1910, the Economic Botanist handed back to the Professor of Agriculture for further testing a few more strains which had appeared in his tests to be the best of those he originally took over. Meanwhile the Director (1904-07) and later the Deputy Director (Mr. Milligan) were trying to encourage the spread of the cultivation of American cotton in the province. Seed was distributed annually by the Department in sufficient quantities for the sowing of several hundred acres (1906-1912). The Canal Department gave special assistance in the way of better supplies to growers of this cotton up to 1907. In 1906 and 1907, arrangements were made with certain firms who were assisted to buy the *kapas* in villages or markets. They gave a premium over *deshi* (Rs. 1-8-0 per maund) which was important compared to the prices of *deshi* at that time. "The usual evils of monopoly" were however so marked that, in 1918, Mr. Milligan proposed and held auction sales for the *kapas*. The premiums commanded were no higher (Rs. 1-6-0 in 1908) but the system was free from the abuses of the previous one.

(4) In 1910, seed, chiefly imported from Dharwar, was distributed by the Agricultural Department sufficient to sow about 1,000 acres and Mr. Milligan reported that the crop from local acclimatized seed in Jhang amounted to several thousand bales. The more rapid spread of American cotton in Jhang where the cultivators received at most only indirect assistance from the Department's activities is worthy of note. The reasons for this appear to have been:—

- (1) In Jhang acclimatized and "naturally selected" seed was used, whereas the Department was chiefly distributing the Dharwar American annually imported. Many strains of this at least were unsuited to the Punjab.
- (2) In Jhang cotton was, and is, the chief *kharij* crop (other than fodders). Hence the lesser susceptibility of "acclimatized" American cotton to vicissitudes of season and disease was more fully appreciated.
- (3) The somewhat greater demand of American cotton on the water supply did not greatly concern inhabitants of that district, who have always notoriously tended to over watering.

(5) In 1911 and 1912, the Economic Botanist's selections were still under trial at the farm and Dharwar was still the chief source of the seed supplied to growers by the Agricultural Department. In 1912, seed of two of the Economic Botanist's selected strains, which appeared greatly superior to the fresh Dharwar seed, was given out to selected *zamindars* for trial and multiplication, and in 1913, 400 acres of 3 F. and 100 of 4 F., were thus grown. Moreover to supply the increasing demand for seed, the Department, contrary to the policy which was being adopted, distributed some forty maunds imported from Dharwar. That year was a bad one for cotton. The 3F. (smooth leaved) failed, the Dharwar imported did poorly; but the 4 F. type (hairy leaved) stood the test. There must also have been a considerable area in Jhang and other parts which apparently did fairly well. Moreover the produce of 4 F. seed commanded a good premium (Rs. 2-13-0) in the auctions. Thus, in 1914, the Professor of Agriculture could distribute all the seed he had (400 maunds) mostly for seed farms. The rapid and continuous increase since that date in the area of American cotton compared to *deshi* is well known.

(6) Since 1913 the following have been the estimated areas of American cotton grown:—

Year.	Area.	Authority.	Estimated area under pure 4 F.
1913	30,000	Mr. A. S. Pearse's report	1,000
1914	60,000	Mr. Roberts' report, Agricultural Journal.	3,000
1915	65,000	Mr. Roberts' report, Agricultural Journal.	9,000
1916	125,000	Irrigation Department returns and Mr. Roberts' report.	30,000
1917	277,000	Irrigation Department returns and Mr. Roberts' report.	At least 120,000

(7) The extent to which the auction sales have been beneficial may be judged from the following table showing the quantities sold and the premiums obtained over *deshi* cotton and over American sold to the factories in the ordinary way:—

Year.	Number of sales.	Quantity of <i>kapas</i> sold.	Premium over <i>deshi</i> .	Premium over American sold otherwise.
			Rs. A. P. Rs. A. P.	
1908-09	2	A few hundred maunds	1 5 0 to 1 9 0	Practically the same.
1909-10	2		1 6 0 to 1 8 0	Do.
1910-11	2			

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Year.	Number of sales.	Quantity of <i>kapas</i> sold.	Premium over <i>deshi</i> .	Premium over American sold otherwise.
1911-12 . . .	}	No sales held, factory owners gave about Re. 1-0-0 per maund over <i>deshi</i> .		
1912-13 . . .				
1913-14 . . .	1	950	Rs. A. P. 2 13 0	Rs. A. P. Rs. A. P. 1 8 0 to 2 0 0
1914-15 . . .	2	5,200	up to 3 13 0	About 2 0 0
1915-16 . . .	8	8,000	up to 3 5 0	„ 2 0 0
1916-17 . . .	9	48,000	4 0 0 to 7 0 0	„ 3 0 0
1917-18 . . .	12 (?)	(?) 80,000 to 100,000	4 0 0 to 5 0 0	1 0 0 to 3 0 0

(8) The value of these sales to *zamindars* is shown by the fact that even this year here in Lyallpur, the pure American *kapas* in the auction fetched Rs. 1-4-0 more per maund than it would have done if sold in the ordinary way. Actually this means even more than appears, as in the ordinary way of selling there are often allowances and deductions obtained by the buyers and commission agents, which are not always entirely justified.

(9) From the above history, it will be seen that rapid increase in area only occurred when the Department was distributing a really safe type of seed and made such arrangements that the produce commanded a good premium. In Jhang, the variety being grown was safe enough; but little or no premium was obtained for it; consequently the cotton spread, but it spread slowly in spite of other favouring factors. In Lyallpur and Sargodha, although the auction sales enable the *kapas* to command a small premium, yet success was not attained until the Department started distributing the selected type of acclimatized cotton.

(10) In view of these facts and that we have now a successful variety, I think that we should not introduce any new selection until it has been grown and tested for several years by the Economic Botanist and for several more on the Farm. (The type No. 280 does now seem to have been tested nearly sufficiently and will, if it continues to do equally well, probably be distributed tentatively next year or the year after.)

953. *Further increases in production of American cotton.*—The spreading of American cotton up to the limits possible in the present Canal Colonies may be confidently expected to take place very quickly even under existing conditions. The Agricultural Department in these colonies will need some expansion to deal with this area satisfactorily but I think this expansion is expected and will be provided for by Government. Any further increases beyond this amount depend chiefly on the Irrigation Department. The Irrigation Department alone might bring about some increase in growing of staple cotton in such an area as south-east Punjab) Jullundur, Ludhiana, Karnal, etc.), but I think that experiments there are necessary for three or four years before the Agricultural Department should attempt to push American cotton at all vigorously. In the most hopeful areas, where we know that agriculturally the crop is a success, i.e., West Punjab, any increase in area firstly depends on the Irrigation Department and only secondarily on the Agricultural Department. The role of the Agricultural Department must chiefly be to help the people to take advantage of improvements in water-supply during April–October. On some inundation canal areas, tube-wells or other improvements in lift irrigation may enable American cotton to be grown instead of *deshi*; but I do not think that the Agricultural Department should encourage expenditure on tube-wells in areas where there is a possibility of the inundation canals being greatly improved by weir headworks, etc.

(2) Increase in yield per acre depends mainly, I think, on the progress and expansion of the Agricultural Department.

954. *The improvement of the local marketing system.*—The auctions held by the Agricultural Department have been referred to. They have served :—

- (1) to enable us to get back pure seed.
- (2) to command for the growers of the seed given out by us, a premium more or less proportional to the value of the cotton.
- (3) to advertise the American cotton and to some extent to establish its price for all growers. They will serve to the same extent for any new variety we may subsequently introduce. There are, however, elements of unsoundness in them and the Agricultural Department cannot greatly expand the scope of these sales and it is doubtful if any other agency could take them over. Lastly, they do not encourage any improvement apart from the introduction of new types by the Agricultural Department.

(2) To keep the market as staple and sound as possible, I think that we must chiefly trust to the presence of as many kinds of buyers of *kapas* in the market as possible. At present we have :—

- (1) the gin owners who are also more or less speculators.
- (2) exporters.
- (3) representatives of Indian mills.

(3) Unfortunately owing to the fact that the latter two classes own no gins in the Chenab Colonies they buy little *kapas*.* I do not see that Government can do much more than allow any exporters or mills who are willing to put up gins, to do so. But this I think should be allowed even though there be already too many factories in the particular locality. Cheap rates and specially quick booking for unginned cotton would assist any such firms who put up factories.

(4) But really to encourage improvement is quality, differences in quality of our *kapas* need to get more recognition in the local markets than they do at present. Suppose two men should to-day bring American

* NOTE.—Since drafting the above, the local agents for Messrs. Tata and Sons have purchased two factories in Lyallpur.

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cotton *kapas* into Lyallpur and the class and *kan* (ginning outturn) of the cotton in each case is average, but the staple in one case is so superior as to be worth say Rs. 15 per *khandi* more in Bombay than average Lyallpur American and the other so inferior as to be worth Rs. 15 less. It is certain that the first man will not get Rs. 8 per maund more for his *kapas* than the average. I do not think he would get any premium unless, possibly, he happened to be able to sell it to one of the exporting firms. The man with the cotton of poorer staple might get something less than average; but it is impossible to say how much. The above will hold true even if the parcel of cotton be a fairly large one, certainly if it is less than 1,000 maunds. Even for this quantity, a higher price could not be obtained from the local gin owners. This is also true as regards staple of *deshi* cotton but this is of less importance. More regard is certainly paid to the class of *kapas* but I doubt if the seller of “superfine” *kapas* can often get the premium which it deserves.

(5) Some improvements in this respect may result from the setting up of gins by millowners and exporters if they will do so. But the local gin-owners may yet remain the chief buyers of *kapas*, and we want them to compete for the best cotton too. The local ginner will only give more recognition to variations in staple, if these are more recognised in the prices paid for *rui* in Bombay. The reason that they are not so recognised seems, so far as I can make out, to lie in the absence of a satisfactory system of standards for this cotton and impartial arbitration. If the Cotton Committee can bring about any improvement in this respect, it will greatly assist us here in the Punjab. The Local Agricultural Department would naturally assist in any way that they could.

955. *Future fiscal policy.*—This is a matter which I allude to with extreme diffidence. But I note from the daily papers that some witnesses have already referred to it and this must be my justification for doing so. Since it is the Provincial Governments that are mainly concerned with agricultural production, whereas the Imperial Government controls fiscal policy, there is I think some danger of the effect of fiscal arrangements on Indian agriculture not receiving quite the attention it deserves. If the Committee can emphasize the necessity of considering any such changes from the point of view of their effect on agriculture, they will, I think, do much good.

(2) As an instance of this, there seems to be some idea abroad that export taxes may possibly be levied after the war, on raw goods exported outside the British Empire or to enemy countries. Such taxes are commonly *ad valorem* but in the case of cotton, at present, it would (I suggest) have a better effect if this tax be specific. For in the case of short stapled cottons, India seems to have few competitors and an export tax per bale (if not too great) would probably have little effect in lessening production; in the case of more valuable cottons where India has to compete with other countries, the tax, if specific, would be less harmful on account of the higher prices per bale. Similarly such a tax would give a direct stimulus to the production of valuable staples. Personally I think that the same would hold true with regard to the existing import and excise duties, but I do not know enough about this to suggest a change in existing arrangements.

956. *Some suggestions regarding an annual cotton conference.*—I think every Agricultural Officer has felt the disadvantages which result from want of intercourse between the Agriculturalists scattered about India and the many commercial interests connected with cotton in this country. Here in the Punjab we are in close touch with the local representatives of firms and so on; but it is difficult to get and keep touch with Indian and Bombay mills and the heads of exporting firms. I would suggest an annual cotton conference of three or four days duration, more or less on the lines of Board of Agriculture. The following I should like to see represented :—

- (1) The Agricultural Department of each cotton growing province should be represented by the expert chiefly working on cotton.
- (2) Representatives of Cotton Sections of Indian Chambers of Commerce.
- (3) The exporting firms.
- (4) Whenever possible, a representative of the British Cotton Growing Association.

The above would constitute the formal representatives who alone would be expected to speak; but anyone interested in cotton should be welcomed as a visitor. The subjects for discussion will be commercial aspects of cotton problems—scientific papers would not be needed. As usual, in such conferences, as much good may be expected to result from the informal meeting of representatives of the various interests as from the formal discussions.

Mr. O. T. FAULKNER called and examined.

957. (*Mr. Henderson.*) As to what we are doing in regard to implements, we are not exactly strongly pushing, but we are encouraging, the use of iron ploughs; we are endeavouring to produce a type better suited to bullock shaft under local conditions. We are also strongly advocating the use of implements for sowing in lines. Pending the production of a cheap and efficient implement for interculture, on which we are working, we have nothing new which we are prepared very strongly to recommend for it. We have hoes which we offer for sale; but I cannot say that we are pushing them. We are advocating the wheat drill. It is of the same type as in other parts of India but with slight alterations to suit Punjab conditions. We do not use the marker on it. We are explaining and demonstrating reapers. We are not trying to force any of these implements on the people because there are so many economic factors coming in the way, but we are demonstrating them and assisting any one who is willing to take them up. Except the Raja ploughs and the reapers, the implements are all locally made. We have a certain number of spring tined harrows and chain harrows out; but they are too expensive to go very far. The bar-harrow which is a wooden harrow, and cost Rs. 7 before the war, now costs Rs. 12 but is sold at Rs. 8 as against Rs. 50 to Rs. 70 for any iron harrow. We are pushing it strongly; it is useful for cotton as well as wheat. The general position is that we are going on with *deshi* made implements excepting the plough and the reaper. We have got a threshing machine here. We thresh for people at a charge of annas four per maund; but we are not in a position to advocate any one taking up such machines excepting the big landlords. It might be possible for co-operative societies to do it, but I doubt if they could manage it at present.

958 I do not think that want of labour at the time of sowing cotton is a limiting factor as regards the area under cotton. If a man had the water, and considered that he could grow a larger area under cotton than he was doing, he would not be deterred by want of labour at time of sowing. The limit for the extension of the area under cotton has not been reached on the labour at present available. The limiting factor for the increase of cotton is, I think, water supply. There are many parts of colonies which are growing less cotton than others. A small increase in the area under cotton would not be at the expense of wheat. Even an increase of 100 per cent. would not necessarily make much difference to the area under wheat.

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959. As to the yield of cotton this year, I think a figure of about five or five and a half maunds an acre is about right. Improvements in cultivation would mean a considerable increase in yields. The figure for the average of the district is always much lower than the yield of a good field; because there are so many fields and parts of fields which have little or nothing on them owing to *kalar*, bad levels, weediness, late sowing, flooding or bad cultivation. As to the question of yield being reduced since the opening of canals, I should imagine that, in this colony, we have reached the limit of any deterioration if such really occurs. If any deterioration is now going on, it is extraordinarily slow. I do not think we are living on our capital with the present intensity. I hope to see a considerable improvement in the standard of cultivation all round. The use of improved implements, sowing in lines and interculture would help a great deal.

960. I think there are considerable possibilities for green manuring in this province but there is a lot to be worked out about it. It is very largely a matter of water supply. I do not think green manuring would take the place of wheat. If more water is given in *kharij*, green crops might be grown in *rabi*, but they would mostly be fed to cattle. It is one means of increasing the fertility of the country. It is an extraordinarily big question which should be worked out. We have an intensity of something like one hundred per cent., and on many fields leguminous crops are seldom or never grown. Under these conditions, I think some leguminous crops could be introduced in the *kharij* season, if the water arrangements were such as to encourage the cultivators to do it. If the intensity is increased, I think it will follow that more land will have to go under leguminous fodder crops. I am certainly not satisfied that the existing conditions are all that they might be. There is no doubt that they could be very considerably improved; but it is a matter for investigation more than for demonstration.

961. As to the arrangements for seed selection in this province, we have been mainly concerned with replacing *deshi* by American. Selection within the American is only now becoming important. We have done a certain amount of rough but systematic selection and we have an organization for replacing seed; but we have not gone to any very great distance in the matter, because we have been occupied in getting *deshi* replaced by the American. As to the best arrangement for future seed supply, we have exceptionally good facilities in the form of large landlords. We must have a good system on the farms and people near Lyallpur to spread the seed to the next stage, and after that we can increase the area under pure seed very rapidly by the help of the big landlords. It is not very difficult to get seed from one district to another. The facilities are quite good enough not at present.

962. (Mr. Roberts.) My reasons for thinking that it is possible to do much more by improved methods in increasing the yield of cotton than of wheat, are that cotton is usually sown on land which has had very little cultivation; one of the most usual rotations is after *toria*. After the *toria* has been harvested, there is practically no cultivation as the cotton is sown within less than two months' time. This applies even more to cotton sown after gram or sugarcane. A certain amount of cotton is always sown directly after wheat. The best cotton is sown after *seni*. Very little cotton is sown on land that has been fallow for any length of time, whereas wheat is invariably sown after the land has been lying fallow for six months. I have approximate figures showing the amount of cotton sown in lines, this year. It is something like five to six thousand acres.

963. As to my estimates for the area under American cotton next year, I am estimating that we shall have 250,000 acres or so, for which we shall sell our own pure seed. The total area will probably be something between 325,000 and 350,000 acres in the Lyallpur Circle, which includes most of the area under American cotton. We shall sell 25,000 maunds of seed. It includes all except the Upper and Lower Jhelum Colonies. The ultimate figure for American cotton under present conditions has been estimated at 400,000; though I personally think that it might go considerably higher because if the price remains anything like it is at present, cotton will replace maize and even to some extent *toria*. In that case, it would not be at the expense of the wheat area but of other *kharij* crops. That is, of course, if the price keeps over Rs. 15. If it goes down to Rs. 7, that would be a different matter. A large increase, say to much more than 500,000 acres can only be made possible by increased irrigation facilities.

964. I think we have reached a state of equilibrium on the present intensity. If you increase the intensity, I certainly do not think that the system of agriculture followed in these colonies is a sound one. If you increase the intensity considerably, I think it must be followed by a diminution in yield in each crop. To give up our fallow periods, we must have increased manure in some form. The land would not stand higher intensity with the present high proportion of grain crops. If the intensity be greatly increased, much of the increase must take the form of short-period crops. That I think practically means fodder crops, pulses and gram. I cannot explain the statement that there is no demand for water in early *kharij*. The explanation might be that the distributaries or water courses get badly silted in the *kharij*. My experience leads me to believe that the *zamindars* would certainly take more water in early *kharij* if they could get it with certainty for any length of time.

965. (President.) Jhang is still an important district for American cotton though it has not increased in the same proportion there as elsewhere. The cultivation there is very poor.

966. In the first two years 1908 and 1909, the premium obtained at our auctions over *deshi* and over American cotton sold in the ordinary way was the same; for American in the ordinary market was getting no premium over *deshi*. At present, the success of these auctions is due to the presence of representatives of such firms as Messrs. Tatas. It would take the buyer himself much time to pick out pure cotton from a large number of carts. He gets the benefit of our organization and is saved the trouble of collecting cotton for himself. He can buy 5,000 maunds of pure American in one day at an auction whereas it might take him three weeks to gather that quantity in any other way. Another important factor is that this makes it worth the while of the chief representative of a firm to attend personally. Thus he has not to trust to the judgment or honesty of a number of scattered subordinates. The auctions now serve only two different purposes. One is that they enable us to collect our seed; and the other is that they secure the *zaminder* a better price for his cotton. Their function as illustrating the price of American cotton, which was their primary purpose, comes more or less to an end this year. The second of the functions referred to just now could be taken over by some other agency. For the first function, auctions are necessary. For introducing new varieties, auctions will be necessary. As it is, we are simply getting more money for the *zamindars* by organized sale; but the thing is getting beyond our abilities, and our staff is not sufficient to carry on these auctions on the scale desired by *zamindars*.

967. I feel that the majority of agricultural officers find it extraordinarily difficult to get into touch with the trade (other than the local buyers) in regard to matters relating to cotton: to get in touch with the big people, with men who are in the know, and can do things, is extraordinarily difficult. I think a conference

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once a year with people connected with the trade would go a great way to meet the difficulty. A Central Cotton Bureau in Bombay consisting of various representatives of the trades, such as brokers, ginners, mill owners, shippers, and agricultural officers, would undoubtedly be very helpful; provided always that it worked in a manner acceptable to the trade and to the provincial officers. Such a Bureau should be able to facilitate connection between us and the trade; it might even hold such conferences as I suggest.

968. (Mr. Wadia.) I put in the rules under which our auctions are held.* There is no organization here for dealing with different standards of *deshi*. A difference of one-eighth inch the staple would fetch nothing in the local market. The American cotton coming into the Lyallpur market every day is about 200 to 300 carts. One could very easily divide those carts of American cotton into three or four classes. The factories pay a little less for those which are dirty and wet; but the best of them practically get the same price as the worst. They deal practically only in one grade. This is partly because the ginners have no room to gin and store separately; and partly because the ginners in this part of the world buy cotton and sell it again and they do not think that they get any more in Bombay for better stuff. They do not, therefore, take any trouble to make a better class. In my written evidence, I have stated that allowances and deductions are obtained by the buyers which are not always entirely justified. For instance, when a cart comes into the market, the buyer says that the price is Rs. 20 a maund. But when it gets to the factory, the factory owner raises objections, which may or may not be valid and declines to pay more than Rs. 19-8. The *zamindar* has to accept the terms of the factory owner, as he would get the same treatment from others. There might be many carts which might be uniform throughout and yet get a lower price such as Rs. 19-8 or less. I have known of actual cases of this kind in every *mandi* (market). I think that some improvements on the present system of marketing are undoubtedly possible. The auctions now show the possibilities of improved marketing. Unfortunately there is no organization which could carry on, quite on the same lines. I personally look for improvement very largely in getting the final buyers of cotton to buy *kapas* instead of *ru* (lint) as at present. If a man comes along and buys *kapas*, he can see what he is getting. It has been very difficult to get this done in the Punjab in the past.

969. As regards the distribution of seed, it depends entirely on our staff. We have no seed unions here; but the big landholders help us very greatly indeed. I think seed unions would be more troublesome than our present system because they need much more inspection and reorganization. If you can get the assistance of a large landholder, he can grow several hundred acres in one place which one man can inspect in a day or two. But if several hundred acres are grown on many scores of farms far apart, it requires a very large staff to inspect it. If the seed farms were all spread out, a very large staff would be necessary.

970. The staff of the Agricultural Department is not really sufficient for controlling the distribution of seed and it needs increasing. At present we are arranging to buy seed for 250,000 acres for next year. I hope next year to get one or two extra subordinates to assist me with this work, but we could carry on, if we don't. There are three Deputy Directors for 29 districts. I would undoubtedly suggest the appointment of more Deputy Directors. The American cotton crop is confined to the Canal Colonies. I do not think we need any greater increase of staff than what has been promised, or we may expect, from Government. At present there are three Deputy Directors in all. The subordinate staff is not sufficient at present and needs expansion. It is limited by the number of men that is turned out from the college every year. The number of students in the college at present is 104. We actually turn out about twenty to thirty men every year. About ten would not be much good or go back to their own land, five would go to private employers and eight or nine would be taken by the Department. Our idea is to increase the subordinate staff as students come out of the college. For a long time we can take all the good men we can get, allowing for the fact that some are wanted by other Departments and some by private landholders. I am certain that no good students will find any difficulty in getting employment. The college is becoming full to its maximum capacity. We took in as many students last year as we could take. The college needs expansion and improvement, as well as more staff.

971. The Jhelum Colonies should be joined to Lyallpur for the present, in one circle. Another circle should be formed in the south-west of the province. To have separate Deputy Directors for the Jhelum, Chenab, and Lower Bari Doab Canal circles would no doubt be advantageous so far as cotton is concerned; but I cannot advocate it at present. For, from broader considerations, there are many other directions of expansion for which staff is more urgently needed. Even if Deputy Directors are appointed for each Doab, the work of the other two must be co-ordinated with the work of the Deputy Director of Agriculture, Lyallpur. This can be done if these Deputy Directors are junior to the one at Lyallpur, and expected to work in with him. But each should have a farm of his own. Regarding the relations between the teaching and other Agricultural staff, it is essential that both the Professor of Agriculture and Deputy Director should have their own farm and each should do important research work. There is plenty of room for both. It is also important that the Professor of Agriculture should be in very intimate touch with the district work. This could be done by making him responsible for some district work. But I do not think it is a very efficient arrangement for one man to be responsible for district work, research work and teaching. Nobody should take up the post of the Professor of Agriculture until he has served for some considerable period (at least two years) either as a Deputy Director of Agriculture or as Supernumerary Assistant to a Deputy Director. Incidentally I also think it is an excellent thing for Supernumerary Deputy Directors of Agriculture under training to attempt some teaching. My proposal then is that the Deputy Director of Agriculture should have charge of district work and of his own experimental and seed farm; and the Professor of Agriculture must have a farm sufficiently large to enable him to do useful research work; and also to make him have to devote considerable attention to farm management. This I consider very important. It is certain that the teaching will suffer, if the Professor of Agriculture has not had experience of district work before he starts teaching and there will be a loss of efficiency all round unless there is real co-operation between the Deputy Director of Agriculture and the Professor of Agriculture. But two men cannot work together under any arrangements unless they are willing and anxious to co-operate.

972. (Mr. Hodgkinson.) Type 280 has not been tested sufficiently yet. If it does as well this year as it did last year, I think we might try it on a small area. I would not like to advocate going in for several thousand acres at present. I would try it on twenty or thirty acres next year; and, if it seems advisable, on 200 or 300 acres the following year. I would like to see it how it does for two or three years before recommending it on a large scale. I am doubtful if it will be more profitable than 4 F: the yield up to date has been less than 4 F. It is extremely difficult to give an accurate exact figure, but the results seem to indicate that it might be a maund or half a maund less. The valuation of that cotton was three farthings

* Vide Appendix IV to Report.

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over "middling." The valuation of 4 F was a half penny or farthing under "middling." Mr. Roberts had them valued in June 1916. The price of 280 F. therefore, works out at Re. 1-8 per maund more than 4 F.

973. (President.) It is the system in the Punjab that the seller takes his American *kapas* to the ginner and that in the original sale, the value of the lint and of the seed is included. With regard to *deshi*, there is a system, more or less *pukka* on which the cotton is sold on the basis of twelve seers of cotton. Then a rough test is made and the price is settled. Thus Rs. 15 may be the price for twelve seers *kan* and an allowance of twelve annas is made per extra seer of cotton. The buyer calculates the value of seed in the price he can afford to give, and the price is worked out in accordance with the Bombay price. If the Bombay price is equivalent to so much per *khandi* of lint in Lyallpur, then allowing for the cotton and the seed, cost of ginning, etc., the buyer can afford to give so much for a maund of *kapas*. The point is that the value of the seed cannot compensate for a smaller outturn of lint. Lint is something like Rs. 44 per maund and seed is only Rs. 3-12. One rupee increase on the price of seed makes a difference of about ten annas a maund in *kapas*. This year we have had a very bad cotton crop in the eastern Punjab. The demand for seed for cattle food is great and the price is high. I cannot say exactly how the firms calculate their price for *kapas*, as this has been given me confidentially. Different firms calculate in different ways, on the basis of the Bombay prices.

974. (Mr. Henderson.) I will give you our method of calculation, which is similar to those employed by the firms. I think that primary selection work should undoubtedly be centralized at one place. Sale organization is a different matter. That can be done at different places.

Chaudhri ANANT RAM, Municipal Commissioner, Lyallpur.

EXAMINED AT LYALLPUR, JANUARY 11TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

975. (1) and (20) Experience.—I am one of the oldest inhabitants of Lyallpur, having settled here so far back as 1896, am a member of the Chenab Colony Agricultural Association and, being a capitalist grantee of about twenty squares of land, know something about the cotton cultivation, and shall deal with the subject from the trader's point of view being a trader by profession and Honorary Secretary of the Central Co-operative Bank, Limited, Lyallpur.

976. (2) and (11) Varieties.—Generally only one variety of *deshi* short-staple cotton is cultivated in this district but now American cotton is coming much in vogue, which was first started about ten years ago and a variety of it known as 4 F is recommended and found successful.

977. (3) and (22) Size of holdings.—In this newly started colony, the land is wholly divided into squares, each square containing about 28 acres is divided into 25 equal parts, each part being known as a *killa*; generally there are three kinds of owners recognised, each peasant owner has a square or two, a yeoman grantee originally got a grant of about five squares, while a capitalist grant ranged from six to forty squares or even more. There is no special proportion of cotton fixed, but generally the average cultivation of cotton goes up to four *killas* per square.

978. (4) and (23) Yields and profits.—It would be very difficult to fix the average outturn of cotton with any certainty, as it depends entirely on water supply, quantity of land, climatic conditions, and the labour spent by cultivators, but taking all into consideration, the average outturn of *deshi* cotton may be put at six maunds and that of American cotton at seven maunds. The profit depends on the rate which has fluctuated so much during last years. The cost of cultivation may be calculated with the help of the Agricultural Department.

979. (5) and (24) Rotations and manures.—Ordinarily cotton is cultivated in fields vacated by wheat and *loria*, while the sugarcane, maize and fodder fields are also utilised. Some good cultivators let the wheat fields lie fallow for about nine or ten months and prepare that land for cotton. Cattle manure, if at all, is applied.

980. (8) and (25) Conditions affecting increase in area.—The area under cotton cultivation does generally fluctuate. If the cotton sells well and no unforeseen causes happen, the effect on the sowings at once becomes marked. The cultivation is often augmented by an excess supply of water, as the *khari* crops require more water and at short intervals. The cultivation may go up to six *killas* per square. As the American cotton sells at 20 to 25 per cent. better than *deshi* cotton, so the former is rapidly replacing the latter, although it requires more water and labour and takes more time as well, and requires good soil too, and in case of early winter there is great danger of its failure. As during the last two years, the cotton rate is rising abnormally, so only sugarcane can compare favourably with it, and in ordinary times wheat and even *loria* could compete.

981. (8) Uses of seed and seed selection.—The seed is almost solely used as food for cattle. Careful farmers usually pick selected staples from the fields, specially separate the seeds by hand machine, as in the factories the cotton gets mixed up and secondly, the impression among the people is, that machine ginned seed loses its germinating power, and when such seed is used, it is generally put ten per cent. more than the hand ginned seed.

982. (26) Suitability of existing varieties.—In my opinion, the American cotton is quite a success in this district, and it would be quite advisable to attempt still better varieties in this soil.

983. (27) Prevention of mixing of different varieties.—For ordinary *zamindars*, the difference of rates and the vigilance of the Agricultural Department are sufficient checks for not mixing up the different varieties and the tendency of the purchasers and factories to mix up can be prevented by the big firms offering for mixed goods the rate of the worst variety of mixture, and the executive officers on the spot may occasionally inspect the factories with this view and other local inconveniences of the *zamindars* can be remedied thereby.

II.—COMMERCIAL ASPECT.

984. (30) Local trade customs.—With regard to the marketing of the cotton crop, there are three prevalent methods in this district. Some people purchase the standing crop from *zamindars* and others buy the picked cotton from their villages and sometimes *zamindars* bring themselves the cotton to the market,

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[Continued.]

but in all three cases, the condition of the cotton is equally spoiled in picking, loading, carrying, weighing, ginning and pressing. The Lyallpur Agricultural Department has done much towards remedying these evils, but still much remains to be done, because so long as the boys of indigenous *zamindars* are not encouraged to come to be coached up in the Agricultural Department in practical methods of agriculture and to be employed as labourers by means of special scholarships instead of paid labourers the real defect would not get cured.

985. (32) Buying agencies.—With regard to buying agencies, although a combination of the Agricultural and Co-operative Departments can do a lot, I have grave doubts of the success of such an agency because unless education gets more general and specially agricultural education among *zamindars*, it would be difficult to beget trust and for them to distinguish between right and wrong.

III.—STATISTICAL.

986. (35) Publication of Liverpool and Bombay prices.—With regard to question No. 35, if by urgent telegram, the price of the cotton is published every day in the terms of per maund ordinary people can easily understand and it may prove useful.

V.—GENERAL.

987. (47) Effect of water rates.—The water rates surely affect the cultivators' mind in selecting his crops; if the price of American cotton goes back to ordinary levels a decrease in the water rate would give a great impetus to its cultivation, though *deshi* cotton is badly needed for the *zamindar's* own private needs.

VI.—IRRIGATION.

988. (51) Wheat versus cotton.—Wheat is preferred to cotton in so far as the former is required for consumption and as an article of food and *bhusa* cannot be replaced by anything else as cattle food and wheat requires much less labour than cotton and less water, does not necessarily require manuring and never fails as crop. There is a proverb "The wheat farmer and the fisherman never came home disappointed."

Chaudhri ANANT RAM called and examined.

(Translation.)

989. (Mr. Roberts.) I am a big *zamindar* holding lands in the district. My experience is that American cotton is as safe as *deshi*. The only danger to American is cold and sometimes bollworm. *Deshi* also suffers from insects and bollworm. If the cultivators got more water, they could be induced to increase their area under cotton. If water were available in the *khari*, they could increase their cultivation to at least six *killas* per square.

990. The Agricultural Department should encourage the teaching of sons of farmers on the lines of the present vernacular class. I mean that illiterate boys should be given practical training in farming. If you call them labourers they will not come. They should be given scholarships and then they will come. I think the Department should give scholarships in return for work.

991. (Mr. Wadia.) The premium that we get for American over *deshi* cotton is Rs. 4. The premium is not the only thing which induces the cultivator to grow American or *deshi*. Better soil is required for American than *deshi* and the *zamindar* looks to the soil. It would be a good thing if firms when buying pressed cotton were to pay for the lowest grade of cotton in the bale. This would stop mixing. Mixing is all done in the factories. The standing crop is bought at so much per acre however the crop may turn out. The buyers fix the price themselves. The crop is picked very carelessly. It is not picked in the proper way and it is not marketed in the proper way. No care is taken in regard to dust or anything else. When it is picked, it is heaped on the ground. The carts on which it is taken to market are never covered with a tarpaulin. The Agricultural Department should teach the cultivator how to pick, load and store cotton through the agency of the students that pass out from the college. The cotton would fetch a better price, if it were properly looked after. It is the same in the ginning factories. The cotton is stacked in heaps which are not covered with tarpaulin and so is exposed to rain and dew, as a result of which it gets spoilt. More sheds should be provided in the ginning factories. The Co-operative and Agricultural Departments are still in their infancy and though they can do a certain amount they cannot do everything at present on account of want of staff.

992. If the price of American cotton decreased to Rs. 8 or Rs. 9 per maund, then it is doubtful whether it would go on. The present water rate would be high for it. At present prices, it is quite all right. Though the water rate for American and *deshi* cotton is the same, if the price of American cotton went down to Rs. 8 or Rs. 9, the premium for American cotton would go down very low and there would be no inducement to *zamindars* to cultivate American cotton as it would not be of as much use to them as was *deshi* cotton. If outlets were given, it would also be an inducement. Wheat is much easier to grow than cotton. It takes less water and less labour; and is less liable to damage by insects. It is a food crop and gives fodder for cattle. Even if wheat fails, it gives some fodder for cattle. No manure is required for it.

993. (Mr. Hodgkinson.) The harvesting of wheat does interfere with the sowing of cotton. It is not possible to get enough labour at that critical time. A great deal of labour is required for fifteen days and the *zamindar* cannot get it from outside. Five per cent. only of the land under cotton is sown in lines. There is great necessity for teaching the people in this matter and then there would be a great improvement in the outturn. The average outturn of *jangli* villages is only four maunds an acre because they do not pay attention to anything in the way of drill sowing, manuring, interculture, irrigation or looking after the crop. The ordinary colonist gets an outturn of eight maunds an acre but a clever and hardworking colonist following the methods of the Agricultural Department sometimes reaches even double that figure.

994. (President.) The capital of the central co-operative bank is rupees three lakhs. 125 societies are affiliated to it and borrow money from it. They are all interested in cotton. The bank has taken up the question of providing implements, godowns and seed. The bank will buy the implements or it will get them for sale on commission. The village banks will get the implements from the central bank either by purchase or on commission and will sell them to the *zamindars*.

995. (Mr. Ashton.) The cultivators do the same amount of work in keeping their water courses clean in *khari* as in *rabi*.

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Hafiz Chaudhri MOHAMMAD ABDULLA.

Hafiz Chaudhri MOHAMMAD ABDULLA, Assistant Director of Agriculture, Lyallpur.

EXAMINED AT LYALLPUR, JANUARY 12TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short-staple cotton.

996. (1) **Experience.**—My experience has been in the Chenab and Jhelum colonies comprising the Districts of Gujranwala, Lyallpur and Jhang in the former and Jhang and Shahpur in the latter. I have been connected with these tracts, particularly the former, for the past eleven years.

997. (2) **Varieties.**—The *deshi* cotton consists of the following varieties :—

Indicum yellow flowered,
Indicum white flowered,
Neglectum yellow flowered,
Neglectum white flowered, and
Multani, a mixture of several types of *Gossypium sanguineum*.

Indicum yellow flowered predominates amongst the mixtures of green leaved *deshi* to an extent of up to seventy per cent. while *Multani* exists only in traces in such cases but the latter also predominates in certain parts of the District where the soil is comparatively poorer. A considerable area can be seen growing only this variety in the Toba Tek Singh Tahsil of the Lyallpur District.

998. (3) **Size of holdings.**—About fourteen acres make the average holding per plough and twelve to sixteen per cent. of the holding is generally under cotton.

999. (4) **Yields and profits.**—The average yield is about six maunds per acre and the profit goes to sixteen to twenty rupees per acre based on pre-war prices.

1000. (5) **Rotations and manures.**—The general rotation followed is either wheat, *toria*, cotton, or wheat, wheat, *toria*, cotton, or wheat, cotton, wheat. Generally no manure is applied. Farnyard manure is given in some cases.

1001. (6) **Comparative returns.**—Cotton returns better than most of the other *kharij* crops as it requires less care and less labour in growing. Country cotton does not compare favourably with American cotton on account of higher prices of the latter.

1002. (7) **Conditions affecting increase in area.**—The area under *deshi* cotton does fluctuate. The reasons are as follows :—

- (1) Water supply in the canal.
- (2) Attack of boll-worm in the previous season.
- (3) Effect of season on the previous cotton crop.
- (4) Increase under area of American cotton.

1003. (8) **Uses of seed and seed selection.**—The seed is used whole for feeding the milch or draught animals. Seed selection is practised. Simply best looking locks are picked from the middle pickings and ginned by hand. This is a common thing with good cultivators. In certain cases, selection is done according to the advice of the Agricultural Department.

(c) Exotic Cotton.

1004. (21) **Varieties.**—The exotic cotton grown consists of American cottons of Upland Georgian origin in different forms and some strains of Dharwar, the latter occupying only a small proportion, generally mixed with the former.

1005. (23) **Comparative returns.**—The average yield is practically the same or a little better than *deshi* in the years when the latter suffers from abnormal conditions. The average yield is about six maunds per acre and the profits work out to some Rs. 30 per acre on pre-war rates. It is more paying than the *deshi* short-staple cotton and other *kharij* crops except sugarcane which pays a little better than cotton but requires greater care and labour.

1006. (24) **Rotations and manures.**—The general rotations for American cotton are (I) wheat, *toria* cotton, (II) maize, *senji*, cotton, (III) *chari*, gram, cotton, (IV) wheat, maize, *senji*, cotton. Farnyard manure is the only manure applied which is generally given before sowing maize. Direct manuring is done but rarely.

1007. (25) **Conditions affecting increase in area.**—The following are the points which would help in the increase of the area under American cotton :—

- (i) Irrigation if available in adequate quantities during the sowing and flowering season. In the Chenab colony, water is nominally allowed for 75 per cent. of the cultivated area in both *rabi* and *kharij*, the latter getting for 25 per cent. only. Out of this 25 per cent. only half at the utmost can be put under cotton. The cultivator can attempt to put more area under cotton at the sowing time but in years of light rainfall is handicapped by not getting water in sufficient quantities later in the season when other crops like sugarcane, maize, and *toria* are also needing water. If the *kharij* supply is increased in any way, it will lead to an increase in the cotton area.
- (ii) The evolution of varieties less susceptible to insect attacks.
- (iii) The premium obtained per maund of *kapas*.
- (iv) The increase will be limited to the extent of the decrease in the area under *rabi* food crops which play an important part both for the local consumption and export trade.
- (v) The rotations do limit the increase in area as is clear from the details in paragraph 997 above.

1008. (27) **Prevention of mixing of different varieties.**—To prevent mixing in the field, pure seed grown under the supervision of the Agricultural Department should be supplied and American cotton only should be grown in a certain *ilaqa*.

To prevent mixing in the factory, the factory should deal with the American crop only and have the bales branded before issue, and deal directly with the growers, thus eliminating the possibilities of mixing, now commonly practised by the middlemen village shopkeepers, etc.)

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[Continued.]

1009. (28) **Importation of seed.**—The direct importation of seed has proved a failure, hence selected seed grown in the Province can be relied upon.

II.—COMMERCIAL ASPECT.

1010. (30) **Local trade customs.**—Cotton is sold as follows :—

- (i) Selling in the market or in the factory.
- (ii) Selling in villages to village shops or factory agents
- (iii) Selling the standing crop at a price fixed per acre.
- (iv) Forward selling of the produce.

Nos. (i) and (ii) are the most common.

III.—STATISTICAL.

1011. (33) **Improvement of cotton forecast.**—The cotton forecast does not show the area under American and *deshi* cottons separately. In consideration of the importance of the area under Punjab Americans to the buyers, it would be much better if figures for the *deshi* and Americans are recorded separately and published as such.

1012. (35) **Publication of Liverpool and Bombay prices.**—Posting of prices is very useful. Our experience with this in the current season, though, limited, is very encouraging.

V.—GENERAL.

1013. (48) **Desirability of alteration in water rates.**—Remission should be given on crops used for green manuring. A combined rate should be charged for gram and *chari* when the former follows the latter.

VI.—IRRIGATION.

1014. (51) **Wheat versus cotton.**—Wheat is a more certain crop as it requires less irrigation and is not so susceptible to insect attacks.

1015. (52) (a) **Critical period in regard to water supply.**—April and October are the critical months. The stringency will become still greater if the area under cotton is increased.

1016. (52) (b) **Watering of cotton.**—Irrigation of cotton begins in May and is continued up till October, four irrigations being given between July 10th and October 30th. The first two waterings are usually at intervals of one month. The volume of water applied is usually three inches to 3½ inches per acre.

1017. (General.)—As the area under country cotton is decreasing yearly, so that does not require to make an important part of details given by me. No long-staple *deshi* cotton is grown in the Province, particularly in the colonies with which I am dealing. Short-staple *deshi* cotton will continue to grow in limited areas for local consumption and in large areas in certain localities where soil does not suit Americans. We are studying different strains of the local *deshi* (originally Hansi) cotton and expect to start distribution of the best type shortly.

American cotton in the Punjab.

1018. **History.**—The history of Punjab American is very interesting and instructive. Before the year 1902, spasmodic efforts were made to introduce the exotics including American, Egyptian, Nankin and Bombay varieties, but in the total absence of experimental farms and of an Agricultural Department, it is not surprising that failure had to be recorded on every occasion. Apart from trials at the Agri-Horticultural Gardens, Lahore, the method adopted was the distribution of seed to cultivators who as a rule took no interest in the matter. In 1902, Mr. Mollison, the then Inspector General of Agriculture in India, held some trials with newly imported Americans at Hissar and was favourably impressed with the results obtained. In 1903, these experiments were transferred to the Lyallpur Agricultural Station, where the original as well as some acclimatised varieties did well. Trials were also made in the Agri-Horticultural Gardens and the Director of Agriculture's office compound at Lahore with encouraging results.

(2) In 1904, five grantees in the Chenab and four in the Jhelum colonies cultivated acclimatised American cotton on a couple of acres each, in addition to the trials at the Lyallpur and Sargodha Farms, a guarantee being given to the growers against loss. Besides the above trials were also carried out by the Deputy Commissioner, Hoshiarpur, the Settlement Commissioner, Patiala, and L. Ram Saran Dass of Messrs. Mela Ram and Sons, Lahore.

(3) The Punjab *narma* being a descendant of the Upland Georgian, distributed by the office of the Director of Land Records, Punjab, in the eighties, did well in most of these trials. This variety used to exist in the central districts of the Province where a few plants were to be met with in most fields. It was rarely grown as a separate crop. The writer remembers seeing a few *marlas* grown in his own fields, about eighteen years ago, where it was grown quite pure and used for home consumption. The stuff produced a nice cloth and was liked very much, but on account of its liability to frost the variety was not multiplied. The colonists in the Chenab colony having come mostly from Central Punjab brought their cotton seed with them, which included traces of Punjab *narma* as well. The same seed got out again and again from the factories in a more pure form and multiplied outside. Large areas of this still exist in the Jhang district where the *janglis*, who were bad cultivators and not careful enough to go for the better seed, still grow it in their fields. This variety is known amongst the *janglis* as *bajwara*.

(4) In 1905, a much larger area of Americans was sown in each colony without any guarantee but with a promise that assistance would be given in obtaining a fair price for the final product. The area totalled about 380 acres in the Jhelum colony on thirteen holdings and fifty acres in the Chenab colony compared with twenty acres in all grown in 1904. Unfortunately both the colonies were subjected to a disastrous visitation of bollworm. Both indigenous and American cottons failed entirely from this cause in the Chenab colony, but the Jhelum Canal American produced an eight-anna crop against a two-anna crop in case of indigenous cotton. The variety sown was chiefly Dharwar because it gave the best results in 1904. Trials were also made by local officers in Hissar, Mianwali and Montgomery, and by Messrs. Mela Ram in their villages in Lahore but they failed more or less on account of bollworm, although some comparative immunity was apparent. The Deputy Commissioner, Hoshiarpur, distributed seed to four men in his district while 250 acres of Punjab *narma* were sown by cultivators on the Sirhind canals in the Patiala State.

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[Continued.]

(5) In year 1906, 1,350 acres in the Jhelum colony and 380 acres in the Chenab colony were sown with Dharwar seed. The cotton was not yielding better than country cotton but was liked by the cultivators on account of advantages gained from a regular and increased water supply, which was considered necessary in those days for experimental cultivation of American cotton. This extra supply of water was thought unnecessary later on and no such concession was allowed after 1907.

(6) In 1907, the operations which were up till then conducted by the Director of Agriculture, Punjab, were handed over to the Deputy Director of Agriculture, and 2,000 *killas* were sown in the Jhelum colony and 260 in the Lower Chenab colony. The crop did poorly in the Jhelum colony where the growers failed to prepare the land properly. This resulted in a set back for the area anticipated in 1908, when the figures for the area sown actually turned out to be 445 *killas* only. The growers in the Lyallpur District were not so severely hit, although they also reported a diminished outturn. In 1908, seed sufficient for 142 acres was sold but the actual acreage under the crop was greater, a good many of the old customers keeping their own seed.

(7) In 1909, the area showed an increase in both the colonies, 631 *killas* were grown in the Jhelum and 423 in the Chenab colony. The crop in both colonies was slightly below average and barely came up to the yield of the *deshi* crop.

(8) In 1910, 1,000 acres were grown from Dharwar acclimatised seed issued by the Department.

(9) In 1911-13, the quantity of seed distributed varied from 50 to 84 maunds only which was surprisingly small even considering its partial immunity to bollworm attack.

(10) As the results with the Dharwar American were not encouraging, so it was deemed necessary to go for the better variety. In 1906-07, preliminary work on Punjab cottons was started at the Lyallpur Agricultural Station and seed from some hundreds of selected plants was sown separately. In 1907-08, a regular collection was made from the Punjab and North-West Frontier Province Districts. Professor Gamble also kindly supplied a complete set of his cottons and a number of plants were selected from the Dharwar American. The whole of this work, which was in charge of Mr. A. C. Dobbs, the then Principal and Professor of Agriculture, was handed over to the Economic Botanist, Punjab, in 1908.

(11) In 1909, the Economic Botanist, Punjab, handed over two varieties of American, that is, a Punjab *narma* and a Dharwar American, which did not appear to be any improvement over the ordinary crop. In 1910, 3 F and 4 F were handed over, both proving good yielders; the former being earlier was selected for distribution in 1912 and 1913. In the latter year trouble with *jassids* occurred and this cotton being smooth leaved was abandoned. 4 F was not affected though 100 acres of this, were also growing with *zamindars*. In many cases the fields were alongside those of 3 F. In 1914, some 3,000 acres of 4 F were grown and in 1915, in spite of the effect of the war, the area under 4 F rose to 9,000 acres. In 1916, the area rose to 35,000 acres and the present year gives the figures of 120,000 acres.

1019. *Seed supply and seed farms.*—As described above, the Department had to depend upon Dharwar for the seed supply until 1913 when 4 F was given out to some selected cultivators and work put in my charge. The areas grown with this variety since its introduction have been detailed above and need not be repeated. The system of working the scheme of seed supply runs as follows:—

The Lyallpur farm makes special selections for its own sowings every year. The seed from the rest of the produce goes to seed farms, and some selected persons in the colony. The seed is issued from the farm on the conditions that the growers will grow it under departmental supervision and sell the produce according to the arrangements made by the Department. The areas so grown are inspected two to four times and advise as to roguing, interculturing, picking and storing given. A premium of two annas to three annas is paid per maund of *kapas* to the cultivator, for the extra care required out of him. This stuff is separately sold with the condition to have the seed ginned under Departmental supervision and a premium of two annas to six annas per maund of seed paid to the ginner. The acreage under these seed farms in the past five years has been as follows:—

	Acre.
1913	100
1914	300
1915	840
1916	3,000
1917	4,600

The seed so produced is sold at the Lyallpur farm and in most of the *mandis* at prices fixed by the Department. The agents in the *mandis* are from amongst the shopkeepers well connected with the colonists, who store the seed in hired godowns and receive a commission of three annas per maund on seed distributed. The agent keeps a register showing the name and address of the purchaser and quantity of seed sold to him. The buyer receives a certificate showing details of the class and quality of seed issued and is to present it to the touring officials of the Department whenever they go to his fields, and is to preserve it till the time of cotton sale. From the sale registers of the farm and the agencies, lists are prepared, and seed farms selected for the ensuing year. The seed farms as a rule are selected from the colonists growing the best quality of seed which is issued to them under special conditions as stated above. The system of seed farms is working fairly well but has its drawbacks also.

1020. *Advice and assistance to cultivators.*—From the very beginning, it was realised that American cotton would do better with better care and a start was made to sow the same with Bombay drills in 1904. The drills did not gain in popularity and most probably were not a suitable type, but my experience with some of the colonists in the Jhelum colony shows that sowing in lines was realised by a very few of the intelligent colonists, who used to sow their cotton behind the plough. The system of sowing in lines was advocated by the Departmental leaflets but rarely followed by *zamindars*. Experiments were conducted at the Lyallpur farm by sowing cotton on ridges *versus* sowing in lines on flat, and interculturing thoroughly afterwards. This was taken up in 1910 when the writer joined the farm as manager. The results were very encouraging in case of the crop grown in lines, and trial sowings were done in 1911 by me with the ordinary plough (*munna*) to which a country made marker had been adjusted with good results. Since then sowing in lines has been steadily advocated. The area sown in lines as departmental demonstrations was only some fifteen acres in 1913 when the work was transferred to this section. The increase has been constant and the recent figure goes to several thousands of acres. Demonstrations of sowing in lines are given in villages by trained men

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[Continued.]

sent from the Lyallpur farm. Interculturing and other operations like thinning are advised afterwards by the touring staff.

(2) When sowing in lines was seen spreading, it was thought desirable to have something better than the *munna* and the marker, which, though very simple, but, was not very elaborate. So after working on several types of drills from Surat and Bombay a drill, named the Lyallpur *kharij* drill, was evolved, and used with successful results. One hundred and twenty-four of these drills have been sold to date. The drill was to be worked with an adjustable yoke which was not controllable by ordinary cultivators, with untrained bullocks, so a marker has been adjusted to make it simpler. The greater part of the area is still sown with the plough but it is hoped that the drills will eventually increase in popularity.

1021. *Marketing.*—In the beginning, the American cotton, being grown in limited areas, was not any way getting its real worth and it was found necessary to help the grower in obtaining a good price for his stuff, because he had to sell it at a cheaper rate than the local cotton if he was to manage his affairs himself. In 1904, arrangements were made with Messrs. Mela Ram and Sons of Lahore who bought the ginned cotton. In 1905-06, Messrs. Tata Sons and Company of Bombay were approached but they expressed their inability to purchase so small a quantity. Eventually Messrs. Mela Ram and Sons agreed to buy it at a premium of Rs. 1-8-0 per maund over the country cotton and their agents bought the stuff in villages. The arrangements detailed were not satisfactory and in 1906-07, the Bombay Mill Owners' Association were addressed but unfortunately they were unable to assist, in spite of an indemnity against loss being offered. Eventually arrangements similar to those of the previous years were made with Messrs. Mela Ram and Sons of Lahore, who agreed to place agents at Lyallpur and Sargodha and to offer a premium of Rs. 1-8-0 per maund over country cotton. It was settled that a part of the cost of maintaining agents should be met from the grant of the British Cotton Growing Association. Meanwhile printed circulars containing full information had been sent to a large number of mill owners and samples were also supplied when required. In response to these, a private firm, Messrs. Sabharwal of Lyallpur, came forward and purchased nearly two-thirds of the total outturn on behalf of various ginning mills at prices slightly in excess of those given by Messrs. Mela Ram and Sons. Over 6,000 maunds of unginned cotton were sold and a promising advance made in marketing. Both of these firms were again in the market in 1907-08 offering a premium of Rs. 1-8-0 per maund, and an attempt was made that the growers should send their produce to the markets at Sargodha and Bhalwal for delivery, instead of delivering in the villages. This however failed and Messrs. Sabharwal left the field to Mela Ram and Sons. Their purchasing agents were exceedingly slow, thus causing a good deal of dissatisfaction amongst the growers.

(2) In 1908-09, a public auction system was tried by Mr. Milligan, the then Deputy Director of Agriculture, Punjab, for the first time, and two sales were held, 2,200 maunds of *kapas* being disposed of. Prices obtained represented a premium of Rs. 1-5-0 and Rs. 1-9-0 per maund over *deshi* the same day. In 1909-10, two sales were arranged each at Lyallpur, Sargodha and Bhalwal. A premium of Rs. 1-6-0 to Rs. 1-8-0 was obtained. These sales continued till 1911 when the factory owners started to pay premiums independent of sales.

(3) In January, 1914, the sales were reorganised and became a necessity, as the Department had to get back the seed for further distribution. One sale was held at Lyallpur that year and 951 maunds of *kapas* were sold. In 1914-15, two sales were again held—one at Lyallpur and the other at Gojra, and 2,982 maunds of comparatively pure cotton was brought in. In 1915-16, six sales were held in the Lower Chenab and two in the Lower Jhelum colonies, and the total quantity sold at these auctions was about 8,000 maunds. In 1916-17, auctions were held in eleven places—six in the Lower Chenab colony, two in the Lower Jhelum Colony and three in the Lower Bari Doab colony, and over 48,000 maunds of cotton were auctioned. In 1917-18, auctions are being held in a dozen places and up till now over 55,000 maunds have been sold. The average premium obtained each year over country cotton works out as follows:—

	Rs.	A.	P.
1913-14	2	13	0
1914-15	3	13	0
1915-16	3	5	0
1916-17	4	0	0
	7	0	0
1917-18	4	0	0
	5	0	0

(4) The auctions have done a lot of good both directly and indirectly. Besides creating a market for the American cotton, they have been the means of introducing the spinners in Japan and Bombay to the growers. The quantity of cottons brought into sales and the area grown are swelling so immensely year by year that it looks difficult to control the auctions in future. Moreover the fluctuations in the market are a serious drawback in the system. I would suggest establishment of seed farms under departmental control to assure pure supply of seed. The concern is a paying one and would, no doubt, pay for the labour and money invested. The stuff so produced can either be ginned at their own plants, if available, or in factories at contract rates, but the former would be more advisable. If this is not feasible, the Department may erect a ginnery of their own, purchase the *kapas* from growers on a fixed premium paid for purity on the current day's rate of *deshi*, gin it and sell the lint to spinners, and distribute the seed. As far as the question of sale of cotton is concerned, I would suggest the establishment of cotton markets in big towns of the colonies, or co-operative sales by the societies. Out of these two systems the cotton market seems to be more hopeful, because it is expected to break down the pool amongst the factory owners and bring in a keener competition amongst the purchasers. The field will thus be widened for outsiders and the growers will be saved of all the bother and losses they are put to now-a-days, by selling their cotton in the factories.

Hafiz Chaudhri MOHAMMAD ABDULLA called and examined.

1022. (*Mr. Henderson.*) I am the Assistant Director of Agriculture. I am attached to the Chenab Colony circle consisting of part of Gujranwala, the whole of Lyallpur and most of Jhang district. I have a good deal to do with arranging the auction sales of cotton. There was an auction of five thousand maunds of cotton at Tandlianwala on the 3rd January 1918. Eighteen men were engaged in carrying out the arrangements. Most of them were *mukaddams* and agricultural assistants. A *mukaddam* is a kind of foreman on

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Rs. 15 a month. There were altogether seven *mukaddams* and the balance of the men were agricultural assistants. The pay of an agricultural assistant starts at Rs. 60. There were five groups for classification, either one agricultural assistant and one *mukaddam* or two agricultural assistants. In certain cases, two agricultural assistants were put together—one experienced and one new. The classification was checked by two groups consisting of six men. We issue the notices for the auctions according to the condition of the crop whether it is late or early. Mr. Faulkner decides the date on which an auction should be held and notices are then sent to the growers. We issue notices only to those growers with whom we have direct dealings. Notices are sent by post. We also send notices to the Deputy Commissioners who send to the *zaildars* and the *zaildars* or the *patwaris* inform the villagers that an auction will be held on such and such a date. On the day fixed, the cotton is brought on bullock carts. We have a site selected for the auction and the carts are to stand outside the compound of that site. The site is either a Government site or one belonging to the Municipality. Generally in the Montgomery district, the carts come in the day before the auction but here they come the same day. The cart-owners are responsible for their own carts. We assist them by arranging for police. On the day the auction comes off, the carts are outside the auction compound to start with. The classification is done outside the compound. I do not exactly remember the number of the carts that came in at Tandlianwala but roughly there were about 200. The groups of classifiers took them cart by cart. The five groups started work in the morning and finished about 2 P.M. They took samples from four or five places in each cart. Those were mixed and an average sample was taken which was analysed to see the percentage of *deshi*. To prevent more than one man valuing the same cart, a chit is given to the cartman counterfoil of which is kept by the classifier. The chit is in a special form giving the name of the seller, the place from which it came, the name of the cartman and the estimated weight and the name of the agricultural assistant who classified it. Then that cart moves off to be checked. We accepted carts up till 11 o'clock and went on classifying up till 2. Checking started in the morning and I finished it about 3 P.M. As already explained, there is another group which does the checking. The same cart is seen again and different samples are taken by the checking party from different places. The checking party remains at a fixed place at the gate of the compound. If the classification is correct, then the cart is passed into the compound. At Tandlianwala, the compound is fenced, at other places it is not but there is a sort of drain round and in certain places a sort of wall. There is no danger of any other carts going in as there are police men and *mukaddams* to stop them. The ground is marked out into blocks with labels, A. B. C. and D. The carts are sent off in charge of a man who can read and write and go to their proper block and stay there. After the checking is finished, we add up the totals of the various classes. Then the sale starts. The time at which it starts varies. The whole of each of the classes is put up for sale at a time. Delivery has to be taken on the same day according to the rules but generally as the quantities are very big, we treat the second day as the first day and the weighment starts on the second day. Weighment takes place after the auction. The buyer is given an estimate at the time of the sale. The buyer has to pay the *aratyas* (commission agents) who are responsible for prompt payment to the seller. The cultivator gets his money from the *aratyas* as soon as weighment is finished. There are different *aratyas* for the different people. As to the number of *aratyas* at Tandlianwala, the A. class was only a limited quantity. For the B. class which was over 1,500 maunds, there might be a dozen *aratyas*. All the *aratyas* were known to me because they were *mandi* men and the people have confidence in them. These *aratyas* get a commission of Rs. 1-6 per Rs. 100 in this colony. It is Rs. 1-9 in Montgomery. This is for the weighing, for supplying men for weighment and for scales. The *aratyas* are responsible for prompt payment but they get their money within three days from the buyer. The *aratyas* pay the seller straight away. We know that the seller gets his actual price, because we give him a chit showing that the cotton has been classed in such a class and that so many maunds have been sold. All the cotton is weighed on beam scales. We help buyers in the way of transit. The Railway Department gives the Director of Agriculture a certain amount of priority. As to the period for which the staff was occupied with the sales at Tandlianwala, they went on the morning of January 2nd, and half of them returned on the evening of January, 3rd. The rest had to stay until the weighments were finished, i.e., till the 6th afternoon. We do not charge travelling allowance to the expenses of the auction. That is paid from Government funds. We have no special staff for auctions but we take men from different sections. This year we took men from Gurdaspur and from Hansi as well as assistants from the agricultural section of the College. We take about fifteen to twenty men everywhere including *mukaddams*. When they have finished, they are sent back to the farms. Their absence does not interfere with farm work. I do not think that we could go on with auctions for a long time. They will go on as long as the war lasts. The auctions were started to introduce a better price for better cotton. In the beginning the quantity was small and it was difficult to get a fair price for it but now that the quantity is so large and fair premiums are paid by factory owners and other buyers, I do not think there is any necessity for auctions. If the auctions continue, I would certainly advocate a permanent extra staff to do the work in future. There are certain drawbacks to the auctions owing to fluctuations in the market. At Gojra, we had two classes which we could not sell as the prices offered were very low and we had to return those classes. There were no buyers. People cannot afford to carry cotton back twenty or twenty-five miles.

1023. (Mr. Roberts.) I have been in this colony practically for the past eleven years and I was never out of touch with it. I was working in Sargodha but I was connected with this Colony also. I saw a good deal of American cotton in Jhang before 1911. The immunity of American cotton to bollworm has been a big factor in its success. The *zamindars* regard the American cotton as a safe crop in comparison with *deshi*. As to whether the profit on American is greater than for wheat, now-a-days it is greater. In pre-war days, there was not much difference. If American cotton is selling at Rs. 10 per maund and wheat at Rs. 3-8 per maund, I should say that cotton would be profitable but wheat more certain. The average yield of wheat is about fifteen maunds and that of cotton six maunds. There have been averages up to eighteen maunds in Chak 32. The highest yield on the farm is over 22 maunds with 4 F. The average yield of wheat last year was about twelve maunds. The year before it was thirteen. For the last two years it has been below the average.

1024. If the supply of water in April and to the end of May were certain, it would lead to an increase in the area under cotton as the most profitable crop grown. As a general practice now, people sow five or six *killas* of cotton in a square. As regards the water supply, the question is not acute in May, June and July. There would be no difficulty in increasing the area under cotton, if water could be made available in October and to some extent in April. American cotton has been sown up to the 20th of May but generally it is sown up to the end of April. American cotton sown in May is not very safe, especially if there are early frosts but the cotton we have sown in these colonies up to the 10th of May during the last two years has been fairly

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successful. This year sowing went on up to the 20th of May. It is distinctly risky. Increased intensity might mean that *senji* would come in after cotton but a large area would not be put under *senji*. *Guara* and *chari* mixed would be grown, then gram and then cotton. That would be two leguminous crops following one another followed by cotton. The present cropping per square is one or two acres of *senji*, two of mixed *chari* and *guara*, two of gram and one of *moth*. If there were greater intensity, that proportion could be largely increased.

1025. (Mr. Hodgkinson.) There was a difference of opinion at Tandlianwala as to where cotton should be weighed. Mr. Faulkner insisted that it should be weighed on the spot and so the factory owners did not bid. Mr. Faulkner gave way in regard to the last lot and allowed it to be weighed in the factory. The factory-owners objected because they had to look after the cotton afterwards and to carry it to the factory. We told them that they might make an allowance in offering their price for the cost of carriage to the factory but they would not agree. There was no suspicion of false weights in regard to cotton weighed inside the factory. The weights to be used in the factory were not factory weights but weights which came from the Mandi. They used our scales as well as our weights.

1026. (Mr. Wadia.) I settled the allowances for dampness. They did not agree to my decision so I had to get Mr. Faulkner to settle the matter. It was finally agreed that my decision should stand. The penalty for not paying on the second day is one anna per maund and on the third day it is three annas per maund.

Shahzada GHULAM MOHAMED, Municipal Commissioner and Zamindar, Sargodha.

EXAMINED AT LYALLPUR, JANUARY 12TH, 1918.

Written statement (Translation).

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" Short-staple cotton.

1027. (1) Experience.—From the year 1905 to the present year, I have been cultivating land as a *zamindar* in the New Colony on the Lower Jhelum Canal, Punjab. My abode has been amongst *zamindars*, and during this time I have been exchanging views with cultivators generally, and have also been making widely known, amongst the cultivators, instructions received for the cultivation of cotton, from Mr. Renouf, Director of Agriculture, Punjab, and Mr. Smith, Colonization Officer, Sargodha, and am still doing so.

1028. (2) Varieties.—The short-staple *deshi* cotton is of five varieties whose names are given below in the order of their quality and grade. They are—

- | | | |
|----------------------------|--|-----------|
| (a) Tillar | \| | (c) Watni |
| (b) Rattar or Rati. | | (d) Poni. |
| (e) <i>deshi</i> Shahpuri. | | |

(a) Tillar.—The seed of this cotton was originally brought from Nabha State and Ludhiana side by the factory-owners and sold at the early settlement. This cotton on account of its yielding a greater percentage of lint has won fame amongst the cultivators.

(b) Rati.—The seed of this cotton was brought from Multan side and distributed. This cotton is not so affected as others by bad climatic conditions, and the *zamindars* of Behra Tahsil on this account prefer owners usually mix it with American cotton and send it abroad.

(c) Watni is the indigenous cotton of this place and is more affected by bad weather than the above two varieties and contains a lower percentage of lint. Now that this cotton has proved by experience to be no good, the cultivators are ceasing to cultivate it, and only a few people cultivate it in the Shahpur Tahsil.

(d) and (e) Poni and *deshi* Shahpuri.—Both these varieties are cultivated in small areas at particular places and are not popular with the *zamindars*.

1029. (3) Size of holdings.—In the major part of the New Colony, the holding of each *zamindar* consists of two squares, which have been granted to him on condition of horse-breeding. To some persons, however, the grants have been made in recognition of their civil services, without any conditions of horse-breeding, but such persons are few. The other part consists of the Old Colony, the size of the holdings in which ranges from half a square to two hundred squares. The cultivators here are known as *janglis* and their character as cultivators is very inferior. The average area under cotton is four *killas* per square in the New and two-and-a-half *killas* per square in the Old Colony.

1030. (4) Yields and profits.—If the average of the last ten years' produce of the New and Old Colonies be taken, it cannot exceed four maunds per *killa*. The average price of cotton can be estimated at Rs. 8 per maund and thus the average price of cotton realized per each *killa* comes to Rs. 32. The average of water-rate and land revenue is about Rs. 7-8-0 and the cost of seed is about eight annas per *killa*. From these calculations, if the labour of the cultivators, the fodder for the cattle and wages of the labourers be ignored, the net profit to the cultivator comes to Rs. 24 per *killa*.

1031. (5) Rotations and manures.—One square of land contains 25 *killas* and one *killa* contains nine *kanals*, in which, if irrigated sufficiently, the following crops can be grown in their proper seasons; cotton, four *killas*; *juar*, two *killas*; *makki*, one *killa*; sugar-cane, half a *killa*; *toria*, four or five *killas*; turnips, one *killa*; wheat, ten or twelve *killas*. The rotations followed are these. After harvesting wheat, *toria* (rape) is sown and in the land under *toria*, cotton is cultivated and after cotton, wheat is cultivated and in the land which was under wheat and on which *toria* was not cultivated, wheat is grown. Manure is applied but seldom in ordinary farming, and is only applied to *makki* and sugar-cane crops though a few people apply it also to cotton.

1032. (6) Comparative returns.—American cotton fetches a higher price than *deshi* cotton and bad weather has comparatively less effect on it.

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[Continued.]

1033. (7) **Conditions affecting increase in area.**—The last ten years' experience proves that the cultivation of short-staple *deshi* cotton is decreasing every day, the reason being the higher price, sale under Government supervision and the successful resistance of the American crop to the effects of bad weather. If arrangements for the supply of water to land at the time of tilling for the cultivation of American cotton were made to the satisfaction of the cultivator, it is possible that *deshi* cotton would cease to be grown. Since the cultivators have come to know of the superior qualities of the American cotton, the *deshi* cotton is grown only when there is scarcity of water. *Deshi* cotton yields a good harvest in untilled land, and grows well even if sown late, but the American does not give a good harvest under these conditions.

1034. (8) **Uses of seed and seed selection.**—Cotton seed is only used as feed for cattle. The cultivators generally gin it with country hand-gins (*lailna*) for seed purposes. The seed of the cotton picked in the month of *Katak* (15th October to 15th November) is selected and ginned with the country hand-gin.

1035. (9) **General economic conditions.**—I beg to say that, if the Government desire that American cotton should be produced in larger quantity, the area under it could be extended from four to six *killas* per square provided that the condition to keep mares were removed for the area, which is cultivated for one mare for its green fodder and is never less than two *killas*, and if the cultivation on those two *killas* of American cotton were made obligatory, the cultivators can grow six *killas* of American cotton willingly. The orders for keeping mares should be rescinded.

(c) *Exotic cotton.*

1036. (21) **Varieties.**—Dharwar and No. 4 F, as proposed by Department of Agriculture, Punjab, are the varieties grown.

1037. (23) **Comparative returns.**—*Deshi* cotton can not be compared favourably with American cotton, for the latter never totally fails on account of the various vagaries of the weather, and the prices obtained are also higher, through the patronage of the Agricultural Department Officers, of course. Other crops also, for the reasons stated above, cannot stand a comparison with American cotton. The average outturn per *killa* of the cotton is about 3½ maunds to four maunds. The average price obtained during the last ten years is Rs. 10 a maund, average water-rates and land revenues is Rs. 7-0-0 and cost of seed is eight annas per *killa*, that is to say after deducting Rs. 8—the land revenue and cost of seed—if the cost of fodder for four cattle, the household expenses and the wages of labourers be ignored, the average profit comes to Rs. 27 to Rs. 32.

1038. (25) **Conditions affecting increase in area.**—In my opinion, the following measures would prove useful in bringing about an increase in the cultivation of American cotton :—

Firstly, water should be obtainable at the time of preparation (tilling for cultivation).

Secondly, its cultivation should be defined in such a manner that the condition of breeding horses may be set aside and in its stead the cultivation of American cotton should be made obligatory.

1039. (26) **Suitability of existing varieties.**—In my opinion, of all the exotic cottons, No. 4 F is the best and this alone should be sown and in order to extend its cultivation the patronage of the Government should be given to the cultivators at the time of its sale, and they should be in every way encouraged, so that, as in the case of other products, they may not be entrapped by the mill-owners and the village shopkeepers.

1040. (27) **Prevention of mixing of different varieties.**—In my opinion, if the following measure were adopted, the exotic cottons would not be mixed with *deshi* cotton :—

(a) The mill-owners can never supply unmixed seed, for they gin *deshi* cotton and the American cotton at the same place and, therefore, I submit that the Sargodha Zamindars' Association should be ordered to put up an oil engine and an agreement should be taken from them to the effect that they shall gin American cotton, under the supervision of the Agricultural Department, pure and that they should supply pure seed for the whole area alongside the canal and the Zamindars' Association should be held responsible for the quality of the seed. Accordingly the Department of Agriculture has already recommended the installation of an oil engine for the Sargodha and Bhulwal Association. The Department of Agriculture sells all kinds of pure seeds through this Agency.

(b) Village shopkeepers, in order to make undue profits, get all kinds of cotton at cheaper rates by advancing money to cultivators and other labourers or by any such means, and sell the seed mixed. The Government should therefore by taking some money from a big firm, advance it through *zamindar* banks to the cotton cultivators for meeting their necessities which compel them to sell cotton in the cotton harvest time, and the cotton should be sold through those banks or through the cultivators, as it is now done, under the patronage of the officers of the Department of Agriculture. And the cultivators, whose cotton is the best, should in some manner be encouraged in order that they may be prevented from selling the cotton to the local shopkeepers, for the main cause of mixing is the village shopkeeper.

(c) The mill-owners in order to make undue profits, mix *deshi* cotton of good quality with American cotton and then blame the cultivators for having brought such cotton. The Government can check them and if any proof be needed, it can be had very easily. The village shopkeepers and the mill-owners are the cause of giving a bad name to the cultivators.

1041. (28) **Importation of seed.**—In my opinion, seed should be got from America or Egypt after every four years, for, after four years the seed, under the effects of climate and soil, cannot retain its original strength.

1042. (29) **General economic conditions.**—As regards obtaining an increase in the cultivation of American cotton and purity of seed, I think that the Department of Agriculture has, in fact, by setting up model farms, inspired the cultivators to some extent to grow exotic cotton, but because the Department of Agriculture is only at one place in one district, and the farm cannot be seen by every cultivator, only a few rich *zamindars* occasionally see it and gain some experience, and so the cultivators of every grade are not benefited. The operations of the Department of Agriculture should, therefore, be extended in such a way that, in the centre of every ten thousand acres of land, five squares should be granted to some *zamindar*, who is interested in the Department of Agriculture and is fully acquainted with farming and who, under the instructions of the Department of Agriculture, would cultivate American cotton on a large scale, and in that area of ten thousand acres he should always give necessary instructions to the cultivators and should always inspect personally their method of cultivation and show them his own model farm so that every *zamindar*

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Mr. D. MILNE, B.Sc.

should envy him on seeing his model, and should grow the same cotton and keep it pure, for, in this country the cultivators do everything out of envy very soon.

II.—COMMERCIAL ASPECT.

1043. (32) **Buying agencies.**—As regards the marketing of the cotton crop, as explained in paragraph 1040 above, the cultivators can only be benefited if the *kapas* is sold through *zamindars'* banks or through cultivators themselves under the patronage of the Agricultural Department. The *zamindars* can get full value only if the cotton is sold through the Agricultural Department, as is already done, that is the Department's officers find out purchasers as they desire. The system should, however, be so amended that, while at present the sale takes place on one date only, it should, in future, take place two or three times in a season and be sold in the same manner. By this method the needs of the cultivators can be met and the whole of the cotton disposed of regularly.

III.—STATISTICAL.

1044. (35) **Publication of Liverpool and Bombay prices.**—The daily publication of Bombay and Liverpool cotton prices in up-country will be highly profitable to the cultivators, for, on account of the non-disclosure of rates, middlemen reap profits of thousands of rupees and thus the poor cultivator loses on account of his ignorance.

V.—GENERAL.

1045. (46) **Attitude of buyers to improved cottons.**—Up to present no purchaser has given any particular premium to encourage the cultivation of exotic cotton.

1046. (47) **Effect of water rate.**—The water-rate has no special effect on any particular crop.

1047. (48) **Desirability of alteration to water rates.**—The water-rate should be fixed on the basis of the actual discharge, which is not the case at present.

Shahzada GHULAM MUHAMMAD called and examined.

(Translation.)

1048. (Mr. Henderson.) I have fourteen squares of land altogether. I have cotton on six squares, fifty *killas* in all. Eight *killas* are *deshi* and the rest is American. American cotton gives the greater yield and is more profitable. American yielded this year about seven maunds per *killa* whereas the yield of *deshi* was only 2½ maunds per *killa*. Owing to the climatic conditions, i.e. rain and wind in August, *deshi* suffered very much and all the bolls were knocked off.

1049. (Mr. Roberts.) In my opinion, if water were given in proper time in the *kharij* from April, it would be possible to grow six *killas* of cotton on each square instead of four, i.e., fifty per cent. more. American cotton always pays better than wheat or *deshi* cotton. I have been cultivating American cotton since 1908. In comparison with *deshi* cotton, it suffers very little from insect pests or from rain. It suffered only in one year, 1908, but even in that year it recovered a good deal. If water were available, the intensity of cultivation could be increased to 125 per cent. The present intensity is 100 per cent, or less than 25 *killas* to the square. We could cultivate 32 *killas* per square.

1050. At the auctions, the price paid was Rs. 21-6 per maund. Since then the market price of *rui* has gone up by Rs. 60 a *khandi* but the buyers in Sargodha now won't give more than Rs. 18 a maund for pure American because the auctions have stopped.

Mr. D. MILNE, B.Sc., Economic Botanist, Punjab.

EXAMINED AT LYALLPUR, JANUARY 15TH, 1918.

Written statement.

1051. **Areas of cotton grown in the Punjab and other parts of India.**—In this province cotton-growing is practically confined to the plains. The crop is chiefly grown on irrigated lands but is also grown to some extent on unirrigated lands. To any one wishing to go into details, the Season and Crop Reports of the Agricultural Department will show the areas of cotton grown on these classes of lands each year but roughly it may be said that about 1½ million acres of cotton are grown within the Punjab inclusive of Native States. Of this about one-third million acres are grown on unirrigated and the remainder on irrigated lands. The extent of the area of cottons grown on unirrigated lands fluctuates considerably, however, from year to year with the dates and amounts of rainfall. Regarding pre-war days, the fifteenth issue of the "Report of the area and yield of the principal crops in India" issued by the Commercial Intelligence Department of India shows that the average number of acres annually under cottons during the thirteen years 1900—1912-13 inclusive was 1,434,669 and the average annual number of bales of fibre was 296,134, for the same period. With the exception of the season 1905-06, when the area rose to over two million acres, the annual area under cotton for the other years under consideration generally ranged between a little over one million and one million six hundred thousand acres. The total area of cottons grown in India including Native States as given in the same report is 21,911,000 acres and gave an outturn of 4,326,000 bales of 400 lbs. each. The latest edition of the Report shows that in 1915-16 the area under cotton was very much below normal owing to causes connected with the war and that the area is again rising.

1052. **Sowing and harvesting seasons.**—On irrigated lands where there may be some reason for early sowing, for example, near towns, where such crops as melons may be grown mixed with the cotton crop, sow-

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ing may commence as early as the end of March. Most of the area of cottons in the Province is sown, however, in April and early May, April being the best month for cotton sowings. End of April and early May sowings are done on lands irrigated by perennial canals and from which wheats have been harvested in April. It is also done in a few cases where irrigation water is very scarce or where there are other obstacles to the farmer having the whole of his area sown earlier. On lands irrigated by inundation canals, sowing may be done in May or June. On unirrigated areas, the dates of sowings depend largely on when enough rain falls to enable the farmers to till the soil and to provide sufficient moisture to germinate the seeds. Sowings on such areas may be done from April even to July. Cottons sown in June and July yield comparatively poor crops. Those sown in July are often ratooned, i.e., left standing for two or more seasons before being uprooted. They do not appear to have time to develop themselves properly in the first season and generally yield best in the second season after sowing. They are usually uprooted in the third or fourth season. As one would expect, cottons grown on all unirrigated lands yield very inconsistent outturns. In dry years, the crop per acre is much less than when the rainfall is good (for figures on the point see Season and Crop Reports of the Punjab Agricultural Department). American cottons are not grown on unirrigated lands. Among Indian cottons, the picking season usually begins about the middle of September on both irrigated and unirrigated lands and it continues to about the end of November. The picking of American cotton usually commences in early October and continues till the end of December. In wet years, such as the past season, when vegetative growth is rank and the first formed flowers have dropped from the plants owing to heavy rains, picking of both *deshi* and American cottons may commence several weeks later than it does in dry years.

1053. *Soil*.—The soil in the plains is alluvial. The depth of the deposit is unknown in many places and in most places it reaches far below the depth to which any roots penetrate. Cotton roots may descend nine feet or more into the soil and the character of the deposit to that depth at least should be considered where cottons are concerned. At the surface and often to a depth of many feet below that, the character of the land here ranges from almost pure sand, where the water current which deposited it had been swift, to stiff clay where there had been little or no current. Traces of these currents are frequently met with in the plains. They are often very sharply marked and sometimes make soils of very different quality in fields lying close together. This, as I shall show later, has a very important bearing on long-staple cotton-growing in the Punjab. Hard nodules known as *kankar* and composed largely of carbonate of lime and clay are common in the soils and more or less hard layers of *kankar* nodules from a few inches to a few feet in thickness are frequently met with.

(2) White efflorescence salts locally known as *kalar*, *reh* or *shora* are to be found in large or small patches in most parts of the plains. Where these salts are at all concentrated, they harm or destroy the crops. The permanent water level is anything from almost the surface of the soil in such places as along the banks of the Indus in the season when the river is in flood to over 100 feet from the surface in some parts of the plains. On most lands the permanent water level is quite low enough to admit of the proper development of the root systems of crops.

1054. *Climate in the Punjab*.—The climate in the plains of the Punjab is hot and dry in summer and mild in winter. From the beginning of May to the end of September it is very hot. Our hottest month is June; the normal maximum shade-temperature (mean of ten years) for that month is recorded at between 101 and 110° Fahrenheit for different stations in the Province, but, in many places, temperatures of over 120° F. are frequently recorded. Usually there is a drop of between 20° and 30° F. in the temperature at night. From June the temperature gradually falls till in January the average maximum shade temperature for the stations above referred to is 63° to 71° F. with again a drop of 20° to 30° F. at night. In December and January, we usually have a few nights when the thermometer registers very slight frosts, and every few years we have a winter with a few nights of frost which does considerable damage to mango trees and other comparatively tender plants. Occasionally also slight frosts occur in November. If these frosts occur in November or December, they prevent the proper development of the lint in the later formed bolls of American cotton. Bolls so affected also do not open well. The harvest of *deshi* cotton being over by the end of November, these cottons do not usually suffer in this way.

(2) The rains which we get chiefly fall between early July and the beginning of September. We also usually get a few showers in January or February. The average annual rainfall ranges from about seven inches in the plains at Multan to about 34 inches at Rawalpindi, which is at the base of the Himalayan Hills. For more detailed information see tables of average temperatures, rainfalls, humidities, winds, etc., attached (Annexure I). I designed these tables, a number of years ago, in order to assist me in comparing our conditions with those obtaining in other cotton-growing countries. The data for them were kindly supplied to me by the Director of the Indian Meteorological Department, Simla. I have already found these tables very useful in connection with the crops which I have worked on or wished to try in the province. For use with the meteorological tables, the map of the Punjab issued by the Irrigation Department should also be studied, but I hope to have this map replaced soon by one showing canal irrigated areas, perennial and inundation; areas irrigated by wells, non-irrigated and waste areas, the principal markets, railways, canals, contour lines at decided intervals, etc., etc.

1055. *General remarks on the kinds of cotton growing in the Punjab in 1907*.—Indian cottons were being grown in all cotton-growing tracts in the province and constituted practically the whole of the Punjab cotton crop. The examination of any single field seen, however, invariably showed it to be composed of an extraordinary mixture of species and types of cottons to which I shall refer later. Some impure plots of a cotton, evidently *G. hirsutum* and generally called *narma* were to be found. This cotton appears to be an American cotton. The date of its introduction is not clear. It may have come into the province with any of the several attempts to introduce American cottons into the Punjab, but it had evidently been growing in insignificant plots or as straggling plants in fields of country (Indian) cotton since any one that I have met can remember. American cotton seeds have been brought into the Punjab at various times during the past sixty years or more in attempts to start their cultivation here and it may have come in with any of these. An Upland American cotton (*G. hirsutum*) introduced in 1904 into the Punjab from Dharwar in the Bombay Presidency by Mr. Renouf, Director of Agriculture, Punjab, had been tried against the old *narma* cotton and others, and, being considered better than these, it had been decided to push its growth in the Punjab. Consignments of its seeds were repeatedly brought from Dharwar by the Agricultural Department between 1904 and the time my own selections were sent out to growers. This Dharwar cotton is known in the Agricultural Department as "Dharwar American" and the name is commonly used by people outside the Agricultural Department. I may mention that the term *narma* in the vernacular means "soft" and that, in some parts of the province, it is applied to both the old American cotton and to the Dharwar American. It is even

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applied to some varieties of *deshi* (Indian) cotton. For example, we found it applied to all types of *G. sanguineum* in parts of the Shahpur District. Straggling plants or very tiny impure plots of a *khaki* linted type of *G. hirsutum* were also to be found.

1056. *The start of the Botanical Section in the Punjab*.—Before proceeding further, I must first explain that when I arrived in the Punjab in early November 1907, no botanical section existed and I was given as assistants a few young men who had had a two-year training at the Agricultural College in Cawnpore and had joined the Agricultural Department in the Punjab as Agricultural Assistants in July 1907. I had therefore to formulate a plan of work, train these men in what I wanted them to do and get started as best as I could. The Agricultural College was being built then and my work of designing the fittings of the botanical, entomological and mycological sections of it, the making out of courses of instruction for students in these sections, my work in the Lahore Exhibition in 1909-10, the teaching connected with the college after we opened it, etc., prevented me from touring much or paying a great deal of attention to crop improvement work for the first five or six years after I arrived.

1057. *Sir James Wilson's views*.—Shortly after I arrived in the Punjab, I met Mr. James (now Sir James) Wilson, I.C.S., then Financial Commissioner for the Punjab, and we discussed my position. He asked me not to yield to the temptation to go off into some of the many interesting side-lines of scientific research open to me, which, although leading directly to my getting a D. Sc., from a University or other honour from a scientific body, would not be of immediate practical value to the Province, but to remember that the people of the Punjab were paying my salary and that my duty was to give them real practical results of money value in the shortest time possible. He pointed out that cottons and wheats are the chief crops in the Punjab and that it was my duty, whatever my tastes were, to improve these crops in preference to others. He laid stress on the necessity for starting my sections of the agricultural college on sound lines and on my turning out graduates with a knowledge of their subject of practical value to them. These were exactly my own views and I have done my best to carry on the work on those lines.

1058. *Note written in February 1908 on my sphere of work by the Inspector General of Agriculture in India*.—In February 1908, the Inspector-General of Agriculture in India visited Lyallpur and wrote as follows:—

"He, the Economic Botanist, should in future, in consultation with his colleagues and the Deputy Director of Agriculture, initiate and control at Lyallpur the work of plant-improvement during the experimental stage by (a) separation of the type-specimens, (b) selections, (c) cross-breeding, etc. He should have another area of good land preferably in one block of about thirty acres for fruit orchards and for experimental work connected with the introduction and improvement of agricultural crops. This area should be securely fenced. When an improved variety shows clear promise of successful cultivation on, say, half an acre, it should pass out of the hands of the Economic Botanist for multiplication on a demonstration plot under the Deputy Director of Agriculture. The Economic Botanist will doubtless wish to watch for signs of future improvements or deterioration of a variety sent out for cultivation on a field scale" (see enclosure to Director of Agriculture's letter No. 1328, dated 28th April 1908). Shortly afterwards I was given thirty acres of land of which ten acres were available for growing cotton each year and on this land I conducted my cotton experiments until the past season.

1059. *Outline of the plans of the work on cottons*.—Very briefly, my plan to improve the cotton crop in the Punjab was to begin by collecting samples of seed from every *tehsil* of every district in the Province, in order to secure as complete a collection as possible of the types of cotton plants grown, sow the seeds at Lyallpur, separate the types, multiply pure strains from single plants as Pasteur did with yeasts and many men have done with agricultural plants since that time, compare the types as regards their economic values, etc. As soon as staff would permit after the types were isolated, I proposed to make a detailed survey of the growing cotton crop over the whole province, district by district, to discover whether I had all the types in my collection; to discover the relative prevalence of the types in the different localities and, if possible, the cause of the predominance or scarcity of types in particular localities so as to be a guide as to which of my pure types might do well there. To assist in this as well as to help to throw light on whether types improved at Lyallpur would maintain their characters when grown elsewhere in the Province, to show how far work done at the Lyallpur Station would be useful for other parts of the Province, etc., such points were to be studied as the effects on the types of cotton of the different climates and soils in the Province, methods of culture practised, etc. Regarding the further objects of these district surveys, see Cotton Survey Report of Shahpur District, now with the Director of Agriculture, Punjab.

(2) For numerous reasons, I proposed to take up crossing work seriously only after we had discovered the best of the types already in the Punjab and had collected some information regarding what localities they were doing best in and why they were best there. A comparison of the data regarding climate, soils, cultivation, etc., collected in the Punjab with similar data from other cotton-growing countries in the world, together with data regarding the characters of the cotton plants, quality and quantity of the crop got in each case was expected to give useful information on what cottons in other countries would be likely to do well here and it was intended to make a more thorough collection and study of foreign cottons then on similar lines. A certain amount of this work has already been done as is shown below.

1060. *Work on American cotton at Lyallpur begun in 1907*.—When I arrived at Lyallpur in the beginning of November 1907, the Agricultural Assistants, who had joined the Department a few months before my arrival in the Punjab, had been started to make single plant selections in a field of American cotton (*G. hirsutum*) which had just been brought from Dharwar to the Lyallpur Agricultural Farm. The field appeared a typical one of such cottons. I joined in the work and over 1,000 selections of the Dharwar cotton were collected during that picking season. The small parcels of *kapas* (unginned cotton) from these were ginned and examined by me at the end of that picking season.

1061. *Definition of an improved cotton*.—From talks with assistants, while they were collecting *kapas* in 1907 and from a glance at the *kapas* collected and the plants they were collected from, I soon found that these newly joined men had little idea of what they had to select except that it looked well to bring in *kapas* from a large number of separate plants. However, as what I wanted to start with was *kapas* from every plant that differed in any way from the others—and this we seemed likely to get in the multitude of samples being collected—the work was of use to me. Still it was quite obvious that I could not recognise the best types of this vast collection and so got rid of the inferior ones nor could I make satisfactory progress with the work until we had decided what an improved cotton is and could set up a criterion by which I and the

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men engaged to assist me could work. Questions in various directions elicited extremely diverse opinions and it was soon evident that the point had to be threshed out. In isolating or evolving new types of plants the object for me to aim at seemed to be the production of types that would yield increased profits per acre as to obtain that appeared the only reason why any one should prefer to grow our new types at all. I therefore defined improved types as those which in ordinary agricultural conditions here would yield to growers larger profits per acre than the types which they were already growing, then began to try to discover the various factors involved in this definition and to assign to them their relative values in the criterion to be set up.

1062. *The kan-factor.*—At this time there was a very strong opinion that selection for *kan*, i.e., the weight of lint got from unit weight of the unginned cotton (*kapas*), was the main, if not the only, point to be kept in view. This was strongly backed up by cotton traders and my first struggle was against this opinion. The value of a difference in *kan* in *kapas* when I went into the case with cotton dealers here is shown in the following:—

The Karachi price for acclimatised American cotton was, say, Rs. 27 per maund (82 lbs.).

Dealers had to deduct—

	Rs.	A.	P.
(1) Cost of ginning one maund of American cotton, say	1	6	0
(2) Cost of pressing one maund of American cotton, say	0	8	0
(3) Cost of freight of one maund to Karachi	0	15	0
TOTAL	2	13	0

The value of unginned fibre in Lyallpur was therefore Rs. 27 less Rs. 2-13, i.e., Rs. 24-3 per maund or Rs. 0-9-8 per seer (1-40th maund). Where three maunds of *kapas* contained one maund of fibre and the dealer could get about Rs. 2-7 per maund for the cotton seeds, he would deduct a few annas for wastage in ginning, etc., and would estimate the value of the seeds got from the three maunds of *kapas* at something like Rs. 4-2. The dealer therefore in this case had the following facts in mind:—

(a) that for *kapas* containing one-third of its weight of fibre, he could offer Rs. 24-3 plus Rs. 4-2, i.e., Rs. 28-5 for three maunds or Rs. 9-7 per maund;

(b) that if the *kapas* contained less or more fibre than one-third maund of its weight, he could deduct from or add to the above at the rate of Rs. 0-9-8 per seer (1-40th maund).

(2) We find American *kapas* giving anything between 11½ and 13½ seers of fibre per maund or at the market rate above quoted differing in value from Rs. 8-5-7 to Rs. 9-10-11 per maund. In *deshi* cottons common in the Punjab, we find the *kapas* yielding anything between 11½ and 16 seers of fibre per maund and sometimes making a difference of Rs. 2 per maund in the value of the *kapas*. Obviously then it is a very important thing for farmers to grow a cotton with a high *kan*, but if an improved cotton from a farmer's point of view is one that will leave him a greater profit per acre than those he is already growing and it seems to me that this must be so, then *kan* is by no means the only factor that he must keep in view. Further, when I had ginned my thousand or more samples of *kapas* referred to already and had set aside all those with a high *kan* record, I found that there were very great dangers in selecting by high *kan* figures. I found for example that, in a number of cottons which had given me high *kan* figures, a large number of crushed cotton seeds had been left among the fibres. These broken seeds having not only added considerably to the apparent weight of fibre but reduced the real weight of seeds, a false and very high *kan* figure was recorded. This crushing of the seeds during ginning happens especially in damp weather.

(3) To obtain vigorous healthy plants, we require well developed seeds containing a plentiful supply of food for the baby plant but it was seen that most of the parcels giving the highest *kan* records contained a very large percentage of seeds immature, or small or of which the food store had been devoured by bugs. Indeed the results got showed quite clearly that selection on these lines would have led not towards improvement of the crop but in quite the opposite direction. Bug sucked and immature seeds being unfortunately lighter than sound well developed seeds it was evident that even a very small amount of fibre from each of such seeds would show a high *kan* figure. It is also evident that small seeds have a much greater surface in proportion to their weight than large seeds have and therefore if a small seed and a large seed were merely equally well covered with fibre, the small seed would show the higher *kan*. Again a small seed may be worse covered than a large seed and still show as high a *kan* as the larger one. In attempting to raise the *kan* figures, there is thus a tendency to select smaller and smaller seeds or unsound ones which, because of their small size or unsound food store, are unable to produce healthy vigorous plants. What the farmer really wants when he asks for a cotton with a improved *kan* is a variety which gives a large proportion of sound well developed seeds bearing a greater amount of fibre per unit area of their surfaces than is borne by the seeds of ordinary varieties. Unfortunately the *kan* figures obtained in the manner in which he obtains them at present do not help him in this, and it is therefore absolutely essential for *zamindars* when considering the *kan* figures to examine the soundness and size of the seeds in the consignment, the freedom of the fibre from crushed seeds, etc.

1063. *Outturn of kapas per acre as a factor.*—When we do find a variety which has well developed seeds and a higher *kan*, we are even then not certain that it will be a more profitable variety to grow, for although the *kan* of one variety may be higher than that of another, the second variety may have yielded so much more *kapas* that it gives a greater amount of fibre per acre, therefore the farmer who has selected his cotton for *kan* only may have done himself considerable harm as far as profit per acre from his crop is concerned. Some years ago, a sample of a variety of Indian cotton with an exceptionally high *kan* was sent to me along with a letter stating most decidedly that this was the Indian cotton which the Agricultural Department should advise farmers to grow. The extremely high *kan* and the nice appearance of the *kapas* had attracted the attention of the gentleman who sent the sample. I had eliminated that variety from the Lyallpur experiments, however, as after growing it for several years we found that it invariably gave such a poor outturn of *kapas* that farmers could obtain more money per acre by growing other Indian varieties. Indeed from our experiments here

NOTE.—*Kan* is sometimes expressed as the percentage weight of fibre got from the *kapas* and sometimes as the number of seers 1-40th maund) of fibre got per maund (82 lbs.) of *kapas*.

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and from all that I can learn of the results that farmers got when growing it, the variety is about the worst one from their point of view that I have ever met with. In order that the gentleman who sent me the letter referred to should satisfy himself on the point, however, some seeds of the variety were sent to him so that he might try growing the cotton himself and give us an account of his experiences in due course. When the crop was harvested, he was asked to report but we have never got a reply from him. Since then I have seen that variety growing in very small plots but never doing well enough to compete with other Indian cottons. Obviously then besides *kan*, outturn of *kapas* per acre is a very important factor in the question of profit per acre.

1064. *The Spinners point of view.*—Factors affecting the value of the fibre to the spinner are also deeply concerned. In reply to questions of mine, the Chairman of the British Cotton Growing Association stated that three main points from the spinner's point of view are (1) strength, (2) length and (3) fineness and smoothness of the fibre, but that strength is by far the most important as weak cotton, however long, will always fetch a poor price. Indian cotton (i.e., *deshi* unselected), he said, chiefly wants improving in length, fineness, and smoothness, it being so short that it is of no use to the bulk of the spinners in Britain. He emphasised the importance of an even length of fibre and the great disadvantages to all concerned if cotton contains a large quantity of leaf and other foreign matters. He added also that if we could produce lint three-quarters of an inch to one inch in length we would certainly be able to extend the market for Indian cottons.

1065. *Other factors in profit per acre.*—Other important factors affecting the case are connected with the habit of the plant, resistance to disease, etc.

1066. *Method of judging cotton plants on very small plots.*—In order to give the points of importance as nearly as possible the relative values agreed on and to set before myself and staff, as clearly as I could, an ideal of the plants we were in search of, I adopted the system of according marks to the various points to be considered. I had already practised this system with good results on other articles where a number of important points had to be considered collectively by different people judging the same thing. It had been applied with success to many cases elsewhere by others. The points first put up and the marks assigned to them were as under, the details being altered to suit the sort of cotton being judged and also with our experience in the work:—

	Maximum marks.	Total marks.
HABIT—		
(a) Erectness	1	14
(b) Compactness, i.e., many lateral branches starting from the main stem; short internodes	8	
(c) Well developed bolls	2	
(d) Number of loculi, one mark for each loculus above the ordinary number	1	
(e) Earliness	2	
HEALTH—		
(f) Resistance to insect pests	15	25
(g) Resistance to fungus and other pests	10	
YIELD—		
(h) Minimum 10 maunds per acre (3 marks per maund above 10 maunds up to 20 maunds)	30	30
LINT—		
(i) Length of lint; minimum 0-8" (marks for each 0-1" above 0-8" up to 1-2")	12	31
(k) <i>Kan</i> (minimum 25 per cent. weight of <i>kapas</i> to be fibre) and seed properly covered; regularity in length of lint, strength, fineness and smoothness, etc.	19	
TOTAL	100	100

(2) If a type was perfectly free from insect pests while those around were very badly attacked, it got fifteen marks. If it was no more resistant to insect pests than others, no marks were given under that heading while any degree of resistance between these points was awarded a corresponding proportion of the marks. Again if the weight of the produce of *kapas*, when multiplied by a certain number representing an ideal number of plants in an acre of such a crop, came to ten maunds or less, no marks were given and the selection was thrown out of the selection list, while if the outturn came above ten maunds three marks per maund were added. Similarly for other factors.

(3) The uses of this system had its limits, of course, as the amount of ground-space, light and air that a plant gets, the quality of the soil that the plant grows on, its proximity to a water channel, etc., all affect the plant greatly but it provided some sort of common criterion for myself and staff and with modifications as experience prompted, it reduced the staff from a number of members, all working at sixes and sevens, collecting a mass of separate cottons requiring years of time and labour to test, for no reason clear even to themselves, except that it looked well to collect a large number, to one with some definite object. It enabled me therefore to make a much better use of the men engaged to assist me in the early days when they were new to their work and when the multitude of my other duties often prevented me from being with them than I could have done without such a system.

1067. *Form A.*—In order to induce my men to examine the different parts of the various cotton plants with some care and to get some sort of record of the constancy or otherwise of such characters as shape and size of bolls, opening of the bolls, habit of the plant, length and quality of the lint cropping powers when growing on similar or different sorts of soil and other points which would help me in gauging, as far as

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possible, the probable profits per acre from the selections while on the small plots to which I was limited, I made out Form A below :—

Cotton Records.

Number of row and plot.		HABIT.	STEM.		LEAF.					FLOWER.																
Number of variety.	Percentage of germination.		S. = Spreading; E. = Erect; M. = Medium; D. = Drooping.	H. = Hairy; S. = Smooth.	G. = Green; R. = Red; G. R. = Greenish Red; R. G. = Reddish Green.	S. = Strong W. = Weak.	Length in inches.	Internodes.	Height of the plant in feet.	Length in inches.	Breadth in inches.	L. = Length; B. = Breadth; and S. = Shape; of the longest lobe.	Shape of sinus.	Number of lobes.	Upper side Smooth.	H. = Hairy; S. = Thin.	B. = Brittle; Tk. = Thick; Th. = Thin.	R. = Red; G. = Green.	V. = Vitis.	Shape and number of glands.	R. = Red; W. = White; Y. = Yellow.	Colour of the petals.	C. = complete; I. = Incomplete; T. = Trace; A. = Absent.	Eye.	Length of the pistil above the stamens in inches.	Shape and number of glands.	C. = Calyx; B. = Bracteoles.
Number of Carpels	Sketch of the boll.	Shape.	L. = Length; B. = Breadth in inches.	Length of the longest lobe.	Date of sowing.	Date.	Amount.	Date.	Amount.	Date.	Amount.	Colour, length, regularity, strength and quality.	R. = Robust; S. = Sickly; F. = Fair.	Reasons for selection.	REMARKS. (Notes on petals, general character of the plants not already included, final recommendations as to their selections, etc.)											

(2) I had this form filled up annually for each plot of selected cottons. As different people were to fill up these forms and their value as records would be in proportion to their accuracy and the degree to which they could show differences, I made the column headings so that the information to be filled in should be as definitely comparable as possible. For example, in the case of the boll, a typical specimen is simply cut in half lengthwise, placed on the paper and a pencil line drawn round it. The outline of a transverse section is got in a similar way. This eliminated idiosyncrasies of judgment as to whether the boll is large or small, how the shape of its apex should be described and other points that would come into the case should a written description be attempted. To get figures for the percentage stand column, the number of properly spaced plants that would be grown on the vacant spaces in the plot without unduly crowding the plants actually growing is counted, subtracted from the ideal number of plants which should grow in the plot and the stand of the crop is expressed as a percentage of the ideal stand. This column, backed up by one giving the height of the plants in feet and inches and a few remarks on the regularity of the stand, gives a good deal of useful information. For example, it shows whether a poor outturn of *kapas* is due to poor yield from a good stand of well grown plants to paucity of plants, or to a fair number of plants which are poorly developed owing to some cause such as poor soil, bad cultivation, etc., etc. These columns were therefore very helpful to me in interpreting the outturn figures got from my experimental plots in terms of the normal cropping powers of the selections.

(3) Counting the actual number of plants growing in a plot was found quite impossible as a general practice even on my small experimental area of land because of the tremendous amount of labour entailed in counting each plant in all the plots. Even on individual plots it was very unsatisfactory because when two plants had been left in one hole at thinning time or where some plants had been planted closer than they should have been, useful figures were naturally got neither when two such plants were counted as one, nor when counted as two, and the adoption of any intermediate course would have entailed very indefinite orders.

1068. *Further records kept.*—Records of the dates of sowing, cultivation, irrigation given, etc., were entered in another register, and from the time I had my experimental lands laid out, I had maps made annually showing the patches where crops were better or poorer than usual, where they were badly diseased, etc., and notes were made on the possible causes of these differences in the crop.

1069. *Markedly different characters in different plants of unselected Dharwar, American and Narma cottons shown to be hereditary.*—Walking through a field of the Dharwar, American or *narma* cottons growing on the Agricultural Farm, and on farmers' field in 1907, the extraordinary differences in the health of the plants in any one field at once struck me, and on closer examination the differences in length and quality of the lint, *kan*, etc., were hardly less striking. In the summer of 1908, when examining the plots of cotton selected in the picking season of 1907, these same differences in health, habit, character of the lint, etc., were markedly obvious, while in some cases the characters of all the plants of a selection were extremely uniform. In an experiment in which packets of seeds from each of ten individual plants were divided into seven lots making seventy lots in all and sown in separate rows on seven different dates and on seven different areas, the characters of the progeny of any one of the ten original plants were so uniform and distinct over all the areas of that selection that all probability of the extraordinary difference in character noticed among the other selections, being due (within limits) to slight differences in the soil in planting or any of the other matters for which

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labourers could be responsible, had to be dismissed. This and similar evidence that these characters were hereditary enabled me to reject a large number of our first selections with some confidence almost at once, and indicated that Dharwar, American and *narma* cottons could be vastly improved by simple selection alone. It also indicated that these selections which produced plants that did not have similarly uniform characters were crosses, and this has been repeatedly demonstrated since then. A notable feature was that the plants which gave progeny that did not agree in character were nearly always those which had been outstandingly vigorous when selected. This has also frequently been seen to happen since then and is in accordance with what is known about hybrids.

(2) Samples of lint from the first crop of our selection to give us any considerable quantity of fibre (1909-10 crop) were sent to various spinners and traders for opinion as to their comparative qualities and commercial values; also for comparison with important commercial cottons of other parts of India and elsewhere. This has been repeated annually since then. I am especially indebted to Messrs. Tata and Sons, Spinners, Bombay, the British Cotton Growing Association, Liverpool, the Chamber of Commerce, Bombay, and Professor Gammie, the Imperial Cotton Specialist, in this connexion.

1070. *Tests after the selections had reached the stage of small plots.* After the selections had reached the stage of small plots and we had got the spinners and traders' valuations of their lints, these selections were judged by the money value of crop per acre which each produced after taking into consideration the area of the plot from which the calculation was made, the percentage stand of the crop, the degree of development of the plants and other points which help to indicate what a fair crop of the selection on average lands would be or which would influence the profits from the crop.

(2) The great value to us of our attempt to discover the factors involved in the improvement of cottons, to assign to these factors their relative economic values and to judge our selections on this standard has been apparent at every turn. For example, in 1912, Messrs. Tata & Sons in valuing our cotton selections wrote "only one sample No. 161 can be compared with American. It is splendid cotton, especially in length and strength of its fibre. If the cultivation of this cotton turns out a commercial success, it will finally solve the problem of obtaining long stapled cotton from British territory." It was evidently by far our best cotton from the spinners' point of view in the earlier years of our work, but when its cropping powers, etc., were taken into consideration it was found that many other of our selections were much more profitable from the growers' point of view, and that to have sent it out to farmers would have been a step in the wrong direction. The case of the Indian cotton with the very high *kan* mentioned above is another example.

1071. *Influence of soil on the acclimatised American cottons.*—As already stated, I have had a block of thirty acres of land set apart for experimental work on crops and ten acres of this have been under cotton each year. The plots all get the same treatment, and our aim is to keep the land in a condition that an ordinary farmer might keep his lands in. The land was handed over to me in 1909. A comparison of the maps of the condition of the cotton selections when grown on the various plots with the data concerning quantity and quality of the lint got, etc., soon showed that about two-thirds of this experimental lands are of fair quality for growing American cottons on and about one-third which runs in a diagonal streak through the area is quite unsuitable for this purpose. This streak is of a more sandy nature than the remainder, and was evidently deposited by one of the swifter currents of water which laid down the alluvial lands of the Punjab. That the poverty of the cotton crop on this streak is due to the quality of the soil is shown by the facts that the outlines of this bad area are in the same position each year and that no matter what selection of American cotton is grown on that area the plants are badly developed and the crop is poor. No efflorescence of salts appear on the surface of this streak of soil.

(2) The fact that the American cottons grown on poor sandy soil give a small amount of *kapas* per acre had been noticed by *zamindars*, but our data showed us also a point of much greater importance as far as cotton improvement work and American cotton growing is concerned, viz., that the lint grown on these sandy soils was not only shorter in general but so weak and irregular in length and strength that if mixed with that of even the same selection grown on fair quality of land the character of the whole consignment would be ruined.

(3) Messrs. Tata and Sons, when valuing a number of samples of cotton grown on that sandy strip in 1912, remarked on the great irregularity of the length, etc., of the fibres. Next year, when the lints of some of the selections grown on better land were valued by the same firm they noted the absence of this irregularity. In 1915, when the same cottons were grown on the same land as in 1912, the same irregularity in the lint appeared while, in 1916, it disappeared. Since 1912, I have repeatedly found that fibre from selections which obtain high valuations when grown on good soil sink to comparatively low valuations when grown on these sandy lands and when a strip of one selection of cotton begins on good soil and ends in the sandy streak, good fibre is got from the plants on the good land while poor irregular fibre is got from those on the sandy soil. At the 15th Lancers farm at Risalewala near Lyallpur, where Dharwar American cottons have been selected and grown for a number of years back, the former Manager (Risaldar-Major Ali Ahmad Khan) also found that, while the loamy plots on his farm grew excellent crops of these American cottons, the same cottons were a failure on sandy plots there. In my experimental lands at Lyallpur, I have got moderate crops of Indian cottons where the American crops have been failures; and at other places in the Punjab, I have noticed that American cottons have been a failure on sandy lands where Indian cottons have given a small crop. The lint of Indian cottons being shorter and stronger than that of American cottons is less markedly affected. From these experiences, it is quite obvious that differences in the quality of the soil are a very much more important factor in cotton growing than they have hitherto been believed to be. From the beginning of these experiences, it appeared to me that the short irregular fibre got on such sandy lands as the streak in my experimental area, was due to a poor water holding capacity of the soil, and I hoped years ago to have had analyses of the soils in typical spots in my area to throw light on such points as the relationship of the mechanical constitution of the soil with differences in its water holding capacity; the effects on the length and quality of the lint of definite amounts of moisture in the soil at different stages of the plant's life cycle, etc., but, owing to want of staff, I regret to say we have never got further than the bottling of a few samples of soil for analysis or attempts which have been interfered with by rains, or in other ways, to control the quality of the lint by irrigations. A proper staff is urgently required for these investigations as, in my opinion, the matter must be thrashed out properly before we can go with safety far into the question of long staple cotton growing in the Punjab.

(4) It is already evident, however, that farmers will get disappointing results regarding the quality as well as the quantity of *kapas* if they sow American cottons on sandy lands; that even if only one selection of American cotton is grown in a locality and part of the crop is grown on these poor sandy soils, the fibre from

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that part, if mixed with the other, may ruin the whole consignment from the spinners' point of view ; also that in judging which of a number of selections is the best from our point of view we must be very careful to take into account the quality of the land on which they were grown.

1072. *A few remarks on the influence of climate on American cottons.*—In 1909, through the kindness of Mr. D. Fairchild of the Department of Agriculture, United States of America, Washington, D. C., I obtained several varieties of Upland American cottons, and these have been grown at Lyallpur annually since then. In the first year after their arrival, the varieties were grown on land of fair quality and got the same treatment as all my other cottons, but although the seeds germinated all right, many plants died off very young. The plants that came up looked unhealthy and never reached the height of the ordinary acclimatised American cottons grown in the experimental area. The bracts and leaves of all these newly-imported cottons and the bolls of all except one of them were so very much bigger than those of our acclimatised cottons that they were glaringly noticeable to any one as being different from our varieties. An outturn at the rate of something like a maund (82 lbs) or less of *kapas* per acre was all we got from them. Since then seeds from the healthier plants only have been resown ; the stand of the crop has annually become better, the bolls, bracts and leaves have diminished considerably in size, the leaves have become thinner and more hairy, and the general appearance of varieties is such that they might easily be passed now by the casual observer as one of our Dharwar or *narma* Americans. There are other interesting changes, but I will not carry the subject further as the flowers of the varieties were not bagged and self-pollinated annually and therefore it is possible that cross pollination with acclimatised varieties might have taken place. Unfortunately, it was impossible for us to bag these cottons annually and give them the close observation which I should have liked to give, as I have only had one man to help me with my cotton work during these years, and we had hundreds of sowings of other cottons to get more immediately important data from.

(2) I got a duplicate set of the same cottons from America last year, and hope to have better luck as regards staff to deal with these so as to get evidence on several questions in my mind. Meantime it is interesting that the first crop of the second lot imported has behaved exactly like the previous lot.

(3) Some American cottons brought from America to Jullundur by an Indian farmer about 1913-14 appear to have behaved similarly. I saw a small plot of these cottons in 1916. The stand was miserably thin, most of the plants were in miserable health, and the crop got must have been extremely poor. I hear that the variety has been given up altogether owing to being unprofitable. The Dharwar American cottons which were being imported into the Punjab from Dharwar in the Bombay Presidency when I came here in 1907 also contained a large percentage of sickly, poor yielding plants. Their leaves were rather bigger, thicker and less hairy than those of the old *narma* cotton (American) which had been introduced into the Punjab very many years before. The fibre of these *narma*s was also shorter and rougher than that of the Dharwars mentioned above.

(4) The dates of sowing and harvesting cottons in the United States of America correspond roughly with those of our country cottons here, and on comparing the climate of the cotton belt with that of the Punjab, we find that our temperatures are a good deal higher than the American temperatures especially in the months of April, May and June when the cotton plants are young ; also that our climate is much drier than that of the American cotton-growing states. Apparently the reduction in the size of the leaf, its increased hairiness and other changes in the characters of the plants are adaptations to our hotter, drier climate. From our experiences and observations, it seems evident that cottons directly imported into the Punjab from America have always been miserable failures from the profit per acre point of view for a sufficient number of years to make people reject them as useless. It is also evident that many plants do not succeed in adapting themselves to Punjab conditions even after growing very many years here, while others lose characters of important economic value in doing so. The old Punjab *narma* American for example gave less promising results than the more recently imported Dharwar Americans did in the trials made before I joined the Department. Our results indicate that useful work in improvement of such cottons here can be done by the recognition, selection and multiplication of individual plants possessing the proper combination of character to give what is required by spinners and also increased profit per acre to farmers.

1073. *Tests after leaving the Botanical Section.*—Although on very small plots, one can make accurate estimates such characters as length and strength of lint, *kan*, etc., reliable information on such important factors as cropping powers of the types can only be got from tests on a larger scale than my facilities would admit of my making, and I have had to hand my half done work over to the agricultural section for completion. This in my opinion, has been a great defect in the organization.

1074. *Difference in gross income from unselected Dharwar and 4-F. when grown interstripped with each other.*—A test between my American selections and the ordinary unselected Dharwars was conducted on the agricultural farm in 1912 (see pages xii and xxiii of the Annual Report of the Agricultural Department of June 1913).

(2) Referring to this test the report states—"The different types were grown side by side with Dharwar American cotton for comparison on an area of eight acres, type 4-F averaged 10 maunds 21 seers against 6 maunds 29 seers for Dharwar."

(3) Regarding unselected Dharwar cottons and a cotton known as 3-F. grown on the farm in the experiment referred to above, Messrs. Tata and Sons, Spinners, Bombay, in their letter, dated 10th December 1912, wrote as follows :—"We have carefully examined the average sample of cotton which is for sale in the neighbourhood of Lyallpur (unselected Dharwar cotton), and we find that it is mixed with *de-hi* (Indian) cotton. The fibre is irregular and weak, and we are afraid it is unsuitable for the requirements of our mills. We regret, therefore, that we are not prepared to make an offer for the same. The other sample marked 3-F. is undoubtedly a cotton of superior quality resembling fully good middling American. The fibre is strong, long and even, and appears to be even better than the cotton purchased by us last year on your side from Risalewala Farm. We value it to-day at Rs. 12½ per maund for *kapas* at Lyallpur, say, Rs. 2 higher than the other sample which we value at about Rs. 10-1-6 or Rs. 10-1-0 per maund." Unfortunately 4-F. does not seem to have been valued on the same date, so absolute accuracy of comparison is impossible, but 4-F. has a better *kan* than 3-F. had, and there was no very great difference in the fibre, therefore if we value 4-F. at Rs. 12½ per maund we should get a gross income within the mark. Taking Rs. 12½ per maund as the value of the 4-F. *kapas* and its outturn of 10½ maunds, it yielded a gross income of Rs. 129 per acre in the experiment, while the unselected Dharwar grown along with it and yielding 6½ maunds of *kapas* at Rs. 10-10-0 per maund, gave about Rs. 71 per acre only. The cottons being interstripped and grown on an area of eight acres give some indication of the advantage to *zamindars* of growing 4-F. instead of unselected Dharwar.

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1075. *Growers' and traders' opinions of 4-F.*—What the *zamindars* think of 4-F. is shown by the fact that the Agricultural Department has never been able to supply enough seed to meet the demands of growers even when prices higher than those of local seeds were demanded. The cotton trade also recognise it as superior to country cottons. The following are a few figures showing the annual areas sown with seed supplied direct by the Agricultural Department and the prices got for the produce :—

In 1913, the area sown was 100 acres and *kapas* sold in January 1914 by auction at sales fetched Rs. 9-10-0 per maund when country cotton was at Rs. 6-13-0. The Agricultural Department acts as organiser of and arbitrator in those sales (*vide* Annual Report of the Department ending June 1914, page 3, paragraph 7, and dated June 1913, appendix, page XII).

In 1914, the area was over 3,000 acres and the produce fetched a premium of between Rs. 2-5-0 and Rs. 2-8-0 per maund over country cotton at the auction sales (*vide* Annual Report of the Department, June 1915, page 10, and Agricultural Journal of India, Volume XI, part III, July 1916, page 239).

In 1915, the area was over 7,700 acres and *kapas* at the sales fetched Rs. 2-8-0 to Rs. 4 per maund over country cotton. A good deal of the *kapas* from the above area was also sold privately (*vide* Annual Report of the Department ending 30th June 1916, page 10, paragraph 20).

In 1916, the area was over 50,000 acres. The Professor of Agriculture writes that as much as Rs. 17-1-0 per maund of *kapas* was obtained for some lots of 4-F. in November 1916 when the price of country cotton here was only Rs. 8 to Rs. 9 per maund (*vide* Annual Report of the Department, dated June 1917, page 8, and Agricultural Journal of India for July 1917, page 491).

This year, the area is reported as 215,000 acres (*vide* Annual Report, dated June 1917, page 8). The Professor of Agriculture states that the seed issued this year was sold at fifty per cent. over bazaar rates. In those years, also the growers have always got more maunds of *kapas* per acre from 4-F. than from the ordinary country cottons. Owing to limitations in staff, the Agricultural Department cannot supervise the growing of all the 4-F. seed sent out and make special arrangements to have the crop ginned separately, etc., therefore increasing areas of 4-F. get into the market annually and are resown quite independently of Government help. As one acre of cotton will easily yield seeds enough for twenty acres in the following year, and there is a keen demand for 4-F., the area of it growing in the Province is doubtlessly very much greater than that directly supervised by the Agriculture Department.

1076. *Help in the spread of selected American cottons from the 15th Lancers' farm Risalewala.*—In the spread of American cottons in the Punjab, we are greatly indebted to Resaldar-Major Ali Ahmad Khan who was Manager of the 15th Lancers' Farm at Risalewala for many years. In the early years of my work, this man, visiting his brother, my chief assistant, frequently saw my American selections, and was convinced that they were a great improvement over the ordinary American cotton which he was attempting to grow then. He asked me for a few seeds of some of these selections for trial, but being prohibited from giving any seeds to any one, I had to refuse his request. My assistant being his brother, however, helped him to select his cottons on the same lines as mine, and before my 4-F. was sent out by the Professor of Agriculture he was getting more maunds per acre and Re. 1 or over per maund more for his cotton than any one else could get for American cotton outside the Agricultural Department. His seeds were eagerly bought by private *zamindars* at a premium over market prices, and he has now for years been sending annually into the market seed sufficient for 7,000 to 8,000 acres. These cottons with what has been issued directly from the Agricultural Department form practically all of the American cottons grown in the Punjab at present. Surplus seeds of selections being worked on by us and which are sold in the local market, doubtlessly add to the area also.

1077. *The change in farmers' opinions regarding American cottons and some reasons for this.*—The net result of the attempts to introduce long-staple cotton in the Punjab was that the area of these cottons grown in the province was practically nil until comparatively recent years. To induce *zamindars* to grow the American cotton which the Director and Deputy Director of Agriculture had imported annually from Dharwar from 1904 for several years onwards, these officers arranged for grants of extra supplies of irrigation water to *zamindars* who would grow it, and gave more or less of a promise of a premium in price of its *kapas* over that of *deshi*. In 1908, however the Deputy Director of Agriculture writes (*vide* appendix 11, paragraph 8 in the report on the operations of the Department of Agriculture for the year ending 30th June 1908) :—"It is estimated that the growing of the American variety represented a loss of Rs. 6-7-0 per *killa* as compared with *deshi*." In the same report (see paragraph 3) he writes :—"We have refused to guarantee anything about the water supply, which I consider perhaps the best move of all, thus getting rid of what was certainly an inducement to grow if not an actual bounty on American cotton. I have put up a scheme for the disposal of the produce by auction which I hope will be sanctioned as I am sure that better prices will be thus obtained. The scheme should rest on a commercial basis and should stand or fall on its own merits." Again "owing to the backwardness of the work on cotton at the Lyallpur station, the true policy seems to be to avoid sudden expansion until the selections, crossings, etc., have produced some definite result. We are quite prepared to advance to a large area when a type more suitable to the country has been produced."

(2) It is interesting to compare the keenness of *zamindars* to-day to grow American cottons with their attitude towards them up to the time that the Deputy Director of Agriculture wrote the above report, and it is important for future progress that the reasons for the change should be understood. In my opinion, the first important step in the work was the experiment which showed that certain differences in the health of individual plants, the lengths of their lints, *kans*, cropping powers, etc., are to a substantial extent hereditary. This enabled us to throw out a large number of unhealthy poor yielding plants and raised the crop yielded by those left by a very large amount straight away. The next step was the decision to select and push forward types possessing a combination of characters which would yield increased profits to growers in ordinary conditions here in preference to pushing on those merely possessing some such character as the longest lint or highest *kan*. Events have shown that *zamindars* are very keen to grow such types as we have decided to select, and having isolated these, the next matter of importance for a rapid spread of these cottons was a supply of seed. This the people were able to get first from the 15th Lancers' farm and later from the Agricultural Department direct. The special sales above mentioned for American *kapas* have been continued and have helped the work, but that the spread of these cottons rests on really improved plants and not on these sales is shown by the fact that a far greater area of American cotton is grown and marketed quite independently of such help than is grown or marketed with it. For example, it was estimated by the Professor

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of Agriculture that, in 1916, a total of 120,000 acres of American cotton were grown in the Punjab, while the Agricultural Department supervised the growing and arranged for the sales of the produce of only 30,000 acres. An area of 90,000 acres or three-quarters of the whole area under American cottons in the Province was therefore apparently grown simply because the types of American cotton now available to growers have been consistently yielding more profit than their country cottons were. Regarding extra profits, the Professor of Agriculture states that the ordinary premium for American cotton in 1916 apart from sales arranged by the Agricultural Department was Rs. 4 per maund, and taking six maunds per acre as the average crop calculates $120,000 \times 6 \times 4 = \text{Rs. } 28,80,000$ as the extra profit got by cultivators by growing American instead of *deshi* cotton (*vide* Agricultural Journal of India, dated July 1917, page 491). This estimate, however, must be very much below the mark, for it does not take into consideration the fact that the selected American cottons simply growing in fair agricultural conditions yield a greater number of maunds per acre than the ordinary unselected *deshi* cottons do in similar conditions. This is obvious from our own work on the experimental lands and from what one sees on tour in the districts when one comes across plots of American and ordinary *deshi* cottons growing side by side. Also the *zamindars* who grow American cotton all agree on this point. In my opinion, if selected American and ordinary unselected *deshi* cottons are grown over a large area of fair quality of lands receiving fair cultivation, the excess of the selected American over the unselected *deshi* would be two maunds per acre approximately. The fact that American cotton comes rather later into flower than *deshi* and has a longer picking season, has accentuated this difference in its favour on several occasions. For example, in 1911, when boll-worm caused very severe damage, much more crop was got from the American cottons than from the *deshi*, although both appeared about equally severely attacked when the attack was raging. The attack was stopped by a very heavy wind and rain-storm which caused affected buds and fruits to fall off the plants into the sea of water at their bases, and as this occurred after the *deshi* varieties had produced the majority of their flowers, they yielded very little crop while the American plants formed a considerable crop of flowers and bolls after that storm.

(3) In 1915, excessive heat and drought in the early summer caused a very large number of early formed flowers and bolls to fall off cotton plants, and the *deshi* crop suffered more than the American owing to its earlier and shorter flowering season as it has a larger proportion of its total crop on the plants at that time. In the past summer (1917), excessive rains caused a very large number of flowers to fall from both *deshi* and American cottons and again the American crop will give much better outturns than the *deshi* for the same reason as before.

(4) As harvesting of American cotton extends to later in the year than in the case of *deshi*, American cotton requires an extra watering or more after watering for *deshi* is unnecessary in order to get the best results, but the past phenomenal rate of spread of American cotton-growing here shows that this will not be an effective deterrent to *zamindars* growing it in preference to *deshi* so long as they get more money value out of it. Even if no extra watering is given, however, he will still get some crop late in the season, although the quality of the lint may not be so good, and as he can sell even this lint in the market for as good or a better price than he can get for *deshi*. Doubtless this also weighs with him.

(5) I think events have shown that *zamindars* here are quite keen enough to grow more profit-yielding cottons when they can get hold of them, and it seems to me important that arrangements be developed for providing a steady and sufficient annual supply of good seed to growers, and that work on improving the types to be sent out should follow the general principles adopted in evolving the types already evolved.

1078. A comparison of the values of the lints of Punjab American cottons with those of other cottons, also a few other characters.—As already stated in paragraph 1069 samples of lint of our selections have been kindly valued for us by Messrs. Tata and Sons, Bombay, the British Cotton Growing Association, Liverpool, or other bodies repeatedly since 1909-10. They have frequently reported that the lints sent from quite a number of our selections are suitable for Lancashire. In these years, they have valued a number as equal to middling American and a few as better than that grade.

(2) The following table shows the spinning counts and the prices per *k'andi* of eight of these selections as reported by Messrs. Tata and Sons, after valuation of samples sent to them in 1917. I have added columns showing the length of lint and *kan* :—

Selection.	Length of lint.	Kan.	Spinning counts.	Price per <i>khandi</i> of 784 lb.
				Rs.
161-AF	1"	31	30 to 40	580
280-F	1.1"—1.2"	28	50	650
281-F	1.0"—1.1"	29	44	630
282-F	1.1"	29	50	650
285-F	1.2"	32	50	650
286-F	1.2"	29	50	665
287-F	1.0"—1.1"	31	48	650
288-F	1"	29.5	48	640

Many other samples were valued between Rs. 570 and 630. Messrs. Tata and Sons report that, on the date of valuation, Sind American was selling at Rs. 530, American Middling spot Liverpool at 19d per lb., F. Navasari at Rs. 600, F. Surat at Rs. 570, Cambodia at Rs. 550 and F. Broach at Rs. 550 per *khandi*. Samples from

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four of these selections were also sent to the British Cotton Growing Association, and their report, dated 27th September 1917, includes the following :—

Mark.	Quantity.	Classification, etc.	Value.
No. 280-F.	Sample A*	Equal in grade to Fully Good Middling Bowed, very bright creamy, good staple. (Useful cotton)	About 80 to 90 on
No. 280-F.	Sample B*	Equal in grade to Mid. Fair Bowed, good colour, staple smooth, strong, about 1 inch in length, very desirable cotton	About 175 on
No. 282-F.	..	Equal in grade to Mid. Fair Bowed, very white and bright, staple about 1 inch in length, inclined to be a little rough, very desirable cotton	About 150 to 170 on
No. 285-F.	...	Equal in grade to Mid. Fair Bowed, very bright, good colour, staple strong smooth full $1\frac{1}{2}$ to $1\frac{3}{4}$ inch in length, very desirable cotton	About 250 on
No. 286-F.	...	Equal in grade to Mid. Fair Bowed, rather creamy, staple rough strong, full $1\frac{1}{2}$ to $1\frac{3}{4}$ inch in length, very desirable cotton	About 250 to 300 on

Price of Middling American 18-62d.

(3) For comparison with the selections mentioned in this paragraph, I may state that the length of lint of 4-F. is about .9 inch, its *kan* is 32 to 33 per cent. and it spins 20s to 30s when well grown. There are other hardy selections which have lint .9 inch or over. Among the scores of selections which we have on hand there are wide differences in earliness, hardness, lint and other characters of economic value, and there seems a large field for improving the cotton crop by combining the best of these characters in one plant. Many of our selections have on the whole longer and better lints than those which we had in earlier years combined with higher *kans* and better cropping powers.

1079. Start of the work on Indian cottons.—I may now make a few remarks on what has been done on Indian cottons. I started my work on these cottons in 1908, and my plan of work on these was as described in paragraph 1059.

(2) As my duties connected with the starting of the Agricultural College and other things prevented me from being absent from head-quarters for lengthened periods just then, it was decided that a collection of the seeds of the cottons grown in every *tehsil* of every district in the Punjab and from as much of the North-West Frontier Province as possible should be made that year through the District officers concerned, and that the main types of cottons found should be isolated and studied as far as possible at Lyallpur. This collection was accordingly made for me through the channel above referred to. The work of classification and identification of the cotton types met with and the selection of the best of the plants of each of these types from an economic point of view commenced when the first crop was grown in 1908-09. It was found that every one of the samples of seed sent was a very bad mixture of types of cotton, and that every type of cotton to be found in the Punjab could be found in the samples from almost any *tehsil*. The proportion in which the different types of cotton occurred differed in samples from different localities; but although a record was made of the proportions in which the types occurred, I recognised that collected in the manner the samples were they could not be relied on to represent the relative proportion of the different types in the mixtures of cottons grown in their respective localities or even that they included all the varieties of cotton grown. I expected to get accurate information on these points as well as even more important data referred to in paragraph 1059 from the proposed district surveys.

1080. Natural crossing amongst the Indian cottons.—As soon as I was able to collect seed from individual plants of the collection and plants had been grown from these seeds, it was evident that the different types of these Indian cottons had been cross-breeding among each other. In some cases, the seeds from a single parent plant gave rise to plants which could be classified by obvious characters in simple Mendelian numbers; in other cases, a plant had evidently been a cross, although the proportion in which the obvious characters appeared were more difficult to explain.

1081. Classification followed.—From what we now know of the possibility of combining characters of one plant with the characters of another when plants cross breed, from our knowledge of the nature of what is known as fluctuations and mutations and of evolution in general, backed up by such experiences as the extraordinary changes which I have seen take place in the cottons which I imported from America, I did not consider it advisable at that stage of the work to strain over whether the types which I found agreed exactly in all particulars with those of the various authorities who have attempted to classify cottons. In order, however, that our work here should be connected with the classification of other Indian cotton, I followed the classification of Professor Gammie, Imperial Cotton Specialist in India, in his "Indian Cotton Bulletin" No. 2, Vol. II, dated September 1907, Department of Agriculture, India.

*NOTE.—Sample A 280-F is from a picking made on 14th November 1916 and sample B. 280-F is from the same cotton, but picked on 4th December 1916.

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1082. *Types of Indian (deshi) cottons commonly grown in the Punjab.*—The Indian cottons commonly grown in the Punjab as represented in the collection made were classified in 1911 as follows:—

		Colour of flowers.
1. <i>Gossypium sanguineum</i>	{ A broad lobed type B narrow lobed type	{ Deep red with dark 'eye.'
" " var. <i>minor</i>	{ A broad lobed type B narrow lobed type	{ Pink with dark 'eye.'
2. " <i>herbaceum</i>		Yellow with dark 'eye.'
3. " <i>indicum</i>		Ditto.
" " (var. <i>Mollisoni</i>)		White with dark 'eye'
4. " <i>neglectum</i>		Yellow with dark 'eye'
" " (var. <i>Roseum</i>)		White with dark 'eye.'

(1) Specimens of the cottons named above were sent to Professor Gammie for opinion and were approved by him. He also saw and inspected the cottons growing at Lyallpur. Botanical descriptions of these cottons were written up several years ago, but have not been published owing to difficulties regarding the making of coloured drawings of the specimens. I have, however, herbarium specimens of the plants and their lint for the inspection of the Committee.

1083. *Some characters of Indian cottons.*—The following table shows the general lengths of lints, *kan*, etc., of the types of Indian cottons found in the Punjab:—

Name of variety.	Ginning percentage.	Length of lint in inches.	Spinning counts.	REMARKS.
<i>G. sanguineum</i>	29—33	6—85	Up to 16's	Generally selections are later croppers than those of <i>G. sanguineum</i> (var. <i>minor</i>), but we have some selections which are quite as early.
<i>G. sanguineum</i> (var. <i>minor</i> .)	29—33	6—85	Do.	Usually heavier yielders than those of <i>G. sanguineum</i> . Generally early croppers but there are a few selections which are exceptions.
<i>G. indicum</i>	25—32	6—95	Do.	Most common type of cotton in the Punjab, Medium cropper.
<i>G. indicum</i> (var. <i>mollisoni</i> .)	33—39	5—75	Up to 10's	} Lint very rough.
<i>G. neglectum</i>	28—34	6—8	Up to 8's	
<i>G. neglectum</i> (var. <i>roseum</i>)	33—39.8	5—7	Do.	
<i>G. herbaceum</i>	24—32	7—95	...	Late ripening. Not successful in the Punjab plains.

(2) A notable peculiarity of these cottons is that those varieties which have more or less white colour in their petals, viz:—

G. sanguineum (var. *minor*), *G. indicum* (var. *mollisoni*), and *G. neglectum* (var. *roseum*)

have markedly smaller flowers than the main types to which they belong, also they have, as a rule, a higher *kan* and shorter and rougher lint. *G. herbaceum* has, as a rule, the finest and longest lint of the lot, lint of an inch or over having been frequently found. This cotton is not common in the Punjab. Plots of it tried on the botanical area at Lyallpur have done very badly indeed. *G. indicum* has the next longest lint. Selected plants of it have been found with lint up to one inch in length. The *kan* is, however, usually only 25 per cent. to 31 per cent. of the *kapas*. A large number of selections of these varieties are now being tested as regards their comparative economic values in my area on plots as large as I can afford to give them.

(3) The marked differences in cropping powers, *kan* and other characters in the abovementioned selections show that some of these selections will be much more profitable to grow than others, and we can already see that we can improve Indian (*deshi*) cottons in the province by giving farmers the varieties which will suit them best and by sending into the market a much more even length and quality of fibre than can possibly be sent at present owing to the mixture of types grown. I am informed by representatives of the trade that if they could get a more even length of fibre than they do at present even in *deshi* cottons, it would be important. Traders have also given me some very interesting information regarding differences in the quality of the lint that they habitually find in certain markets, and I am finding our district survey analyses of types of cotton in the fields of the areas which contribute to these markets very useful in helping me to a decision as to whether these differences are due to differences in the conditions under which the crop is grown, or to lints of different varieties being found in different proportions in the consignments of cottons for sale in these markets.

1084. *Selections of Indian cottons which have been taken over by agricultural officers for further tests up to date.*—Unfortunately the work on Indian cottons has been greatly retarded and upset by the best of the *kapas* from most of the selections having been stolen several years in succession from the botanical experimental area. It is hoped that this area will be securely fenced and closed to all except those on business there soon. A small part of the fence has been erected and materials for other parts are arriving. A selection of *G. sanguineum* was handed over to the Professor of Agriculture unofficially in 1912 and is now growing on the Agricultural Farm under the rather misleading name of "Farm selected." This selection was handed

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over to the Agricultural Farm as the real "Farm selected" cottons had become hopeless mixtures and had to be discarded. Our own selection was not quite pure, but it was a much heavier cropper than any in the Agricultural Department then, and numbers of people outside had asked for seeds of it. The Agricultural officers have been able to take over from me ten more *deshi* cottons for testing on a field scale. These types are enumerated and brief remarks are made concerning them later in this note.

1085. *District surveys.*—I was able to start the district surveys of cotton fields in 1912 and the districts of Lyallpur, Hissar, Lahore, Jhang, Gujranwala, Shahpur, Sialkot, Multan and part of Rohtak have been surveyed. The reports of those of Gujranwala and Jhang, which the Director of Agriculture has kindly printed, show the type of work done. As I found that the objects of these surveys were not understood, I explained them in the beginning of the Shahpur District report.

(2) As a general rule, the fields in these districts contained a mixture of almost every type of cotton found in the Punjab, the proportion of the types varying in different fields and localities. Sialkot District showed the least mixture. There many fields were practically pure *indicum*. *G. indicum* is the most common variety of Indian cotton in the Punjab. The *sanguineums* are found in their greatest proportions in the Multan District and the *neglectums* in the eastern side of the Punjab. The proportions of the crop formed by each variety of cotton in the districts so far surveyed are as follows:—

LYALLPUR.

Toba Tek Singh.—*G. indicum* predominates, but there is evidence that *sanguineum* is gradually replacing it especially on light soils.

Lyallpur Tehsil.—Yellow flowered *indicum* predominates very largely, followed by *neglectum* yellow flowered, and *hirsutum* (American) in about even quantities.

Samundri and Jaranwala.—*Gossypium indicum* yellow flowered, and *gossypium neglectum* yellow flowered in almost equal quantities.

There is everywhere a fairly considerable admixture of the white flowered varieties of *gossypium indicum* and *neglectum*. *Gossypium sanguineum* is not uncommon in the Lyallpur and Samundri Tehsils, but is the predominant type in few villages.

HISSAR.

In Hissar, Hansi and Fatehabad tehsils, two-fifths are yellow flowered *gossypium indicum* and one-quarter to one-third is white flowered *neglectum*. White flowered *indicum* and yellow flowered *neglectum* are also common. There is no *gossypium sanguineum*. Cotton is unimportant in Bhiwani and Sirsa Tehsils.

LAHORE.

Yellow flowered *indicum* represents 74 per cent. in Chunian, 78 per cent. in Kasu and 91 per cent. in Lahore Tehsils. In Chunian, about ten per cent. is yellow flowered *gossypium neglectum*; in Kasur, there is a good deal of broad leaved *gossypium sanguineum* in canal irrigated villages.

JHANG.

Gossypium indicum yellow flowered and *gossypium hirsutum* (American cotton) were found to predominate; there is also a fair proportion of *gossypium sanguineum* broad leaved. *Gossypium hirsutum* is increasing in the irrigated areas of the Chinot and Jhang Tehsils, while it is in the Shorkot Tehsil that *gossypium indicum* yellow flowered prevails.

GUJRANWALA.

Cottons are as usual grown with nearly all varieties mixed. *Gossypium indicum* yellow flowered is by far the most predominant type throughout the district: it is 74.3 per cent. of the crop. *G. sanguineum* red flowered broad leaved comes next in importance and forms 13.1 per cent. of the crop. *G. neglectum* yellow flowered comes next with 5.1 per cent. Where the *G. sanguineum* types were predominant, the cultivator considered them more drought resistant and heavier croppers than the other *deshi* types. Where *G. indicum* (var. *mollisoni*) and *G. neglectum* types are predominant, the cultivators have selected them for their *kan*, and for the ease and cleanliness with which the cotton can be picked.

SHAHPUR.

All the *deshi* cottons known in the Punjab are grown mixed. *G. indicum* yellow flowered was 62.1 per cent. of the crop of the whole district: the highest proportion 74.7 per cent. being for the Shahpur Tehsil. *G. sanguineum* red flowered broad lobed type averaged 12.1 per cent. for the district.

The pink flowered broad lobed *sanguineum* formed 3.7 per cent. of the crop. *G. indicum* white flowered came next with an average of 3.4 per cent. Other *deshi* cottons have still lower figures. *G. herbaceum*, of which the famous Broach cotton is a type, was found growing in some plots in the Mohar tract of the Khushab Tehsil. American cotton (*G. hirsutum*) formed 2.7 per cent. of the crop examined in the Shahpur Tehsil, 12.3 per cent. in the Khushab Tehsil, 26.7 per cent. in Bhera Tehsil, and 27.3 per cent. in Sargodha Tehsil, making about 20 per cent. of the cottons grown in the whole district. In many fields a considerable amount of *deshi* cottons was grown mixed with the American cotton.

SIALKOT

The types of *deshi* cottons were found growing mixed to a less extent than in the other districts surveyed so far. *G. indicum* yellow flowered predominated showing 89 per cent. of the whole cotton surveyed; *G. sanguineum* broad lobed 4.4 per cent. and *G. neglectum* 2.7 per cent. Other types were even less important. There were, however, a few fields with one or other of the types showing a higher percentage than usual. *G. hirsutum* (American cotton) was practically not grown.

ROHTAK.

Sonepat Tahsil.—In the khadir tract, *neglectum* (principally yellow flowered) with a percentage of *indicum* was found prevailing. The banjar tract showed *neglectum* and *indicum* (both yellow flowered) in about even proportions.

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MULTAN.

The Multan District has just been surveyed. The survey shows that *G. sanguineum* red flowered broad leaved type forms 39.45 per cent. *G. sanguineum* red flowered narrow leaved 0.78 per cent. *G. sanguineum* pink flowered broad leaved 9.65 per cent., *G. sanguineum* pink flowered narrow leaved 2.3 per cent., *G. indicum* yellow flowered 36.52 per cent., *G. indicum* white flowered 2.57 per cent., *G. neglectum* yellow flowered 0.87 per cent., *G. neglectum* white flowered 0.10 per cent. and *G. hirsutum* (American) 0.83 per cent. of the crop of the whole district. *G. sanguineum* red flowered broad leaved formed from 32.46 to 48.81 per cent. and *G. indicum* yellow flowered from 33.0 to 45.66 per cent. of the crop in the different *tehsils*. *G. hirsutum* formed 19.43 per cent. of the crop in Kabirwala Tehsil, 8.46 per cent. in Mailsi Tehsil and one per cent. or less in the others.

In the Multan survey, a pleasing feature was the large amount of pure acclimatised American cotton which is being grown by the colonists on the lands brought under cultivation by the new canal known as the Lower Bari Doab. This cotton is doing exceedingly well there this year. Its crop will be much heavier than that from the *deshi* cottons.

1086. *Some differences in cotton cultivation noticed during the cotton surveys.*—I may mention here, however, that during these surveys, it has been very noticeable that the crops on lands irrigated by wells are exceptionally well cultivated and very good. This is probably due partly to the fact that the holdings are small and the crop must be well attended to in order to provide a living for the family but it is probably mainly due to these people having to spend a great deal of time and labour in lifting their irrigation water from the wells making them careful to preserve their soil moisture as far as possible by interculture of the crops, etc.

(2) On canal irrigated areas, the crops are sometime moderately well cultivated. At other times, they are more or less neglected and overrun with weeds. This is worst where the farmers are tenants on the *batai* (crop share) system and they are keen on rearing cattle. In such cases the grass and weeds which grow among the cottons form cattle fodder of which the landlord gets no share and although the cotton crop got is small, the tenant recoups himself on his cattle. Indeed in some cases the whole aim of these people seems to be the rearing of cattle. In such cases they frequently sow fodder crops such as *juar* (*Sorghum bulgare*), *sawank* (*Panicum colonum*), *mandwa* (*Eleusine corocana*), etc., for which the landlords usually get no *batai* among their cotton crops. This sort of thing is most frequently seen in the districts of Shahpur, Jhang and Multan, especially on inundation canals where the holdings are large. Tenants on these lands are often people who lived by rearing cattle before canals were so common. These tenants and also the landlords who own those lands require to be taught agriculture before good American cottons lints can be grown there. The conditions on which the land is let also should be altered to compel tenants to grow fodder crops separately which will harm the cotton crop and to provide, as far as possible, incentives for clean and thorough cultivation.

(3) Lands irrigated by canals are very seldom as well cultivated as those irrigated by wells. One reason for this seems to me to be that, while the farmer on well lands evidently tries to increase his crop by interculture, so as to save irrigations which cost him much, the farmer on canal lands tries to save the expenses of the labour of interculture and to increase his crop by extra waterings for which he has nothing extra to pay to the canal authorities. Some system of distributing canal water is required by which it will be to the farmer's interest to conserve the moisture in his fields. In this connection, the feasibility of charging farmers for water by volume which I understand is already being experimented on by the Canal Department, appears to me a matter of great importance in the question of cotton growing. The harmful effects of over irrigation and the beneficial effects of interculture should also be demonstrated to *zamindars* on all possible occasions and on their own lands when practicable.

1087. *Some varieties of cotton tried in the Punjab since 1907, which have failed.*—*Caro Hill Asiam Cotton* (*G. cernuum* Tod.) was tried for several years here but although the *kapas* had a *kan* up to fifty per cent. and it hung out of the bolls in such huge masses that it could be harvested with a minimum of trouble with little or no leaf or dirt in it, the stand of the crop was always so poor and the number of bolls per plant so few that it is the worst annual Indian cotton from the farmer's point of view that I have tried here.

(2) *Buri cotton* seeds were procured from the Central Provinces in 1907. This is a type of American cotton (*G. hirsutum*) which was, I understand, acclimatised in Bengal. It differed from the ordinary Upland American grown here in requiring a much longer season to mature. The lint was good. The variety was tried at Lyallpur for two succeeding years but although the plants grew lustily, they came into flower far too late, and the crop of *kapas* was so small that for all practical purposes, it was a failure. In the second year of trial, in order to see the effect of earlier sowing, I put down sowings at intervals of two weeks from the end of February till late April but the result was the same as before as regards the date of coming into flowers and crop got. The variety was therefore discarded.

(3) *Cambodia cotton* which looked like another strain of the same cotton as *buri* was got from the Central Provinces in 1910 and was tried sown at the same time as the ordinary cotton crop here. The results were practically the same as in the case of *buri*. Since then Cambodia has been tried at Gurdaspur near the base of the Punjab Himalayan hills by the Deputy Director of Agriculture, Gurdaspur. The results got were similar to those I got at Lyallpur.

(4) *The Egyptian cottons*, Metafiffi, Ashmouni, Abbassi and Yannovitch were got from the Khedivial Agricultural Society, Egypt, and tried at Lyallpur for several years but the plants were unhealthy and the crops of *kapas* got were most miserable.

(5) *Two African cottons* named *Beni* and *Niger* were at Lyallpur when I arrived. The plants grew to great sizes but were even later than *buri* and Cambodia and gave scarcely any *kapas* at all.

(6) *Caravonica* and *Spence Tree cottons*, also at Lyallpur when I arrived, were grown for several years. The plants grew luxuriantly but flowers always appeared too late in autumn to allow even a small crop of *kapas* to be got. They were quite useless.

1088. *The most important diseases of cottons in the Punjab.*—A bollworm which is the larva of the moth (*Earias insulana*) does a lot of damage to flower buds and bolls in some years. A parasite (*Rhogas lefroyi*) on the bollworm is bred by the Agricultural Department and issued to needy districts in years when the disease is bad. Rains in June and July are believed to check the bollworm materially. Severe winters are believed to increase the pest in the following season by killing off the parasite in large numbers while not killing the bollworms to the same extent. The crops of cotton least damaged by bollworm are therefore expected after a mild winter and good rains in June and July. The pest is also checked by plucking off and destroying the earliest formed flower buds. A note on what is known about cotton bollworm in the Punjab

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was written by Lala Madan Mahan Lal, Assistant Professor of Entomology, Agricultural Department, Punjab, in 1913 which should be consulted.

(2) *Jassid insects.*—In the autumn of 1907, when making our single plant selections of American cottons, we noticed that the leaves of certain of the plants became curled at the edges, unhealthy looking and finally shrivelled up while the leaves of certain other selections remained quite healthy. In 1908, our numerous single plant sowings showed that these differences in health were due to hereditary characters and that those most severely attacked consistently had thicker, more brittle, and less hairy leaves than those which were quite healthy. We also found unfortunately that many of those least susceptible to attack had very short and rough lint while many whose outturns had been reduced much by the disease had much longer and finer lint. Selections showing various degrees of attack intermediate between those above mentioned and having various lint and other characters of economic importance were also met with. We at once began discarding unhealthy selections keeping only such as had particularly good lint or some other character which we hoped to make use of later in crossing, etc. I came to the conclusion that the unhealthy leaves were being sucked by the tiny insect which rose in clouds when the cotton bushes were shaken. In the summer of 1913, I produced the disease by enclosing a number of these insects with a branch of cotton bearing healthy leaves in a glass cylinder the ends of which were closed against the insects escape by fine muslin, the branch remaining attached to the growing plant during the experiment. Mr. Grove, Officiating Imperial Entomologist, to whom I sent specimens of the insect, a *jassid*, for identification wrote as follows:—

"We have tentatively called it *Empoasea gossypii* and have asked Mr. W. L. Distant in the British Museum, London, to adopt the name suggested and to incorporate the description in the Fauna of British India Series."

Professor Gammie, Imperial Cotton Specialist, to whom I showed the diseased plants growing in the field and pointed out the destinations in leap between the types of plants attacked and those unattacked considered the worst attacked type of cotton to resemble the New Orleans cottons and those not attacked to be more like the Upland Georgian. Later experience has confirmed the view that liability to the disease is hereditary. We have found numerous selections which are practically immune to the disease while others are more or less completely destroyed by it in bad years. For example, 4 F was practically immune in 1913 while 3 F was ruined by it. We have now also numerous transitional grades between these extremes. Long fine linted characters seem to be closely bound up with liability to *jassid* attack, but we think we have got a number of selections with greatly improved lint which are also resistant enough for cultivation in the Punjab. The disease does more damage in some years than others, those years in which the summer is damp and cloudy being the worst. The past summer (1917) has been excessively bad for example. *Deshi* cottons are practically immune but, in the past year, I even saw slight indications of attack on *deshi* although nothing to hurt their cropping powers.

(3) *Cotton root rot.*—A disease to which this name has been applied for many years does considerable damage in the Punjab. The disease starts from some spot in the field and the plants die out in a gradually widening area from that point. In some years, the disease is more destructive than in others. It is not carried by cotton seeds but appears to be connected with something in the soil as it breaks out at the same spots year after year. We are not yet agreed as to the cause of it. Our experiments have shown that it attacks both *deshi* and American cottons but *deshi* more than Americans.

1089. *List of cottons taken over by the agricultural section for testing work.*—The following is a list of the cottons which, up to the present, the Professor of Agriculture and other agricultural officers have been able to take over from me for testing in larger areas than my facilities would allow.

Statement of cottons handed over to the Professor of Agriculture for testing on a field scale.

Serial No.	Variety No.	CLASS.		Year of handing over.	REMARKS.
		American.	Deshi.		
1	266 F	Narma	.....	1909	Discarded in 1910. Said to be a poor yielder on the Agricultural Farm. It gave 12 maunds 5 seers per acre in the Botanical Section on a 1/2 acre plot in 1908 and it gave 10 maunds 4 seers, per acre in 1909 on a 1 1/2 acre plot on the Agricultural Farm. In 1910, it gave 6 maunds 35 seers, as compared to <i>deshi</i> giving 4 maunds 16 seers per acre.
2	267 F	Dharwar	.....	1909	No room to grow it on the Agricultural Farm.
3	29	...	<i>G. indicum</i> (Lyallpur <i>deshi</i>).	1909	Not a high yielding cotton but was given as a <i>deshi</i> cotton was wanted and we had nothing purer and better than in the Botanical Section. Was discarded in 1911 as obviously better ones were coming up in the Botanical Section.
4	199 F alias 3 F	Dharwar	.....	1910	The cotton which went under this name on the Agricultural Farm was reported as having done better than others during its three years' tests but it did badly when sent out to <i>zamindars</i> .
5	270 F alias 4 F	Narma	.....	1910	This is 4 F.
6	26	...	<i>G. neglectum</i> (Malor Kotla cotton).	1910	This cotton was sent to the Agricultural Department from Malor Kotla State with a good name. It never did well in the Botanical Section but it was felt that the name it came with was such that it must be tried on field scale before throwing it out, and this was done.

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Statement of cottons handed over to the Professor of Agriculture for testing on a field scale—concluded.

Serial No.	Variety No.	CLASS.		Year of handing over.	REMARKS.
		American.	Deshi.		
7	161 F	Dharwar .	.....	1911	Spinners were emphatic that this cotton would solve the question of long staple cotton growing in the Empire and there was a special request for it. It had a very low <i>kan</i> , however, and was not among my high yielding cottons but we felt we could not condemn it without a trial on a field scale so it was sent to the Professor of Agriculture.
8	126 F	Dharwar .	.....	1911	Stopped growing for want of space on the farm.
9	...		<i>G. sanguineum</i> (var. <i>major</i>).	1911	Now growing on a large area outside the Agricultural Department.
10	168 F	Dharwar .	.....	1912	Never did well in the Botanical Section but were particularly early and were given over at the request of Deputy Director of Agriculture, Professor of Agriculture, and Imperial Cotton Specialist, in order to test a point connected with earliness.
11	179 F	Dharwar .	.....	1912	
12	226 F	Narma .	.....	1913	Discarded in 1915-16. It did not promise to beat others already handed over.
13	280 F	Dharwar .	.....	1913	Still growing on the farm. Much better lint than 4 F
14	275 F	Narma .	.....	1913	Still growing on the farm.
15	199 F	Dharwar .	.....	1913	The Professor of Agriculture reports it as late; no particular quality; discarded for want of space.
16	87	...	<i>G. neglectum</i> (var. <i>roseum</i>).	1914	Still being tested on the Agricultural farm, Nos. 87, 24 and 109 seem most promising.
17	20 A	...	<i>G. sanguineum</i> (var. <i>major</i>).	1914	
18	24	...	<i>G. indicum</i> (var. <i>mollisoni</i>)	1914	
19	135 A	...	<i>G. indicum</i> type	1914	
20	109	...	<i>G. neglectum</i> type	1916	

NOTE.—One type of *G. sanguineum* (var. *major*) was given unofficially to the Manager, Lyallpur Agricultural Station, on his request in 1909. This was given as the original "Farm selected", had degenerated and was a very bad mixture. This cotton unofficially handed over is sometimes wrongly referred to in reports as "Farm selected."

Statement showing cotton varieties handed over to the Deputy Director of Agriculture, Hansi, for trial on a field scale.

Serial No.	Variety No.	CLASS.		Year of handing over.	REMARKS.
		American.	Deshi.		
1	135 A	...	<i>G. indicum</i> type	1914	All still being tested on the farm of the above officer.
2	24	...	<i>G. indicum</i> (var. <i>mollisoni</i>).	1914	
3	87	...	<i>G. neglectum</i> (var. <i>roseum</i>).	1914	
4	20 A	...	<i>G. sanguineum</i> (var. <i>major</i>).	1914	
5	132	...	<i>G. neglectum</i> (var. <i>roseum</i>).	1916	
6	161 A F	Dharwar .		1916	
7	275 F	Narma .		1916	
8	280 F	Dharwar .		1916	

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[Continued.]

Statement showing cotton varieties handed over to the Deputy Director of Agriculture, Gurdaspur, for trial on field scale.

Serial No.	Variety No.	CLASS.		Year of handing over.	REMARKS.
		American.	Deshi.		
1	40	...	<i>G. neglectum</i> (var. <i>roseum</i>).	1916	All being tested still.
2	280 F	Dharwar .	.....	1917	
3	38	...	<i>G. indicum</i> type	1917	
4	87	...	<i>G. neglectum</i> (var. <i>Roseum</i>).	1917	

The above list contains all the selections which the Professor of Agriculture has been able to test for me but the rate of taking over has been inadequate to allow my work to go on freely.

1090. *Removal of the half acre limit.*—Last year, the Director of Agriculture very kindly removed the half acre plot limit under which I had worked and gave me a square more land of which eight acres are annually available for cotton testing work. This is a concession for which I am very grateful but the total area of eighteen acres now at my command annually for cotton growing is still far from sufficient to allow my work to go on satisfactorily. I have several hundreds of cottons some of which have been ready and awaiting testing on a larger scale for years and a much greater area of land for testing work is required.

1091. *A greater field open for improvement of outturns of cotton by improving the cultivation than by selecting and crossing.*—I have not compared the profits to farmers from cotton growing as compared with those from growing other crops nor have I dealt with the effects of cultivation on cottons as I expect that these points will be fully dealt with by the Agricultural officers here. I may mention, however, that my earliest experiments showed me that there is a far greater field for improvement of the outturn of cottons per acre by improvement of cultivation than there is by selection or crossing. These experiments also showed me that unless my type tests were conducted with the utmost care and the comparisons were made with the utmost severity, the effects of differences in cultivation, soil, etc., would quite obscure differences in inherent cropping powers.

ANNEXURE I.

List of comparatively recently introduced cottons under trial in the botanical area.

Year imported.	Name of cotton.	Place from which imported.	REMARKS.
1909	{ Kings cotton . . . Mortgage lifter . . . McCall cotton . . . Pride of Georgia . . .	{ Department of Agriculture, United States of America.	Doing well so far
1917	{ Triumph . . . Columbia . . .	{ Deputy Director of Agriculture, Sind.	Not doing very well at present.
1917	{ Lone Star . . . Dodds prolific . . . Express . . . Trio . . . Wannamaker Cleveland Cleveland 027-11-24 . . . Sea Island cotton . . .	{ United States of America.	Received late this year. Will be sown next season.

A number of other cottons have been asked for and are expected soon.

Part II.

1092. *Defective organisation.*—The organisation under which we have worked has been most unsatisfactory, and the best progress in cotton work will not be made until that is altered.

1093. *Future work on cottons in the Province.*—I think that the programme of work outlined in paragraphs 1058 and 1059 of this note should be continued. The differences in characters of economic value both among the American and the Indian cottons indicate that there is still much useful work to be done among these. The results of our tests indicate that we already have much more profitable cottons than those now grown by cultivators. We are accumulating information and experience from our district cotton surveys and from our experimental lands which should help us to quicker and more accurate decisions as to what types will or will not succeed here, and numerous problems are coming to light, for example, the effect of the water-supply and the characters of the soil on the lint (see paragraph 1071). This is most important in connexion with the possibilities of growing a staple of cotton fit for mills which use middling American or better lints. Investigations on this point should, I think, be carried out with all speed. From these investigations we hope to discover, among other things, the minimum amount of water that the soil must contain at different periods of the season in order to produce a fair crop of good lint, at what intervals waterings are required to maintain that amount of moisture, etc. With this knowledge we will be much better able to say whether and, if so, where systems of irrigation and cultivation could be improved, how far farmers of the lighter soils should be recommended to grow short or long-staple cotton or other crops in place of cotton, etc.

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(2) Meantime it is interesting to note that the little information to my hand indicates that long-stapled cottons in America come from lands which have naturally damp subsoils, while the shorter rougher varieties come from the drier uplands; also that Mr. W. L. Balls, formerly Botanist to the Khedivial Agricultural Society, Egypt, in his book "The development and properties of raw cotton," which has been read by me during the past few weeks, comes to the conclusion that length or strength of lint is degraded by water shortage. Our 4 F. selection is a comparatively short-linted cotton (about 0.9 inch), and since the unsatisfactory effects of growing American cotton on the sandy strip of land in my area attracted my attention some years ago, I have often wondered how far the longer-linted cottons which I have on hand will be grown with success by ordinary *zamindars*. Trials of these on various classes of lands and under various conditions of cultivation and irrigation are urgently necessary.

1094. *Zamindars should be warned as to what happens when cottons are grown on sandy lands, and such areas should be marked.*—Even with the experiences which I have already had, it seems to me essential that the larger areas of sandy lands should be marked out at once as unsuitable for growing long-stapled cotton of good quality, and that all farmers should be warned to look out for any such areas on their farms. It should be noted that the roots of cottons have been followed down to about nine feet, and that although a soil may be sandy on the surface it may be of excellent loam or stiff clay well within the feeding area of the cotton roots and so, when regularly watered, may produce excellent cotton. Again a soil may be stiff clay for a foot or so on the surface and may be so excessively open and drained below that depth that it will hold practically no water at all. There are probably some areas of considerable size in the province which could be marked off as unsuitable at once, but there will be smaller streaks like the one in my own lands which must also be ruled out if a uniform staple is to be got, and to begin with, at least, it seems to me that the most practical thing to do is to warn *zamindars* of what happens to American cottons on such lands and try to persuade them either not to grow them on these, or to keep the *kapas* separate if they do so. Maps showing such areas and streaks would be of use to the Agricultural Department and others interested in the cotton trade.

1095. *Need for a special officer on each important crop in the Province.*—Every person I meet considers himself quite fit to select and test crop varieties, and there is a general feeling that even the most uninitiated has a gambler's chance of hitting on something which will make a name for himself and therefore many people are anxious to try their hands at it. An absolute novice may, however, collect more selections or make more crosses in a single afternoon than could be properly tested in ten years. I personally had not gone very far with my crop improvement work before I discovered that it was absolutely necessary to put men to work exclusively on each important crop if real progress was to be made and we were to avoid the waste of large amounts of money and time. Experience of ten years has only confirmed this view.

(2) I feel that the time will soon come when there will be an officer with a properly equipped staff and other facilities here, whose special duties will be the improvement of cottons in the province, and that his duties will include all those from selection and crossing work to distribution of seed and marketing of the crop. He would have to have the qualifications of an Economic Botanist coupled with an agricultural training. There will also be a similar provision, I think, for each important crop. Such an arrangement would get clear away from dual control with all its evils and would give the province the full benefit of any special knowledge acquired, while the great driving forces of ambition and self-interest would all be directed to helping on the work. As crops like cotton and wheat are grown at different times of the year, several of these officers could work on the same farm. For co-ordination of the work they should be placed under an officer whose title might be "Chief of the bureau of plant industry." The members of the agricultural section would have their own special work of improving implements, methods of cultivation, distribution and conservation of water, manurial and rotational experiments, dairying work, etc., etc.

1096. *Suggestions for arrangements as to land and field staff which might be made now.*—If the special staff and facilities above mentioned cannot be arranged for at present, I would suggest that the Economic Botanist be allowed to test his types to a finish himself. This would avoid much of our difficulties. He would require a farm of about 300 acres for this purpose. There is a certain proportion of the agricultural farm at Lyallpur at present reserved for testing the Economic Botanist's cottons and wheats, and this might be handed over to the Economic Botanist for that work. Further additions of land might be given him as early as possible. Practically all the time I have been in the Punjab, I have only had one assistant to help me with my work on cottons, one for my work on wheats and one to be my farm manager, my store-keeper and to attend to all my experiments on other crops. It has therefore been impossible for me to investigate many points which my work has brought to view simply on account of want of staff. A Research Assistant whose special work would be on cottons is urgently required. His qualifications like those of all men on research work should be the highest possible. Other staff necessary for the farm would also be required.

1097. *The Economic Botanist to test his types on zamindars' lands when necessary.*—It seems to me important that the Economic Botanist—who after all is the man who suffers or gains by the behaviour of a variety when it gets out to growers—should have permission to test his varieties on *zamindars'* lands when he finds that helpful to the work. This concession would have many advantages. For example, had I had a few acres of my longest linted cottons on selected *zamindars'* lands during the past year or two, I could have made more definite statements now on the possibilities of growing good even lint of long-stapled cotton in the Punjab. Again if there is insufficient room on the botanical section lands to test all the varieties ready, this concession would prevent blocking of the progress of the work from want of land. Some such arrangement could be made with *zamindars* as that which I have worked with satisfaction to all concerned in the case of the introduction of Scotch potatoes in the Simla hills. When I started that case, I promised that if my crop did not yield as much money per acre as the local crop on the same lands, I would make up the difference to the growers, while if it yielded more money I would allow them to keep the difference. I reserved the right to buy back the produce if desired at market rates. For cotton work a small budget allowance could be set aside to meet any expenses which might turn up. *Zamindars* are more than ready to accept these terms, and as my areas would be small and, for my own sake, I am not likely to try varieties which do not give promise of being at least better than the local varieties, unless I have a special object in view there is little chance of these experiments costing Government much money. If my tests showed that a variety is unsuitable, I could buy the crop back at market rates and sell it again where the seed will be used for commercial instead of reproductive purposes. *Zamindars* are, however, very keen to grow types of cotton which will yield them the largest profit obtainable, and they would be only too glad to drop from cultivating any type which does not do so. On the other hand, as soon as any type does show itself better than others available nothing would so well pave the way for the distribution of its seed by the department.

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1098. *Suggestions regarding office work.*—For a number of years back the offices of the Economic Botanist, Agricultural Chemist and Professor of Agriculture, although not of the Agricultural Engineer, have been combined in a central office, charge of which is held by the Principal of the Agricultural College, who until lately was also Agricultural Chemist. The place is understaffed, but there is also the difficulty that, except in the case of the Principal of the Agricultural College, we have to get work done by people we have no power over. The Professor of Agriculture having a clerk at the farm was not altogether destitute of clerical help but, having no clerk at all, I have found the system very uneconomic. I have to do a good deal of drafting simple letters, collecting data for cases from the files, etc., etc., which my clerks, when I had them, did for me, and saved my time for more important work. When urgent cases turn up, one cannot usually get a clerk at once to help one without great inconvenience to the central office, and in such cases I simply have to do the work myself. The system has been most unsatisfactory in other ways. I think the accounts work might be done in the central office, but it would help me greatly if I had a typist and another clerk to keep my records, collect data from cases and do general office work for me.

1099. *Distribution of cotton seed.*—In a crop like cotton which is liable to cross fertilisation it is necessary that a steady supply of pure seeds of good varieties be maintained for *zamindars*. The system which I would suggest for cottons, where the growing and marketing of the crop cannot be supervised, is that a grower should be supplied annually with an amount of seed which, when multiplied, would yield him sufficient seed to sow the whole cotton crop on his farm in the third year. As cottons under poor cultivation multiply at the rate of over twenty fold, one acre of cotton crop would provide seed for twenty acres next season and for 400 acres the year after. When the system had been working three years, a grower would have one acre sown with fresh seed, twenty acres or more sown with seed got in the previous year, 400 acres or more sown with seed got two years previously and so on.

(2) Some advantages of this system are—

- (1) That pure seed of a good variety could be distributed over a large area with great rapidity.
- (2) If the type should prove not very suitable for particular conditions, a grower would have experience of the crop before it occupied a large area of his farm.
- (3) The seed will be off the farm before it gets very much crossed.

The above system is one with the working of which I was intimately acquainted during my youth in connection with the renewal of seed of other crops. It gave very satisfactory results.

(3) Where the growing and marketing of the cotton crop can be looked after officially, it would be better to grow an improved variety in compact blocks. In the case also of a *zamindar* who will give a variety the required attention and would sell seed of his crop to others around him at reasonable rates, larger quantities might be supplied. Other exceptional cases might occur.

1100. *Closer connection with zamindars helpful to the Economic Botanist.*—At present, the agricultural and botanical sections are sharing crop work, and as the Economic Botanist is responsible for evolving types suitable for the province and the trade it is necessary that he be intimately connected with meetings of *zamindars* and people interested in these in order to keep himself in touch with what is wanted and to explain or show what he has coming forward. I think there has been a tendency in the past to keep the agricultural and botanical sections too separate in such cases.

1101. *At present no incentive to growers and middlemen to diminish the practice of mixing of cottons.*—*Zamindars* cannot be easily prevented by law from growing American or any other cottons they wish on sandy lands, neither can they be easily prevented by similar means from mixing short irregular American fibre with American lint of better quality if they choose to do so. If the quality of cotton exported from the Punjab is to be the best possible, it seems essential that growers shall receive a sufficiently higher price for superior quality of cottons to make it worth their while to keep their best separate and to strive after placing still better cottons on the market. In the past, it has never repaid the grower to grade his cottons carefully and keep the grades separate for the open market. This is partly because spinners do not know what amounts of different grades of cottons could be had here if it was made worth the while of *zamindars* to keep them separate. Consequently, spinners cannot offer middlemen maximum prices for better grades nor can middlemen offer such terms to *zamindars*. It is also partly because, if small consignments of superior cotton are sold to different dealers, they are too small to make consignments of sufficient importance to be kept separate—consequently the dealers simply have to mix them with what they have on hand. At present, therefore, a *zamindar* who brings to the market a small consignment of cotton cleaner and more true to type than his neighbour gets practically the same price for it as for the ordinary *kapas*, so it repays him to increase his weight of produce by mixing with it as much inferior *kapas* and dirt as will still allow him to procure the market price per maund. Other farmers seeing that that amount of mixture procured the market price make sure that they do not lose anything by sending too pure a consignment to market. Buyers protect themselves by lowering the prices and so the quality and price come down. Middlemen know that cottons from a certain district with a certain amount of waste and mixture in them are selling in the world's markets at a certain figure, and it is to their disadvantage not to lose money by sending off consignments too pure. For *zamindars* and middlemen who wish to make money rapidly the incentives are therefore to lower instead of to raise the standard of quality.

1102. *Mixing and adulterating cottons causes loss to spinners, growers and the nation.*—On the other hand, when a spinner buys cotton, he does so with an eye on the amount in it of blowroom waste, the counts it will spin, the breaking strain of its yarn, etc., and he is more than willing to pay a higher price for cotton containing less waste and with a more even quantity of fibre as (a) cleaning is an expensive process, (b) the more the fibre is cleaned, the weaker the yarn from it becomes and (c) the evenner the fibres are in length and strength, the more economically he can use it. Mixing of dirt with cottons or different types and qualities of cottons is obviously, therefore, a great national loss, *zamindars* ultimately being the chief losers. Anything that can be done to avoid this loss would be worth striving for.

1103. *A spinner's or cotton specialist's farm for cotton growing.*—To stimulate farmers to grow improved cottons on any parts of their lands where that can be done and get good prices for the produce, I proposed to Mr. Pearce, Secretary to the International Federation of Master Spinners and Weavers, when he met me here in 1913, that some large concern interested in spinning, like the British Cotton Growing Association, should take up and farm an area of land in the Punjab sufficient to enable it to have good consignments of its own for sending home, and to which any *zamindar* could add his small lot with profit to everybody concerned. Mr. Pearce approved of the idea, and said he would like his own Federation to take the land up. After consulting the Professor of Agriculture, the Director of Agriculture, and his own committee,

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he entered into negotiations with the Punjab Government to lease 10,000 acres of land in Montgomery District. Unfortunately the scheme did not come to fruition.

(2) My opinion was that a large spinning concern, growing cotton in our midst, would be the greatest help to zamindars as it would be to its interest to encourage the growing of better class of cottons. Being spinners, the concern would be in a position to give to growers the very highest possible prices for good cottons without loss to its members as no middleman's profits would have to be deducted. If, however, Government wants to take a really effective hand in improving the cottons of the province, the land should be farmed, I think, by the Cotton Specialist of the Agricultural Department. Small quantities of good *kapas* grown by zamindars could then be added to the specialist's lots just as would be the case if spinners farmed the lands. The lots could be sent direct to spinners. At any rate, the specialist should farm a large area of land so as to be able to issue substantial amounts of seeds to zamindars annually and to carry on cotton improvement work properly in all its phases. All means by which growers and spinners may be brought more closely in contact should be carefully sought after.

1104. *The Agricultural Department to keep spinners informed as to the amounts and grades of cottons available.*—I think it would be helpful if the Agricultural Department could keep spinners well informed as to the probable amounts and grades of cotton that could be had here if they were kept separate. The annual returns of the area and purity of American and *deshi* cottons—kindly started for us at my request the year before last by the Canal Department—should be helpful as regards information on American cottons as nearly all the American cottons are grown on canal irrigated lands. The form being filled up for us is headed as follows:—

Area in kanals containing 5 per cent. <i>deshi</i> plants or less.	Area in kanals containing 6-10 per cent. <i>deshi</i> plants.	Area in kanals containing 16-25 per cent. <i>deshi</i> plants.	Area in kanals containing 26 to 35 per cent. <i>deshi</i> plants.	Area in kanals containing 36 to 50 per cent. <i>deshi</i> plants.	Area in kanals containing over 50 per cent. <i>deshi</i> plants.

NOTE.—One kanal=one-eighth acre.

(2) Samples of lint might also be sent to the principal cotton buying bodies. It would be for spinners to decide whether they want these grades; and, if so, to see that zamindars get such offers for them as will repay them to sell these separately. If zamindari banks would combine, distribute seeds amongst their members, arrange their own ginning and send good grade consignments of cotton direct to spinners, so much the better. Meetings of representatives of spinners and growers would, I think, result in showing up just what methods of dealing are practicable and advantageous to both parties.

1105. *Suggestion for spinners to buy cottons on certificates granted by a recognised testing house.*—It seems to me that if spinners could buy their cottons on a certificate showing blowroom waste, spinning counts, breaking strain of yarn and other characters of value on standard set machinery they would be in a position to offer the maximum price to growers for their cottons with safety to themselves. In such a case, sellers of dirty, mixed, or adulterated cottons would receive a correspondingly poor price for their wares, and as wilful mixing and adulteration would no longer be a paying business to those who practise these, they would soon cease. Huge sums of money would thus be saved which are now spent in cleaning needlessly dirty or mixed cottons. The natural incentives would then be in the direction of obtaining strains pure and of as good quality as possible and the nation would receive the benefit of these. Legislation to enforce the production of certificates showing analysis of the above nature would be required before this method of purchase by spinners would come into practice. These certificates would have to be granted by a recognised and properly equipped testing house.

(2) Local buyers being on the spot could protect themselves without such certificates, and they seem most necessary in the case of the spinners. The ginner, I think, should have to produce these as he could be responsible for what goes into his bales. A 100 lbs. sample would be required for a test on which to grant the certificate. Ordinary spinning mill machinery which would deal with the fibre up to and including spinning would be necessary. About six samples could be dealt with, I understand, per day on such a set of machinery. There are about 140 ginneries annually working in the Punjab, and, if each factory sent one sample, it would therefore take about 24 days to deal with them all, while four sets of such machines could deal with a sample from each ginnery per week. As one set of opening and cleaning machinery could deal with about 1,200 lbs. of cotton per day, fewer of these particular machines would be necessary in such a case. The testing work would only extend over a few months of the year, therefore it might be economic to run the testing house as a small spinning mill for the remainder of the year or have it run in connection with a technical institute. The cost of the machinery and of working it would not be a fraction of the amount of money gained by such a system of testing. The house might either be organised and run by those interested in the cotton trade or by Government. The certificate granted from this house could also state the amount of moisture, salt, etc., in the samples thus overcoming difficulties with regard to these matters at the same time.

1106. *Legislation regarding branding of bales.*—I should also like it to be made law that all bales of cotton should bear the name and address of the ginner and of the ginnery in which the cotton is ginned, fraudulent marking being penalised. This in itself would, I think, do much to stop cotton from one part of India being sold as cotton from another.

(2) The names on the bales would become a sort of trade mark bearing a certain value in the market, and those dealers who mix their cottons would soon become known and marked. They would be offered less by spinners for their wares, and would therefore be unable to offer growers as good prices for their cotton as honest dealers. Consequently they would have either to discontinue their practices or leave the market. The markings on the bales should be done in such a way that they cannot be transferred from one bale to another. At present private marking done on the cloth enveloping the bale is sometimes transferred by removing the piece of cloth bearing the mark and sewing it on to another bale.

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[Continued.]

ANNEXURE.
METEOROLOGICAL DATA FOR TEN SELECTED STATIONS IN THE PUNJAB.
Average rainfall recorded at ten Meteorological stations in the Punjab.

STATION.	JANUARY.			FEBRUARY.			MARCH.			APRIL.			MAY.			JUNE.		JULY.			AUGUST.			SEPTEMBER.			OCTOBER.			NOVEMBER.			DECEMBER.			TOTAL.		
	Number of rainy days.	Rainfall in inches.	Elevation above sea level, in feet.	Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.		Number of rainy days.	Rainfall in inches.									
Delhi	2-40	1-23	718	1-40	0-71		1-40	0-71		0-21	0-90		2-20	0-72		3-41	3-20		5-20	8-48		0-20	8-52		4-10	3-61		0-60	0-11		1-10	0-53		37-10	28-09			
Sirsa	1-50	0-84	682	1-40	0-33		1-40	0-33		0-26	0-60		1-60	0-71		4-10	3-10		5-00	8-14		4-30	8-37		3-30	3-74		0-40	0-11		0-80	0-41		23-40	14-43			
Ambala	2-80	1-62	892	2-30	1-40		2-30	1-40		0-31	0-90		1-70	0-73		6-29	3-20		9-80	7-65		7-90	8-93		3-60	4-24		0-50	0-03		0-20	0-78		32-70	32-96			
Ludhiana	2-40	1-84	812	2-40	1-30		2-40	1-30		0-71	0-90		1-70	0-61		3-50	3-02		7-60	9-27		5-20	6-35		3-30	3-61		0-50	0-33		0-20	0-66		32-70	28-67			
Lahore	1-30	1-12	702	1-10	1-70		1-10	1-70		0-65	1-00		1-50	0-82		2-09	3-08		3-30	5-96		5-20	5-30		3-30	3-99		0-40	0-20		0-80	0-38		22-90	20-10			
Shakot	8-30	3-40	2-51	3-50	1-80		2-90	1-14		1-90	0-82		2-30	1-03		3-60	3-08		9-00	8-01		8-40	9-69		3-30	3-83		1-00	0-25		0-30	0-09		1-10	0-52		40-70	31-75
Rawalpindi	1-674	4-20	2-74	4-40	2-24		4-20	1-89		3-20	1-70		3-00	1-47		3-20	2-01		9-10	8-53		8-00	8-70		4-20	3-23		1-30	0-44		0-80	0-29		1-60	0-74		47-30	33-98
Khushab	812	1-50	0-82	1-80	0-69		1-70	1-13		1-50	0-62		1-20	0-78		1-50	1-72		3-50	4-52		2-80	2-73		1-60	0-54		0-20	0-01		0-80	0-42		18-00	14-12			
Montgomery	558	1-30	0-84	1-30	0-67		1-20	0-85		0-70	0-13		1-00	0-27		2-00	1-14		3-20	4-22		2-30	2-99		1-30	0-87		0-10	0-03		0-20	0-06		0-60	0-42		16-10	10-25
Multan	420	1-10	0-45	1-20	0-43		1-20	0-39		0-70	0-10		0-80	0-30		1-10	0-62		2-50	2-41		2-30	2-02		0-70	0-32		0-10	0-07		0-10	0-19		12-40	7-30			

Average humidities recorded at ten Meteorological stations in the Punjab.

STATION.	JANUARY.			FEBRUARY.			MARCH.			APRIL.			MAY.			JUNE.			JULY.			AUGUST.			SEPTEMBER.			OCTOBER.			NOVEMBER.			DECEMBER.		
	Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.	Elevation above sea level, in feet.	Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.		Mean vapour tension at 8 A.M. in inches of mercury.	Cloud amount, 8 A.M.							
Delhi	259	3.6	718	282	3.7	288	323	3.0	366	373	2.0	388	400	2.4	56	722	5.0	75	870	6.3	861	6.7	69	745	3.2	50	422	0.8	59	287	1.4	61	250	2.4		
Sirsa	251	4.2	662	288	3.4	284	354	3.2	399	391	2.9	401	490	2.9	51	710	4.5	75	857	5.9	855	4.7	64	723	3.2	50	400	0.7	59	288	1.8	69	237	3.0		
Ambala	251	4.2	892	304	3.4	303	387	3.0	475	430	2.9	506	506	1.2	67	729	3.0	86	937	5.7	88	941	5.5	82	754	2.7	70	510	0.5	75	355	1.1	82	277	2.4	
Ludhiana	251	4.5	812	324	3.5	324	403	3.5	431	419	2.8	451	515	1.9	56	736	3.3	76	893	6.4	79	802	6.3	75	754	3.1	61	458	1.0	64	310	1.1	76	260	3.8	
Lahore	255	4.0	702	295	3.6	295	374	3.4	419	419	2.3	411	501	1.8	52	693	2.8	71	877	4.3	75	880	3.8	67	734	1.4	57	433	0.5	67	313	1.5	78	252	2.9	
Shakot	269	3.4	788	307	3.2	307	383	2.8	436	436	2.1	441	518	1.5	52	699	2.0	74	885	3.9	79	802	4.2	72	740	2.0	59	434	0.7	65	304	1.5	74	247	2.6	
Khawab	230	4.7	820	263	4.3	263	339	4.1	462	462	3.1	442	472	2.1	50	620	2.8	72	808	4.2	80	839	4.0	72	665	1.9	62	391	1.0	63	258	2.1	74	210	3.6	
Montgomery	246	3.8	689	275	3.7	275	358	3.2	402	402	2.4	382	442	1.1	43	594	1.8	65	847	2.7	69	839	2.8	69	679	1.1	45	351	0.3	43	226	1.3	60	199	2.7	
Multan	244	3.2	430	304	3.5	304	327	2.8	413	413	2.2	366	476	1.5	60	667	1.5	60	838	2.9	83	831	2.6	59	702	1.2	46	405	0.6	46	386	1.8	65	280	2.5	
	259	3.6	718	282	3.7	288	323	3.0	366	373	2.0	388	400	2.4	56	722	5.0	75	870	6.3	861	6.7	69	745	3.2	50	422	0.8	59	287	1.4	61	250	2.4		
	251	4.2	662	288	3.4	284	354	3.2	399	391	2.9	401	490	2.9	51	710	4.5	75	857	5.9	855	4.7	64	723	3.2	50	400	0.7	59	288	1.8	69	237	3.0		
	251	4.2	892	304	3.4	303	387	3.0	475	430	2.9	506	506	1.2	67	729	3.0	86	937	5.7	88	941	5.5	82	754	2.7	70	510	0.5	75	355	1.1	82	277	2.4	
	255	4.0	702	295	3.6	295	374	3.4	419	419	2.3	411	501	1.8	52	693	2.8	71	877	4.3	75	880	3.8	67	734	1.4	57	433	0.5	67	313	1.5	76	260	3.8	
	269	3.4	788	307	3.2	307	383	2.8	436	436	2.1	441	518	1.5	52	699	2.0	74	885	3.9	79	802	4.2	72	740	2.0	59	434	0.7	65	304	1.5	74	247	2.6	
	230	4.7	820	263	4.3	263	339	4.1	462	462	3.1	442	472	2.1	50	620	2.8	72	808	4.2	80	839	4.0	72	665	1.9	62	391	1.0	63	258	2.1	74	210	3.6	
	246	3.8	689	275	3.7	275	358	3.2	402	402	2.4	382	442	1.1	43	594	1.8	65	847	2.7	69	839	2.8	69	679	1.1	45	351	0.3	43	226	1.3	60	199	2.7	
	244	3.2	430	304	3.5	304	327	2.8	413	413	2.2	366	476	1.5	60	667	1.5	60	838	2.9	83	831	2.6	59	702	1.2	46	405	0.6	46	386	1.8	65	280	2.5	
	259	3.6	718	282	3.7	288	323	3.0	366	373	2.0	388	400	2.4	56	722	5.0	75	870	6.3	861	6.7	69	745	3.2	50	422	0.8	59	287	1.4	61	250	2.4		
	251	4.2	662	288	3.4	284	354	3.2	399	391	2.9	401	490	2.9	51	710	4.5	75	857	5.9	855	4.7	64	723	3.2	50	400	0.7	59	288	1.8	69	237	3.0		
	251	4.2	892	304	3.4	303	387	3.0	475	430	2.9	506	506	1.2	67	729	3.0	86	937	5.7	88	941	5.5	82	754	2.7	70	510	0.5	75	355	1.1	82	277	2.4	
	255	4.0	702	295	3.6	295	374	3.4	419	419	2.3	411	501	1.8	52	693	2.8	71	877	4.3	75	880	3.8	67	734	1.4	57	433	0.5	67	313	1.5	76	260	3.8	
	269	3.4	788	307	3.2	307	383	2.8	436	436	2.1	441	518	1.5	52	699	2.0	74	885	3.9	79	802	4.2	72	740	2.0	59	434	0.7	65	304	1.5	74	247	2.6	
	230	4.7	820	263	4.3	263	339	4.1	462	462	3.1	442	472	2.1	50	620	2.8	72	808	4.2	80	839	4.0	72	665	1.9	62	391	1.0	63	258	2.1	74	210	3.6	
	246	3.8	689	275	3.7	275	358	3.2	402	402	2.4	382	442	1.1	43	594	1.8	65	847	2.7	69	839	2.8	69	679	1.1	45	351	0.3	43	226	1.3	60	199	2.7	
	244	3.2	430	304	3.5	304	327	2.8	413	413	2.2	366	476	1.5	60	667	1.5	60	838	2.9	83	831	2.6	59	702	1.2	46	405	0.6	46	386	1.8	65	280	2.5	
	259	3.6	718	282	3.7	288	323	3.0	366	373	2.0	388	400	2.4	56	722	5.0	75	870	6.3	861	6.7	69	745	3.2	50	422	0.8	59	287	1.4	61	250	2.4		
	251	4.2	662	288	3.4	284	354	3.2	399	391	2.9	401	490	2.9	51	710	4.5	75	857	5.9	855	4.7	64	723	3.2	50	400	0.7	59	288	1.8	69	237	3.0		
	251	4.2	892	304	3.4	303	387	3.0	475	430	2.9	506	506	1.2	67	729	3.0	86	937	5.7	88	941	5.5	82	754	2.7	70	510	0.5	75	355	1.1	82	277	2.4	
	255	4.0	702	295	3.6	295	374	3.4	419	419	2.3	411	501	1.8	52	693	2.8	71	877	4.3	75	880	3.8	67	734	1.4	57	433	0.5	67	313	1.5	76	260	3.8	
	269	3.4	788	307	3.2	307	383	2.8	436	436	2.1	441	518	1.5	52	699	2.0	74	885	3.9	79	802	4.2	72	740	2.0	59	434	0.7	65	304	1.5	74	247	2.6	
	230	4.7	820	263	4.3	263	339	4.1	462	462	3.1	442	472	2.1	50	620	2.8	72	808	4.2	80	839	4.0	72	665	1.9	62	391	1.0	63	258	2.1	74	210	3.6	
	246	3.8	689	275	3.7	275	358	3.2	402	402	2.4	382	442	1.1	43	594	1.8	65	847	2.7	69	839	2.8	69	679	1.1	45	351	0.3	43	226	1.3	60	199	2.7	
	244	3.2	430	304	3.5	304	327	2.8	413	413	2.2	366	476	1.5	60	667	1.5	60	838	2.9	83	831	2.6	59	702	1.2	46	405	0.6	46	386	1.8	65	280	2.5	
	259	3.6	718	282	3.7	288	323	3.0	366	373	2.0	388	400	2.4	56	722	5.0	75	870	6.3	861	6.7	69	745	3.2	50	422	0.8	59	287	1.4	61	250	2.4		
	251	4.2	662	288	3.4	284	354	3.2	399	391	2.9	401	490	2.9	51	710	4.5	75	857	5.9	855	4.7	64	723	3.2	50	400	0.7	59	288	1.8	69	237	3.0		
	251	4.2	892	304	3.4	303	387	3.0	475	430	2.9	506	506	1.2	67	729	3.0	86	937	5.7	88	941	5.5	82	754	2.7	70	510	0.5	75	355	1.1	82	277	2.4	
	255	4.0	702	295	3.6	295	374	3.4	419	419	2.3	411	501	1.8	52	693	2.8	71	877	4.3	75	880	3.8	67	734	1.4	57	433	0.5	67	313	1.5	76	260	3.8	
	269	3.4	788	307	3.2	307	383	2.8	436	436	2.1	441	518	1.5	52	699	2.0	74	885	3.9	79	802	4.2	72	740	2.0	59	434	0.7	65	304	1.5	74	247	2.6	
	230	4.7	820	263	4.3	263	339	4.1	462	462	3.1	442	472	2.1	50	620	2.8	72	808	4.2	80	839	4.0	72	665	1.9	62	391	1.0	63	258	2.1	74	210	3.6	
	246	3.8	689	275	3.7	275	358	3.2	402	402	2.4	382	442	1.1	43	594	1.8	65	847	2.7	69	839	2.8	69	679	1.1	45	351	0.3	43	226	1.3	60	199	2.7	
	244	3.2	430	304	3.5	304	327	2.8	413	413	2.2	366	476	1.5	60	667	1.5	60	838	2.9	83	831	2.6	59	702	1.2	46	405	0.6	46	386	1.8	65	280	2.5	
	259	3.6	718	282	3.7	288	323	3.0	366	373	2.0	388	400	2.4	56	722	5.0	75	870	6.3	861	6.7	69	745	3.2	50	422	0.8	59	287	1.4	61	250	2.4		
	251	4.2	662	288	3.4	284	354	3.2	399	391	2.9	401	490	2.9																						

Punjab.]

Mr. D. MILNE, B.Sc.

[Continued.]

Average winds recorded at ten Meteorological stations in the Punjab.

STATION.	Elevation above sea level, in feet.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.		REMARKS.
		Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	Mean velocity, miles per hour.	General direction.	
Delhi	718	2.9	S. 87 W.	3.5	N. 86 W.	3.9	N. 87 W.	3.9	N. 77 W.	4.4	S. 73 W.	4.9	S. 44 E.	4.2	S. 22 E.	3.9	S. 27 W.	3.5	S. 85 W.	2.3	N. 83 W.	2.1	N. 89 W.	2.5	N. 87 W.	These places are subject to desolative winds as high as 60 miles or more per hour during dust-storms in the hot season. During the monsoon, and the cold season, winds are only light to moderate. The cold weather storms usually give high winds only in the hills to the north.
Sirsa	662	3.4	N. 36 W.	4.1	N. 39 W.	4.7	N. 24 W.	5.4	N. 28 W.	6.2	S. 39 W.	7.1	S. 27 W.	5.5	S. 16 W.	6.3	S. 42 W.	4.9	S. 59 W.	3.4	S. 31 W.	2.7	S. 18 W.	2.8	N. 84 W.	
Ambala	892	1.9	N. 48 W.	2.3	N. 37 W.	2.2	N. 37 W.	3.1	N. 27 W.	3.1	S. 39 E.	2.5	S. 61 E.	7.1	S. 16 W.	6.3	S. 42 W.	4.9	S. 59 W.	1.1	N. 10 W.	1.4	N. 34 W.	1.5	N. 44 W.	
Ludhiana	812	1.7	N. 68 W.	1.9	N. 52 W.	2.2	N. 31 W.	2.6	N. 27 E.	2.6	S. 44 E.	2.8	S. 60 E.	5.4	S. 34 E.	6.3	S. 23 E.	2.3	S. 20 E.	1.1	S. 55 E.	1.0	S. 27 W.	1.3	N. 47 W.	
Lahore	702	1.7	N. 68 W.	2.2	N. 52 W.	2.9	N. 0 W.	3.2	N. 26 E.	3.1	N. 42 E.	2.6	S. 60 E.	5.4	S. 34 E.	6.3	S. 23 E.	2.3	S. 24 E.	1.6	S. 83 E.	1.3	S. 27 W.	1.3	N. 47 W.	
Sialkot	830	1.8	N. 49 E.	1.8	N. 18 W.	2.6	N. 14 E.	2.3	N. 30 W.	3.0	N. 14 E.	2.3	N. 80 E.	5.4	S. 34 E.	6.3	S. 23 E.	1.5	N. 73 E.	1.4	N. 54 E.	0.8	N. 42 E.	0.9	N. 63 E.	
Rawalpindi	1,674	2.0	N. 49 E.	2.3	N. 39 W.	3.1	N. 30 W.	3.7	N. 30 W.	3.0	N. 14 E.	2.3	N. 80 E.	5.4	S. 34 E.	6.3	S. 23 E.	1.5	N. 73 E.	1.4	N. 54 E.	0.8	N. 42 E.	0.9	N. 63 E.	
Khushab	612	2.9	N. 18 E.	2.3	N. 39 E.	5.1	N. 23 W.	6.7	N. 83 E.	7.0	N. 14 E.	2.3	N. 80 E.	5.4	S. 34 E.	6.3	S. 23 E.	1.5	N. 73 E.	1.4	N. 54 E.	0.8	N. 42 E.	0.9	N. 63 E.	
Montgomery	358	3.4	N. 18 E.	4.2	N. 18 E.	5.4	N. 53 E.	6.3	N. 51 E.	7.5	S. 48 E.	9.5	S. 3 W.	9.6	S. 15 E.	8.2	S. 12 E.	6.9	S. 4 W.	3.9	N. 43 E.	2.7	S. 38 E.	2.4	N. 27 E.	
Multan	420	1.3	N. 45 E.	1.3	N. 37 E.	1.9	N. 50 E.	2.2	N. 51 E.	2.6	S. 12 E.	3.3	S. 3 W.	3.1	S. 8.9 W.	2.9	S. 14 E.	2.6	S. 5 W.	1.5	S. 40 E.	1.2	S. 72 E.	1.1	N. 53 E.	

Average temperatures recorded at ten Meteorological stations in the Punjab.

STATION.	Elevation above sea level, in feet.	JANUARY.			FEBRUARY.			MARCH.			APRIL.			MAY.			JUNE.			JULY.			AUGUST.			SEPTEMBER.			OCTOBER.			NOVEMBER.			DECEMBER.		
		Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.	Normal maximum.	Normal minimum.	Normal mean tem- perature.						
Delhi	718	59.3	70.7	65.0	68.3	74.8	71.5	74.8	87.4	69.2	86.6	99.7	73.5	92.5	104.7	80.2	83.3	87.4	94.0	80.7	85.6	91.8	79.3	85.0	93.0	77.0	80.0	82.1	67.9	69.6	82.9	56.2	61.3	73.7	48.9		
Sirsa	662	57.1	71.0	64.3	67.8	73.5	70.6	72.9	83.9	57.1	82.6	107.5	68.2	91.1	107.5	76.3	80.8	84.1	103.5	75.8	89.3	98.4	80.2	87.3	98.9	73.7	79.4	86.1	67.2	84.9	49.5	58.8	74.9	42.7			
Ambala	892	55.8	67.8	61.7	64.3	70.6	67.4	70.5	83.4	57.1	82.3	110.5	76.9	90.8	104.4	73.4	80.8	84.1	103.5	78.3	91.8	97.7	73.9	80.8	93.7	73.9	80.8	86.6	67.2	84.9	49.5	58.8	74.9	42.7			
Ludhiana	702	55.8	67.2	61.5	64.3	70.6	67.4	70.5	84.4	57.1	82.3	104.4	73.4	80.8	104.4	73.4	80.8	84.1	103.5	78.3	91.8	97.7	73.9	80.8	93.7	73.9	80.8	86.6	67.2	84.9	49.5	58.8	74.9	42.7			
Lahore	830	54.5	68.2	61.3	64.3	70.6	67.4	69.7	81.7	55.6	80.8	98.2	84.3	89.0	105.7	72.6	83.4	87.4	97.6	79.4	88.0	94.7	77.7	84.8	95.7	73.8	77.1	82.3	61.0	62.7	84.6	48.6	53.8	70.2	40.3		
Sialkot	1,074	54.5	68.2	61.3	64.3	70.6	67.4	68.7	81.7	55.6	80.8	98.2	84.3	89.0	105.7	72.6	83.4	87.4	97.6	79.4	88.0	94.7	77.7	84.8	95.7	73.8	77.1	82.3	61.0	62.7	84.6	48.6	53.8	70.2	40.3		
Rawalpindi	1,672	50.5	63.1	57.9	53.1	64.8	61.4	63.6	76.5	50.7	74.2	88.4	59.9	83.4	98.1	68.6	89.1	103.5	80.5	88.6	97.3	76.7	81.3	93.9	75.2	81.3	88.6	68.9	72.0	83.2	55.8	60.3	77.3	44.9	36.1	57.0	
Khushab	558	54.5	68.2	61.3	64.3	70.6	67.4	68.7	81.7	55.6	80.8	98.2	84.3	89.0	105.7	72.6	83.4	87.4	97.6	79.4	88.0	94.7	77.7	84.8	95.7	73.8	77.1	82.3	61.0	62.7	84.6	48.6	53.8	70.2	40.3		
Montgomery	420	56.8	70.2	63.5	68.3	74.8	71.5	72.9	83.9	57.1	82.6	107.5	68.2	91.1	104.9	77.3	84.1	87.4	102.6	82.1	90.5	102.0	81.6	87.7	99.6	75.8	79.9	83.8	67.9	66.3	84.2	50.9	58.0	72.9	43.0		
Multan	420	56.8	70.2	63.5	68.3	74.8	71.5	72.5	86.5	58.4	88.8	99.0	68.6	92.1	106.6	77.6	95.8	93.8	103.8	83.7	1.4	100.7	82.1	89.0	100.3	77.6	80.0	95.5	64.4	68.4	84.4	52.4	59.2	73.9	44.4		

Punjab.]

Mr. D. MILNE, B.Sc.

[Continued.]

Mr. D. MILNE called and examined.

1107. (President.) In my written evidence (see paragraphs 1071, 1072, and 1094), I have very briefly remarked on the influence of soil and climate on exotic cottons which have longer lint than our *deshi*, and the imitations imposed in consequence on their successful cultivation in the Punjab. Since writing my evidence for the Cotton Committee, I have come across some notes in books dealing with American cotton growing which I think bear out my own experience with regard to the influence of soil and water supply on cotton lints, viz. :—

- (a) On page 291 of "Southern Field Crops" by J. F. Duggar, the author states that, "on upland soils the long staple varieties are usually less productive than short staple cottons and afford a lint shorter than that produced on moist rich bottom land."
- (b) At page 277 of the same book, when referring to the class of cottons commercially known as "Benders" or "Rivers," he says "These names arise from the fact that this intermediate kind (i.e., $1\frac{1}{2}$ inch to $1\frac{3}{4}$ inch lint) is grown chiefly on moist bottom land. Such soil has a tendency to lengthen the staple even of a short staple variety."
- (c) Under Upland cottons on page 24 of the October 1916 edition of "Cotton Facts," edited by Carl Geller, the statement is made that "in parts of Piedmont section, the length of fibre is very often more than an inch while in the sand hills it may be less than $\frac{3}{4}$ ths of an inch."
- (d) Again on the same page, when referring to Texas cotton, the statement is made that "it has about the same length of staple as Upland cotton except in the river basins and black prairie where the length is usually $1\frac{1}{8}$ inch. The character of the fibre of Texas cotton varies considerably from year to year. When the growing season is dry the fibre is harsher and shorter....."

Both my own experiences and those of other observers, therefore, seem to me to agree in showing that, in the case of these or longer staple cottons, unless a sufficient amount of water be steadily available to the roots of the plant throughout the fruiting season, the crop of fibre got will be uneven in length and strength. Also there are soils in the Punjab so excessively porous and drained that crops of good quality of such fibre will not be raised on them by ordinary methods of farming. The soils in the Punjab have evidently been laid down by rivers as one can see by the irregularity of their texture from place to place and from stratum to stratum. Meandering streaks of sandy soil run over the plains roughly from north-east to south-west and indicate that these rivers ran roughly in the direction in which our rivers are running now. This is of interest in connection with the statement by some of the witnesses that Multan and Montgomery districts are better suited for growing American cotton than Lyallpur and Sargodha districts. Multan and Montgomery are further from the Himalayan hills and as the rivers flowing from these hills would naturally deposit grit first and finer silt afterwards, we would expect, and I think we do find, that the soils in Montgomery and Multan are less variable and on the whole stiffer than in Sargodha and Lyallpur. Therefore the physical condition of the soil is such that if a good steady supply of irrigation water were given and the lands were well cultivated, Montgomery and Multan should produce the more even staple.

1108. There are outstanding differences between the climates of the cotton belt of the United States and the Punjab. The cotton crop is planted and harvested at much the same time of the year there and here. We have much higher temperatures here both in the cotton growing season and fruit developing and ripening season than they have there. By the growing season, I mean the period from sowing time up to the end of August. The main fruit developing and ripening season lasts from the end of August up to the end of November. The rainfall and the general humidity of the atmosphere in the cotton belt of the United States of America are far higher than those in the Punjab. With the exception of Texas and Oklahoma, which have average annual rainfalls of thirty inches approximately, rainfalls of the remaining cotton growing states range more nearly fifty to sixty inches per annum. Comparing rainfalls in the growing season we find the figures for Vicksburg, Mississippi from 1st April to the end of August are 21.7 inches, San Antonio, Texas, 14.3 inches, Atlanta, Georgia, 20 inches. In the Punjab, for the same period, we have 5.45 inches at Multan, 7.01 inches at Montgomery and 10.37 inches at Khushab. Taking the fruit developing and ripening season as from the 1st September to 30th November, we have for Vicksburg, Mississippi, 10.3 inches, for San Antonio, Texas, 7.0 inches and for Georgia, Atlanta, 8.8 inches. In Multan, we only get 0.42 inches, in Montgomery, 0.96 inches, in Khushab 0.85 inches (see Annexure I to my written evidence). The atmosphere of the Punjab is therefore very much drier than that of the American States. The plants grown from the imported seeds consequently find themselves here in a different set of conditions altogether with regard to transpiration, and they have to alter their character a good deal in order to avoid desiccation. If one compares the leaves of *deshi* and American plants, one notices that the *deshi* leaf is much more dissected. Dissection of leaves is commonly associated with drought-resistance. The *deshi* leaf is also more hairy: again a drought resistant character. There are other differences which we now find between the leaves of the old *narma* American plants and those of plants reared from cotton seeds imported recently from America. The old *narma* plants have adapted themselves considerably to our conditions. For example, their leaves are smaller, more hairy and thinner, etc. There is also a tendency to shorter lint in the old *narma* plants. Some American plants seem to be able to adapt themselves to our conditions while others appear to make little progress in that direction. In the old *narma* cottons for example when I first saw them in 1907, many plants were certainly not doing well, while others were in a much better condition. That was also the case with Dharwar cottons and I have had similar experience with those which I have imported from America since 1907. Natural crossing here appears to keep adding to the number of unsuitable as well as suitable sorts.

1109. My ten years' experience has shown me that the Punjab climate is not a bar to the growing of good American cottons. Over 100 of my American selections are doing well. This year—a bad year for the cotton crop—my selection No. 286, on one acre has given an outturn of *kapas* of eleven maunds per acre. During the ten years that I have been here, the total area occupied by my American selections has never been less than five acres and I have never had a single year in which the total outturn from these cottons has not been higher than would have been got from unselected *deshi* cottons grown in the same conditions. I have been getting eight, ten or twelve maunds of *kapas* per acre or even more from these American cottons.

1110. Our temperatures in the Punjab are much higher than I should like to see them. Compare the temperatures at stations in Egypt, the United States of America and the Punjab in table attached (Annexure I). The temperature of Multan is on an average four degrees higher than that of Lahore or Ambala. (Vide Annexure to my written evidence.) That is not a very great difference.

1111. As regards soil, I think that a careful soil survey throughout the province is necessary before a wholesale introduction of American cotton can be recommended. If people begin sowing American cotton

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[Continued.]

on the lighter soils, they will almost certainly get a short, irregular staple which, if mixed with well grown lint, will bring down the quality of the whole. A more even length of staple of American cotton would be got if these lighter soils grew *deshi* cotton. I think it would be well to mark out the lighter soils as not suitable for the cultivation of American cottons. The unsuitability of these soils seems to be due to their poor water-holding capacity. In colder climates there is less difficulty in increasing the water-holding capacity of soils than there is here, as there plant *débris* takes a long time to decay and consequently a good deal of humus, which aids the soil greatly to hold water, can be maintained in a soil. Here in the Punjab plains, on the other hand, decay of vegetable matter takes place so very rapidly that we see practically no humus in our soils. Even when a thick crop of *san* (*crotolaria juncea*) six feet high is ploughed down very roughly and the land is irrigated, the crop will entirely disappear in about a month owing to the combined action of fermentation and white ants. It would not disappear in six months in Britain. I think that cultivators should be warned that American cottons produced on light sandy excessively drained soils will almost certainly be inferior. One cannot legally stop a *zamindar* from growing American cotton on inferior soil, if he wishes to do so and he is not likely to listen to advice on the point unless it is decidedly to his profit. A poor price for the *kapas* would be a deterrent. Therefore there must be some arrangement made for a strict grading of cotton. The mixture of *kapas* from these sandy lands with well-grown *kapas* will certainly lower the standard of the whole crop.

1112. Cultivation is a very important factor in the conservation of soil moisture. To get an even lint a sufficient supply of water must be constantly available to the roots of the plant. A farmer may have good enough soil but if he does not conserve the soil moisture by interculturing with hoe or other implement he cannot expect to get good results in our climate. For the production of a good even lint, it is also most important that farmers on canal irrigated lands get their irrigation water regularly in proper time. A crop of uneven lint may be got from a number of causes besides from sowing seeds from a mixture of cotton types. The supply of cotton in the Punjab could be increased to a tremendous extent merely by improving the methods of cultivation.

1113. Cotton is a very tricky crop to grow. In my own experimental lands and elsewhere, I find that when the size of the plots are the same and the quality of the soil is as equal as possible, if the waterings and details of cultivation have not been done correctly and at the proper moment in each case, the difference in outturns got are sufficiently great to obscure inherent differences in cropping powers in different varieties. This year, although one plot of my selection No. 286 has given eleven maunds of *kapas* per acre, another plot of the same variety growing in the same square of land is giving only half that amount or less. In the latter case, there was not sufficient moisture in the soil when the crop was sown and consequently the germination was bad. The plot giving eleven maunds per acre was sown two or three days earlier than the other and germinated well. The two or three days delay in sowing made all the difference.

1114. I am at present doing a botanical survey of the cottons growing in the different districts. This year I am doing Multan.

1115. The cotton belt of the United States of America lies between 28° and 37° north latitude. The West Indian Islands lie about 18° north latitude. An interesting point about cotton in the American Cotton belt is that the spread of the cotton further west is limited by the slightness of the rainfall (*vide* "Southern Field Crops" by Duggar, page 384).

1116. Regarding the question of directly importing seeds from America, American cottons have never done well when first imported in from America to the Punjab. The climate in the American cotton belt being so different from that of the Punjab the plants have to adapt themselves very greatly in order to do well in the conditions here.

1117. In my cotton work my object is to produce a cotton that will yield to farmers a larger profit per acre than they get from the cottons which they are already growing. Therefore high ginning percentage, length, strength, etc., of lint, cropping powers, disease resistance and all other factors which affect profit per acre must be taken into account. We take into consideration the value of the seed. The value of the seed is very much less than that of lint, often about one-eighth of its value.

1118. I think the entomological section of the Agricultural Department in this Province ought to be strengthened and that the man in charge of it should pay special attention to cottons.

1119. The damage done to the cotton crop of the Province by root-rot is not negligible but is not of vital importance.

1120. As regards the organization of the Agricultural Department and the position of the Economic Botanist, I have put forward one or two alternative proposals in my written evidence. I would like to see a special botanist put on to cottons. It is a very important crop and my own experience of it is such that I feel I could spend the whole of my life and utilize to advantage every minute that I could give to the subject. In my opinion there should be one botanist for each important crop in the Province. I would suggest that it would be best to have a bureau of plant industry, so that a man would be allowed to make all necessary tests on any variety he evolves and could push his improved varieties right through to the hands of the *zamindars* with all speed. At the very least, the botanist should have a 300 acre farm to carry out his tests on. After the completion of the tests he could hand over the seed to the general agricultural officer to multiply and distribute it. The Economic Botanist would naturally always interest himself in his varieties but I would make the responsibility rest with the general agricultural officers after the varieties have been completely tested by the botanist. I think the botanist should be allowed to try his cottons outside his farm on *zamindars'* plots. It could easily be arranged that if the *zamindar* lost anything by growing a plot for the botanist, the difference could be made up from the money set aside under the heading "experiments" in the botanist's budget. In the case of the other alternative, i.e., the bureau of plant industry, you would have one man to push the work of improvement of a crop from start to the *zamindar's* hands and you would have the force of self-interest driving on the work. Self-interest is the biggest driving force in the world. As to staff, I have one man on cotton work. Even with the present organization of the Agricultural Department, I would very much like to have a man of the grade of an Assistant Professor of Botany, if you cannot get a man from home who would specialize on cottons.

1121. From my experiences I would certainly advocate crop specialists in each province for the important crops. The Imperial Cotton Specialist has too wide a field for one officer to cover satisfactorily. India is very large. The conditions under which a crop is grown in one part of India may differ widely from those in others. The cottons suitable for one province may not be suitable for another. Only the other day I had a letter stating that in Bihar, where the annual rainfall is several times what we have here, my 4-F. cotton

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[Continued.]

did not do so well as 285-F. last year and that *deshi* cotton did better than either. The kind of cotton most suitable for Bihar would almost certainly not be most suitable for the Punjab. It would be better to have a cotton specialist for each of the cotton growing tracts than an imperial officer to deal with the whole of India. I am entirely in favour of the proposal suggested by Mr. Faulkner that there should be annual meetings of the agricultural officers working on cotton.

1122. (*Mr. Wadia.*) As regards the improvement of *deshi* cotton, the same general plan has been adopted as in the case of American. We made a collection of samples of *deshi* cotton from every *tehsil* of the Punjab and from the North-West Frontier Province in 1908. The samples bore scores of different names. Seeds from these samples were sown at Lyallpur in 1908. It was seen in that year that each sample contained a mixture of types and with further study showed that there were only ten varieties in the whole collection. Selections from these you have seen here.

1123. As to whether in a place like Hansi, better *deshi* cotton might not be grown I am quite sure that that can be done. That is self-evident in a way. All *deshi* cottons commonly grown in Hansi and elsewhere are a mixture of types which differ obviously to the eye. Not being the same, one must be better than the other. Therefore if the best type is selected and cultivated pure, it must give better results than the mixture. I have handed over some cottons to the Professor of Agriculture and some to the Deputy Director of Agriculture at Hansi. They are certainly better yielder than the ordinary mixture grown. When I handed them over they had been as fully tested as the facilities at my command would allow. But under our organization, only the general agricultural officers are allowed to test them on a field scale and they were handed over for that purpose.

1124. The soil of the Hansi Farm is very irregular in quality. On one occasion, when I was there, I saw certain plots of cotton which differed very greatly in yield and had different varieties been growing in the different plots, I might have been misled regarding their inherent cropping powers. Fortunately, the same variety was being grown on all the plots and as I was informed that the treatment of all had been exactly the same, the differences in yield must have been due to the quality of the soil.

1125. Testing cotton varieties against each other is very tricky work. We do our best with it, but it is not easy even to those who have made a special study of it. In order to get at the difference in the cropping power of several varieties one must first gauge what differences in outturn are due to differences in the quality of the soil, cultivation, etc., and eliminate these. What the *zamindar* wants is a cotton which will give him better profits and all my efforts have been in that direction.

1126. As to whether the testing house suggested in my written evidence should be established, I think that would depend on what connection it had with the Agricultural Department. If the Agricultural Department is to be closely connected with it, it might be best to be at Lyallpur. My idea is to have one in each Province. The machinery required is ordinary spinning mill machinery which would deal with the fibre up to and including spinning. Makers of such machinery have given sets to Technical Schools practically gratis. Machinery sufficient to deal with one sample (100 lbs.) per week from each of the 140 ginneries at work in the Punjab would cost perhaps £4,000. The cost would not be a fraction of the benefit to the Empire which would result in a single year. There is a Technical School at Lahore. Such textile machinery could be installed in it but a special man, highly paid, and who is an expert in spinning would be wanted to look after it. Nothing else would do. The Technical School at Lahore, in its present condition, does not seem a suitable place for it. I saw a set of the machinery required for this testing work in the Technical Institute, Bombay. The Acting Principal who kindly showed me round the place told me that that institute could do the testing work straight away on that machinery. Wherever the testing house is situated there must be a textile man to make the tests. I do not think it necessary at this stage to go into details regarding where the testing house should be situated. If a certificate were granted by such a testing house, a spinner buying on the certificate given would be able to pay the highest possible price for cotton to growers with perfect safety to themselves and cotton growing would be stimulated. An understanding would soon be come to in the trade as in the case of Indian wheats, that a certain proportion of the price would be deducted for every point which a consignment fell below that stated in the certificate.

1127. At home it is compulsory that sellers of artificial manures shall provide a certificate of analysis of their stuff and if a consignment does not come up to the analysis the seller is fined. This is much the same idea. As in the case of the artificial manures, legislation for the production of the certificates would be necessary. In connexion with attempts to stop mixing and adulteration of cottons, a great difficulty is to get the trade to combine. This is partly owing to the fact that buyers belong to many different nations. If certificates of the character, I have mentioned, had to be produced when cotton is sold, they would do away with the necessity for combination among buyers, as all buyers would very soon avail themselves of the protection of these certificates whether they agreed amongst themselves or not.

1128. (*Mr. Hodgkinson.*) A difference of a penny a pound between two samples of 280-F. is certainly a great difference, but that is the valuation we got from the spinners. The samples were not taken from the same heap. As noted in my written evidence, one sample was from *kapas* picked on 14th November and the other from *kapas* picked on the 4th December. When we send cotton samples for valuation, we try to impress the fact that it is the inherent quality of the fibre that has to be judged and that cleanliness of the sample should not be taken into account as that is a mere matter of our care in the process of picking and has nothing to do with the inherent properties of the cotton. The samples just referred to were fairly clean. They were hand-ginned. The comparative figures indicate, I think, a difference in the quality of the fibre.

1129. As to the question whether 280-F has been sufficiently tested to be put out on a field scale this must be answered by Mr. Roberts as I am not allowed to test my cottons on a field scale myself and Mr. Roberts has been testing it on a field scale since it went out of my hands. I understand it is doing quite well.

1130. My object in proposing a central testing house and the issuing of certificates is to help spinners to give the highest possible price for cottons with safety to themselves.

1131. The lints of 285-F. and 286-F. are very similar. These two cottons are not as hardy as 4-F. This has been a very bad year for the *jassid* disease in cotton owing to the dampness of the atmosphere in the summer time and 285-F. and 286-F. have suffered more than some other selections. Cotton improvement work is all a matter of increasing the profit per acre, otherwise no one will prefer to grow new varieties. If the yields of these two varieties are good enough to give a better profit per acre, they will be successful. Everything depends upon that.

1132. We have tried Cambodia here but it was not successful. It was far too late for us. It gave such poor yields that it could not compete with any of our varieties. It was tried again at Gurdaspur and we got the same result. It has been used to a different growing season from that of the Punjab.

1133. As regards moisture in cotton lint, the fibre is very hygroscopic, i.e., it has the power to absorb moisture very readily. For example two ten gramme samples, one of 280-F. (American) and the other of 34 *indicum deshi* which I took from my ordinary stores of cotton and hung in a box containing an atmosphere saturated with moisture but not depositing dew, absorbed moisture to over six per cent. of their weight within five hours. I repeated the experiment and found that at the end of 1½ hours two similar samples of the same cottons both absorbed moisture up to three per cent. of their weight.

Here are the amount of moisture contained in the samples before the experiments started, viz.:—

Percentage of loss by dryage at 105°C. of 280-F., 6.784.

Percentage of loss by dryage at 105° C. of 34 *indicum*, 6.444.

Samples of some other cotton lints taken from my store at the same time gave the following losses by dryage:—

Narma (American)	4.802 per cent.
46 Sanguineum(deshi)	4.708 „
22 Mollisoni (deshi)	4.782 „
34 Roseum (deshi)	4.646 „

The dryage figures were kindly got for me by Mr. Wilsdon. In the case of the ten gramme samples hung in the box all the fibres were more or less freely exposed to the saturated atmosphere. There is no doubt that, when such cotton lint is freely exposed to such an atmosphere, it can absorb at least that amount of moisture in the time. It is evident that a man might have his cotton quite honestly lying in a verandah on a damp day and that the moisture in it would increase greatly. The amount of increase would depend on the degree of saturation of the atmosphere and the amount of fibre exposed to it. One would get different results with small, or large heaps; with cartloads, or a bale. I am conducting experiments to get figures in such cases. Again if a *zamindar* picks his cotton in the morning and allows it to remain till evening dew sets in, he might get a good deal of moisture into his cotton without any criminal intention at all. What I want to emphasize is that cotton fibre is very hygroscopic and that, without any actual criminal mixture of water, the water contents might be altered very much.

1134. It is possible to improve the yield of cotton per acre in India very much indeed by improving the cultivation. Better irrigation and cultivation should double yields in many cases. I consider that this is the greatest avenue to improvement.

1135. The mean normal temperatures of the Egypt in the cotton season are nearer those of the American cotton states than those of India. There is a great difference in the temperatures of the Egyptian delta and those higher up the river. It must be remembered that the diurnal range of temperature in the Punjab plains is very wide. I am giving Egyptian cotton another trial but I am not very hopeful about it. It was an absolutely miserable failure here in previous trials. It was always very badly affected by fungi.

1136. Cotton seeds are pushed further apart on the opening of bolls of varieties with a high *kan* and short strong fibre than in the case of varieties with longer lint and a lower *kan*, therefore the *kapas* of the high *kanned* short linted varieties can be picked more rapidly and clearly. It is due to this that some villages near Multan are growing cotton with a high *kan*. In different parts of the province, I have come across plots of cotton containing a very high percentage of white-flowered varieties such as *mollisoni* and *roseum*. In these cases we usually found such that a house-wife had gone through the fields before the regular pickers to collect some clean cotton for home use and naturally collected *kapas* from the most showy bolls. The white-flowered varieties have the higher *kan* and hence the higher percentage of these in the fields sown with seeds from such *kapas*. In some cases the house-wife had selected the biggest fingers of *kapas* from a heap or store after the cotton had been picked from the plants so the colour of the flower was not used as a guide in the choice of the *kapas*. The longer more silky fibre of American cotton never hangs so well out of the boll as that from *deshi* cotton does and therefore it is more difficult to pick. The people object a little to American for this reason.

1137. (Mr. Henderson.) I think 4-F. good enough for our purpose to start with. Practically all the 4-F. seeds were black and almost naked when I handed them over to the Professor of Agriculture. *Narma* and the American cottons earliest brought into the Punjab have seeds more naked than the later introduced ones. The later introduced ones have a whitish fuzz. I have had cases in which I got both kinds of seed from one cotton plant. Although we get plants which look alike and give the same ginning percentage, the colour of the fuzzy seed has never been very stable. Whether a seed is fuzzy or not is not of much importance.

1138. As regards methods of improvement of cottons, my experience is that the best way to start off is by selection. One may improve them still further by crossing. No technical skill is required to perform the actual act of crossing but when the progeny from the cross is obtained, we are again reduced to selection and comparison with all their difficulties. The success of selection work will depend on the establishment and organization you have. If there is a botanist available he could do something both by selection and crossing. It is quite possible for a Deputy Director—or anyone else—to go far on the right tract. It all depends on how much study a man gives the subject. If there is no botanist in a province and cotton improvement work is important, whatever staff is available should be used in the work in the best possible way. All my *deshi* cottons that have been handed over are selections. There are considerable differences between my selections from the *neglectums*. Some botanists are coming round to the opinion that hybridization has not yielded good results as rapidly as at one time it was thought it would.

1139. In my written evidence, I have explained the method of crop improvement that I have followed here. It has been to find out first of all which are our best strains from the economic point of view and what their special characters are. Where it seemed to me necessary. I have crossed some of these but I did not consider it advisable to fill up my experimental lands and time with crosses before I had isolated by selection the best of the strains and had studied these. I consider that it was better to start with selection than hybridization in the Punjab. I should prefer not to criticise the work of other botanists. I should have acted in the same way wherever I had been stationed.

1140. As to the reason why white-flowered varieties of *deshi* cottons are in the minority in the mixture commonly grown in the Punjab, I have not obtained any satisfactory answer. I am working on lines which I think will bring me an answer.

1141. Regarding the climatic conditions under which cotton is grown in the Soudan, I have collected some data but have not yet in order to compare with our conditions here; but have not yet worked out the case.

1142. I must again point out that the high temperatures here make it very difficult to maintain humus in the soil owing to the rapidity of its decay. A sandy soil with plenty of humus would be as favourable to cotton as any other.

1143. 4-F. is a selection from *narma* and not from Dharwar American cotton.

ANNEXURE.

Comparison of temperature rainfall and humidity at certain stations in Egypt, the United States and the Punjab.

Station.	Elevation in feet.	1st April to end of August.	1st September to end of November
NORMAL MEAN TEMPERATURE IN DEGREES FAHRENHEIT.			
Egypt.			
Abbasia (Cairo)	98.07	69.4°—83.3°	65°—77.9°
Helwan	379.16	68.2°—81.7°	64.8°—79.2°
Assuan	326.68	81.5°—95.4°	73.6°— 89°
United States of America Cotton belt.			
Mississippi (Vicksburg)	226	66°—86°	56°—76°
Texas (San Antonio)	660	69°—83°	63°—79°
Georgia (Atlanta)	1052	61°—78°	52°—72°
Punjab.			
Multan	420	83°—95°	80°—91.4°
Montgomery	558	84°—97.1°	67.6°—88.9°
Khushab	612	81.7°—94.8°	66.3°—87.7°
NORMAL MEAN HUMIDITY.			
Egypt.			
Abbasia (Cairo)	98.07	50—55	61—68
Helwan	379.16	43—54	58—62
Assuan	326.68	29—34	35—48
United States of America Cotton belt.			
Mississippi (Vicksburg)	226	79—87	80—84
Texas (San Antonio)	660	80—85	78—83
Georgia (Atlanta)	1052	74—85	82—86
Punjab.			
Multan	420	44—68	56—65
Montgomery	558	36—63	46—59
Khushab	612	32—69	45—60

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Comparison of temperature rainfall and humidity at certain stations in Egypt, the United States and the Punjab
—contd.

Station.	Elevation in feet.	1st April to end of August.	1st September to end of 30th November.
AVERAGE NORMAL RAINFALL.			
<i>Egypt.</i>			
Abbasia (Cairo)	98-07	0-12"	0-2"
Helwan	379-16	0-12"	0-08"
Assuan	326-68	Nil.	Nil.
<i>United States of America Cotton belt.</i>			
Mississippi (Vicksburg)	226	21-7	10-3
Texas (San Antonio)	660	14-3	7-0
Georgia (Atlanta)	1052	20-3	8-8
<i>Punjab.</i>			
Multan	420	5-45	0-42
Montgomery	558	7-01	0-96
Khushab	612	10-37	0-85

Rai Sahib SEWAK RAM of Gangapur, Lyallpur District.

EXAMINED AT LYALLPUR, JANUARY 15TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

1144. (1) **Experience.**—My experience of cotton growing extends to eighteen years in the Lyallpur District.

1145. (2) **Varieties.**—Hansi and Malerkotla are the varieties grown.

1146. (3) **Size of holdings.**—The average size of holdings is about thirteen acres in Lyallpur and the average proportion of cotton is one-fifth of the holding.

1147. (4) **Yields and profits.**—The average yield comes to about six maunds per acre in ordinary years but as the prices have been fluctuating since many years, no definite idea of profit can be given.

1148. (5) **Rotations and manures.**—The cotton is sown in *toria*, millet and maize fields. The application of manures is not general, but in rare cases farmyard manure is applied.

1149. (7) **Conditions affecting increase in area.**—The area used to fluctuate in the past years but the area under *deshi* is now decreasing every year, the reasons being that a better price is secured for 4-F. There is no possibility of increase under *deshi*.

1150. (8) **Uses of seed and seed selection.**—Seed is used for sowing and feeding cattle. I do not think it is exported. *Zamindars* do select seed by picking the best bolls and also by collecting good cotton from the heap with a view to improve their crop. This seed is hand ginned specially.

1151. (9) **General economic conditions.**—Research in connection with improvement of the plant must be carried on by experimental farms. It is very necessary to establish Government seed farms under Government control for production of improved seeds and also to get the assistance of big *zamindars*. By buying agency, I understand the middleman; he makes a great mixture of different varieties of cotton. Even after he buys it pure, he makes a great mixture of clean variety with the unclean poor variety, which he has bought very cheap. It would not be an easy thing to eliminate the middleman. Some co-operative society of cotton ginners and exporters should be formed, who would buy pure varieties from the *zamindars*. Such associations should form rules and regulations with regard to purity. Whoever breaks the rules and sends impure and bad variety in the market, must pay a penalty or be turned out of the society. Such associations should have a brand and trade mark which will show that best cotton is being supplied. If any buyer then buys cotton without the association's brand he knows what he is buying.

(b) "Deshi" long-staple cotton.

1152. (11) **Varieties.**—No long staple *deshi* cotton is grown by me.

1153. (16) **Suitability of existing varieties.**—Right varieties are not pushed at all. There is now no necessity of pushing these varieties as American cotton is taken up.

1154. (17) **Prevention of mixing of different varieties.**—To prevent mixture in the field, the owner of one holding should only sow one variety and no other. To prevent mixture in the factory, each factory owner should sort the carts as he buys them. It is difficult to prevent mixture by the middle man, as he always does it for his profit.

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[Continued.]

(c) *Exotic cotton.*

1155. (21) **Varieties.**—3-F and 4-F cotton are growing but now 3-F is being eradicated and pure 4-F is being grown.

1156. (23) **Comparative returns.**—I have only experience of 4-F cotton; the average yield of this cotton is six maunds per acre. Its comparison with *deshi* short staple is that, though the average outturn is equal, the price of exotic 4-F is 25 per cent. more.

1157. (25) **Conditions affecting increase in area.**—To increase the area, as the present length of growing is very short and the crop is injured by frost, some successful variety should be found so as to finish the picking by the middle of December. Irrigation available is not sufficient. Early frost affects late sown exotic cottons. Increase of area under cotton would reduce the area under food crops, but we can easily increase it if supply of water is increased.

1158. (26) **Suitability of existing varieties.**—So far as my experience goes, 4-F is the right variety. It is for the Agricultural Department to say whether still superior types could be safely introduced. The ordinary *zamindars* should take no risks and would rely on the Agricultural Department.

1159. (28) **Importation of seed.**—The *zamindars* should have nothing to do with seed imported direct from Egypt and America; let the Agricultural Department buy new seed, and then, if successful, give it to the *zamindar* for cultivation, after acclimatisation.

V.—GENERAL.

1160. (46) **Attitude of buyers to improved cottons.**—Buyers do not give more price for improved cottons. Government auctions have done a very useful work in raising the price. Now that the Agricultural Department have taken in hand the work of posting prices at different markets, it will serve a very useful purpose in getting *zamindars* good prices.

1161. (48) **Desirability of alteration in water rates.**—Water rate should be charged by some measurement system by volume and not per acre. By this system the *zamindars* will make the best use of water by sowing the best crop.

1162. (49) **Effect of tenure of land.**—Present tenure system does not much affect the cotton sowing.

VI.—IRRIGATION.

1163. **Suggested modifications in canal system.**—I am a canal irrigator since eighteen years. The system of canal irrigation requires a good deal of modifications. I may be allowed to suggest a few—

(a) If water is sold by volume, *zamindars* will make better use of it, and consumption will also decrease.

(b) The canal engineer adheres strictly to certain rules and is not inclined to hear any fresh arguments.

I would say if any new suggestion is reasonable, the engineer might take it into consideration.

(c) Assessment work should not be done by the canal engineer, he should only do the engineering and also attend to the distribution of water-supply; the work of assessment should be left to the Revenue authorities.

1164. (51) **Wheat versus cotton.**—At present, cotton is cultivated in less area than wheat, but if facilities be given, the *zamindars* will be prepared to sow more cotton (by facilities I mean more water-supply in the canal at the time of sowing cotton and during the *khari* throughout).

1165. (52) (a) **Critical period in regard to water supply.**—The end of March and beginning of April and also the beginning of October are the critical periods. If there is an increase in the area of cotton, the cultivation of it would become risky, if water in the canals is not increased.

1166. (52) (b) **Watering of cotton.**—Cotton sown by the beginning of April requires first watering sometimes in June. The volume of each watering is about six inches.

Rai Sahib SEWAK RAM called and examined.

1167. (*President.*) The only cotton that I am growing is 4-F. I am keeping it absolutely pure. I think that the staff of the Agricultural Department, both European and Indian, should be increased considerably to carry on experimental work. Co-operative societies of cotton ginners and exporters should be formed to guarantee purity. In that case there would be somebody responsible for keeping cotton pure. Such societies would buy our *kapas*. There should be no middleman. The present trouble is due to the middleman who mixes different varieties of cotton. He spoils all the trouble that we take in producing a pure strain of cotton. By middleman, I mean the *mandi* or small shopkeeper in the villages. I do not think the establishment of a local market (*mandi*) under rules and regulations with provision of adequate accommodation would improve matters. Godowns in the *mandi* would not help the *zamindar*. The *zamindar* as a rule does not bring his cotton to the *mandi*, he likes to sell it at once.

1168. I think it would be a great help if we could get Punjab-American recognised as a standard in the Bombay and Liverpool markets. The Agricultural Department quotes Broach but last year I got Rs. 30 more for Punjab-American than for Broach. At present Punjab-American is not a recognised standard. If it were grown in large quantities, that would help to get it recognised.

1169. (*Mr. Ashton.*) If there were more supply in the canals at the time of sowing cotton and during *khari*, I think the *zamindars* would be prepared to sow more cotton, and there would be a considerable increase. Water for *rabi* sowings after the 15th July is nominally not charged for. In fact we received a circular order last year saying that any water taken in *khari* for ploughing purposes would not be charged for if followed by crop. One watering was, however, actually charged for by the *patwari*. My idea is that it should not be charged for at all. If water is taken and the land is not ploughed up, it could be charged for but if it is taken and the land is ploughed up, it should not be charged for.

1170. (*Mr. Wadia.*) To prevent mixture in the field, only one variety should be sown by the *zamindar* and no other. I would suggest that the District Agricultural Association or the Deputy Commissioner should secure that only one variety should be sown. There should be a standing order which should go to each *zamindar* through the District Agricultural Association or through the Deputy Commissioner directing him to sow only one variety. I think the cultivator can be controlled to that extent. There are lots of other things, e.g., use of selected seed and improved ploughs, etc., which are controlled in a similar way. We abide by the instructions which are sent to us by Government from time to time. The difficulty is that the village shopkeeper buys *kapas* from three or four villages and mixes the lot. The solution for this, which I have suggested in my written evidence, is that the middleman should be eliminated altogether and there should

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be a co-operative system of purchase. The *zamindars* should sell to the co-operative society and not to the middleman. To prevent mixture in the factory, each factory owner should sort out the carts when he buys them. Every cartman should be warned to make a separate heap of a particular variety when bringing it into a factory. There must be some hold on the ginners too. The ginners will not mix if they get a good price for pure varieties. Pools must be abolished entirely or left alone as you cannot prevent those factories which are not working from joining the pool. If you made pools illegal, you would prevent suits being brought in court. I am against pools altogether.

1171. (Mr. Roberts.) It is my idea that the co-operative association of sellers of cotton should not be run by Government but it should be run by a private agency. The Bombay people would only buy the stuff sent by the association. It would be necessary to have these associations recognised in Bombay.

1172. My experience of American cotton is that it is a perfectly safe crop. 4-F cotton has been selected after a series of experiments. I am intending to cultivate 25 per cent. of more cotton on present supplies as in the statement I put in.

1173. I am in favour of water being charged for by volume instead of as at present. In that case the *zamindar* would be able to get a higher duty from the same quantity of water.

ANNEXURE I.

Existing and suggested cropping for an area of 100 acres.

	No. 1. Present common practice.	No. 2. What can be done with cotton at 25 per cent.	No. 3. What can be done with cotton at 30 per cent.
Wheat	40	40	40
Toria	12	12	10
Cotton	20	25	30
Kharif-fodder	8	8	8
Rabi-fodder	8	8	8
Sugarcane	4	3	Nil
Maize	8	4	4
TOTAL	100	100	100

Senji, etc., can be grown without disturbing the above division in *kharif*-fodder area.

Existing and suggested rotations.

Rotation in the case of No. 1 is done by *zamindars* in different ways.

SUGGESTED ROTATION IN THE CASE OF NO. 2.		SUGGESTED ROTATION IN THE CASE OF NO. 3.	
1st year.	2nd year.	1st year.	2nd year.
Wheat 40	Toria 12	Wheat 40	Toria 10
or Wheat 36	Kharif-fodder. . . 8 Rabi-fodder . . . 8 Maize 4 Cotton 1 Wheat or Gram . . 7	or Wheat 36	Kharif-fodder. . . 8 Rabi-fodder . . . 8 Maize 4 Cotton 6 Gram 4
Gram 4		Gram 4	
Toria 12	Cotton 12	Toria 10	Cotton 10
Cotton 25	Wheat 25	Cotton 30	Wheat 30
Kharif-fodder 8	Wheat 5 Sugarcane 3	Kharif-fodder. . . 8	Wheat 6 Cotton 2
Rabi-fodder 8		Rabi-fodder 8	
Sugarcane 3	Wheat 3	Maize 4	Cotton 4
Maize 4	Cotton 4		

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The Hon'ble Khan Bahadur MEHDI SHAH.

The Hon'ble Khan Bahadur MEHDI SHAH of Gojra, Lyallpur District.

EXAMINED AT LYALLPUR, JANUARY 15TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

1174. (1) **Experience.**—I own 36 squares of land (one square is equal to 27 acres and seven *kanals*) in the Lyallpur District and have been living here since 1898. Cotton cultivation is carried on in my own estate.

1175. (2) **Varieties.**—This District has been growing mostly *Tillar* and *Multani* varieties of short-staple cotton and it is only within recent years that American cotton has become so popular; on an average about one-sixth of the whole area is under cultivation here—an acre yielding generally 5½ maunds or so.

1176. (5) **Rotations and manures.**—Cotton is mostly followed by sugarcane or wheat and no manures are applied in the Chenab Colony.

1177. (7) **Conditions affecting increase in area.**—Only one main circumstance causes an appreciable decrease in the area under cotton and that is when an insect called "boll-worm" assumes the form of an epidemic terrifying the cultivators. With the daily growing popularity of the American cotton, there is no possibility of an increase in the area under *deshi* short-staple cotton. On the other hand *deshi* short-staple cotton is fast disappearing.

1178. (8) **Uses of seed and seed selection.**—The seed was formerly used mainly as food for the cattle here, but now it is exported outside the market in small quantities also. The seed meant for sowing purposes is generally carefully selected. When the crop is standing in the field full, healthy and undiseased cotton buds are picked-up by the cultivators themselves. The cultivators in almost all cases prefer the country hand-ginned seed for sowing purposes. The seed obtainable at a factory is generally injured in the process of ginning at a machine and therefore sometimes does not grow properly and is not used in the Chenab Colony.

(b) "Deshi" long-staple cotton.

1179. (11) **Varieties.**—*Deshi* long-staple cotton is not cultivated in the Chenab Colony.

(c) Exotic Cotton.

1180. (23) **Comparative returns.**—The case of exotic cotton is almost akin to that of *deshi* short-staple cotton in every respect, with the difference that it gives a little more yield and also fetches a higher price. Under ordinary circumstances, the average return of the exotic cotton per acre is about seven maunds.

1181. (27) **Prevention of mixing of different varieties.**—It is essential, however, to successfully prevent the mixing of exotic cotton with *deshi* short-staple cotton both in the field and in the factory. But in fact, the factory-men are at the root of the whole trouble. It is found out that if *deshi* short-staple cotton may be mixed up with American cotton up to twenty per cent., this mixture can easily pass off as an American cotton without being discerned. The American cotton fetches a higher price in the market than the *deshi* one, therefore the factory-men are naturally inclined to mix up the two qualities, *deshi* with the American. Some sort of legislation therefore is necessary to stop this happening and to bring about the desired improvement.

1182. (28) **Importation of seed.**—It will certainly be desirable to import selected seed direct from America when required, but, before it is given out to the ordinary cultivator, it must be sown in Government farms or farms owned by Agricultural Conference Members who are interested in the progress of cotton cultivation, so that the seed is properly acclimatised before it spreads. For, otherwise, the danger is that the direct unacclimatised seed from America may not yield a good crop owing to the ignorance and wrong treatment of the cultivators who will be thus discouraged at the very outset, though the fault was their own, with the result that it will become difficult afterwards to push that seed. In the Chenab Colony, the American cotton has become exceedingly popular and is always preferred by the cultivators over every kind of *deshi* cotton, because the experience has shown that the American cotton seed when it is acclimatised can easily beat the best select seed of India, both in its produce and the market. Therefore it is always advantageous to import the seed from America and to get it acclimatised in India.

II.—COMMERCIAL ASPECT.

1183. (30) **Local trade customs.**—Cash payment is the only local trade custom which at present prevails in the markets of the Chenab Colony: no other custom or usage is in vogue at present.

1184. (31) **Standardization of commercial names.**—*Narma* and *deshi* are the only two qualities of cotton that are at present cultivated in the Chenab Colony and these are the only two standard names by which they pass off in the markets, regardless of the locality they come from. I think no alterations are at present needed to change these standard names.

III.—STATISTICAL.

1185. (35) **Publication of Bombay and Liverpool prices.**—The daily publication of cotton prices at various markets by the Agricultural Department has been on the whole very useful. But the cultivator has in many cases been unable to reap the full benefit out of it, owing to the factory-men's combination, locally called "pool," whereby they league together and refuse to purchase unless the poor cultivator offers to sell at rates cheaper than those published in the market. The result is that there being no other buying agency and no place to stock cotton in, the cultivator has no alternative but to sell his cotton at the rates preferred by them. I beg to suggest, therefore, that some legislation should be passed to declare such combinations as void, and that there should be sheds constructed near the factories in every market where cotton might be stocked for a few days so as to be sold at public auctions which should take place once a week at least where the outside traders may also purchase in competition and then keep it in sheds for some time. These weekly

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auctions can easily be arranged by the committees where the markets are situated, with profit both to the public and the committee.

VI.—IRRIGATION.

1186. (56) (a) **Utilization of wells for irrigation of cotton in canal areas.**—The Chenab Colony is irrigated by the canals and therefore no need arises in this part of the country to irrigate the cotton crop by means of wells. But as I have got land in the Bahawalpur State also where the irrigation is done by inundation canals which give water in summer months only, therefore cotton cannot be cultivated there unless sowing is first done by the water of the wells or by any agency other than those of the canals. The Bahawalpur soil is particularly suitable for the cultivation of the American cotton and therefore the combination of both well and canal system would be quite feasible there.

1187. (56) (e) **Tube wells.**—Tube wells can work quite satisfactorily at least in the south-western part of the Bahawalpur State, where the spring level is generally from nine to ten feet deep. I have tried the experiment in my own estate in Bahawalpur in Khanpur District, and the experiment has proved quite a success.

1188. (52) (b) **Watering of cotton.**—In the Chenab Colony, cotton crop needs six waterings in all. The first water is given in the month of March for the preparation of the soil. The second water is given at the end of April when the cotton plant has grown some nine inches in height. Third water is given in the middle of May. The fourth water is given in the beginning of June. The fifth water is given in July, and the sixth in August or September, according to the season of rain. As regards volume of water required per acre, an acre is equal to 40 × 38 *karams* and a *karam* is equal to 5½ feet. Therefore an acre is equal to 11,245 feet. The cotton soil requires water three inches deep. Therefore the volume of water required is one quarter of 11,245 feet.

1189. (60) **Practicability of lining canals.**—I cannot support the idea of the lining of the canals. I do admit that the water may increase a little both in summer and in winter by this process but this small increase in water is not justified by the expenditure incurred. Moreover if the canals are not lined, the water in its course takes mud from here and there and this when it goes into fields serves the purpose of a manure. Thus the productivity of the soil is not lessened in spite of the constant use of the soil. On the other hand, if the canals are lined, the water can carry no such mud with the result that the cultivator will be deprived of a most valuable natural manure, so useful for the crops. This phenomenon is exemplified in the case of the Upper Swat river canal which passes through the mountainous regions and carries no such mud. If it be argued that water logging will spoil the lands adjacent to the canal course, I would suggest that trenches eight feet deep may be dug every two miles apart towards the down stream direction and the water of these trenches may be diverted to another trench which may be excavated joining the ends of all these trenches. The water thus collected can with advantage be utilised in the irrigation of some other area while the land adjacent to the canal course will also dry up. This system is well illustrated in the case of the Hafizabad canal in the Gujranwala District of the Punjab.

The Hon'ble Khan Bahadur MEHDI SHAH called and examined.

1190. (President.) I am a fairly large *zamindar*. I cultivate some squares myself and some are cultivated by my tenants. I sow American cotton 4-F at Gōjra. It is doing well and I am very pleased with it. I used to grow *deshi* cotton, but I have totally stopped doing so. American cotton is much safer than *deshi*. I have moderate irrigation facilities. I have introduced the cultivation of American cotton into the Bahawalpur State. I have five thousand acres there, which I am cultivating under well irrigation. I have got one tube well and one pump which is on the canal. The water is first supplied by the tube well and then from the pump on the canal. This is the second crop of American cotton that I am trying there.

1191. (Mr. Roberts.) The first year I started American cotton in Bahawalpur, I started very late. It was better in the second year; this year is the third year. I have three squares, i.e., about 75 acres under American cotton. The crop is very good. We have had much rain this year; I do not remember ever seeing so much rain in the Bahawalpur State during the last eighteen years. Yet the American cotton has not suffered in any way and therefore I consider there are very good prospects for American cotton in Bahawalpur. It is the best part of India for American cotton. The soil is excellent. With perennial irrigation, it would be possible to extend the area very greatly. American cotton stands rain and boll worm better than any other cotton.

1192. My idea is that more sales should be organized. There should be three or four auctions every month. The difficulty is at present that there is no place for storing cotton in the *mandis* when the carts bring it in. I am President of the Municipal Committee and so I know about all these things. When the carts arrive there in the morning, they have to make the bargain then and there and take the cotton to the factories as there is no place for keeping it in the *mandis*. Cotton markets should be provided which should be managed by committees, associations or Government. I would not like them divided up into shops. There would be the same difficulty as now in the *mandis*. Take the case of wheat. Everybody in the *mandi* knows there is a difference of two to four annas because of competition. Wheat is brought and left there: the buyers come and see whether it is good or bad and we can get a good price for it. I would like the same arrangements made for cotton as for wheat. At present there is no place to keep cotton: some of the cotton lies on the spot where it has been sold. Dust and dirt get into it and as a result the colour is spoilt. I do not think there would be any difficulty in arranging a big cotton market. Everything will then be satisfactory and there will be no difficulty about sales. If no one wants to buy the cotton, it can be kept in the sheds for some time and sold afterwards.

1193. The publication of the price of cotton is a great benefit but the pool at Gōjra reduced the price by Rs. 2. Three of the factories there are not working. This season more cotton has come in to Lyallpur because the people at Gōjra knew about the pool and therefore the *zamindars* as far as eight or nine miles from Gōjra brought in cotton to Lyallpur. They could carry about thirty maunds in one cart so that they got Rs. 60 more per cart for it. It only takes them 36 hours to bring the cotton in and go back to their homes. Railway carriage for thirty miles is difficult as it means making arrangements with the railways and loading and unloading the *kapas* so it was brought in to the *mandi* in Lyallpur in carts. Until there is legislation, the publication of prices will be of no effect on account of the pools. Last year, I arranged to break the pool at Gōjra and I succeeded but this year I tried my best but I could not. One man stood out of the pool last year. He made arrangements to get his cotton pressed at Tandlianwalla. This year, I believe, that the Tandlianwalla people have refused to press for him. He has therefore no press this year though he

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has a gin and has been obliged to go into the pool. Pools cannot be stopped except by legislation. Messrs. Tatas won't join the pool. There is no other firm to compete with them. I cannot say whether their influence will break the pool.

1194. As to the possibility of an increase in the area under cotton, I am of opinion that if the price of cotton continues to be as high as at present, there will be no difficulty in getting the *zamindars* to develop it. If they think that the price will go down or that there is any danger of boll-worm, the area may go down. Everything depends on price. Under present conditions there is every possibility of increasing the area. But the *zamindars* also want water in February for the preparation of the land. If the land is not prepared, what is the use of giving water in April? It is the scarcity of water in February that is the difficulty. Cotton is bound to take the place of wheat and sugarcane where the cultivation is cent. per cent. If the rotation is all right, then manure is not required.

1195. (Mr. Henderson.) The cotton that I am growing at Bahawalpur was sown about the middle of May. I got water every day from the tube well. It took from February to May to level the land and to arrange it in *killas* and squares. The water begins to flow in the inundation canals from May but sometimes it does not flow until a later date. Formerly we were getting water in April, but with the opening of Upper Chenab and Upper Jhelum Canals, the water supply has become less. I do not think there is anybody else who is growing American cotton in Bahawalpur at present. When I started this American cotton, the cultivators who were Arains from Jullundur said that the cotton would be spoilt. I sowed the cotton myself with my own ploughs, i.e., *khud kasht* cultivation. I have been increasing the area every year. I am preparing the land as in Lyallpur. Now other people want to sow this cotton and several of them have asked me for the seed and they may be able to develop it next season. In four or five years' time, the tract will be full of American. As to water, there will be no difficulty as the spring level is about nine feet from the surface of the ground and the people are digging wells. As to the soil, I may say that they are cultivating everything such as wheat and cotton and also sugarcane under wells. Most of the wheat lands are *sailabi* cultivation that is, under inundation. It is the custom there on the inundation canals to bund up the heads. The land is not level. I am talking of the south-western parts of Bahawalpur as I do not know the other parts. Proper irrigation cannot be done until levelling has been carried out and regular canals are made. The period for *sailabi* cultivation is very short. If they were to do away with this system of water-courses, there would not be enough water for *sailabi*. The watering for *sailabi* is done in August and September. That is the period when there is a large amount of water. As to the system of clearance for these canals, we did it ourselves for the last three or four years. Now the State has levied a water-rate and nobody is doing it now. The State is doing the clearance. I have a *zamindari* canal and clear it myself. There is a scarcity of labour. The clearance is done in the cold weather when the canals are closed. Sind is better than the Punjab for cotton as the land is better.

1196. There is no labour available in Bahawalpur. I think the population is one man per mille or so. I have sent cultivators from my *manza*. I have to give them whatever they want. I have to supply them with seed and bullocks and to give them advances. Lately I have been able to secure men from Nushki, Pishin, the Chenab Colony, from Karachi and from Quetta, 10,000 in three weeks, but I could not send one Marwari at one rupee a day. They are useless men. The women are good but only for earth work. Labour cannot be got in those parts. That is a great difficulty but I think people are now coming to Bahawalpur.

1197. The land there was granted to me in 1898 and I got proprietary rights subsequently. The time has gone for buying land cheaply in Bahawalpur. I sent a man from the Rawalpindi District to Bahawalpur. He was my servant. I gave him a part of my tract. There were 3,700 bighas of land and in all I gave him 1,700 bighas. I bought the whole area for under Rs. 500. That man sold his land last year for Rs. 45,000. When I was in Bahawalpur last year I was offered Rs. 47,000 for the remaining 2,000 bighas that comes to Rs. 92,000 in all. It was about sixteen years ago that I purchased the land. I had another tract of land about seven hundred bighas in extent. I was getting rid of it because it was at a little distance from my main tract of land and there was a canal in between. I offered it for sale for Rs. 3 per bigha but no one would take it at that in those days. Three years ago the Bahawalpur State auctioned land in the same place and the rate was Rs. 45 per bigha.

1198. As to the lands in the Canal Colonies keeping up their yields, I think that the yields are less than there were when the canals were opened. I am, however, of opinion that now we have Jhelum water, the fertility is increasing. When we had Chenab water, it was decreasing. In my opinion, there was no silt in the Chenab water. Some *killas* of my land which used not to be good are now better than they were. As to whether if I were to cultivate more *killas* than I am doing at present the yield would go down, I could not cultivate more than I am doing now. In every twelve *killas*, two are under cotton, one under sugarcane, one under *makki*, two under fodder, five under wheat and one under *loria*.

1199. Water should be sold at so much per cubic foot. At present, the *zamindars* are afraid that if they put more land under cultivation, there will be trouble with the Canal Department and some of their water will be taken away.

1200. (Mr. Wadia.) The factory owners are at the root of the whole trouble in regard to mixing. They mix *deshi* short staple cotton with American. No one can tell the percentage of mixture of *deshi* in American up to twenty per cent. The mixing is not done by the *zamindars*. Perhaps some may do it but only to a very small extent. The *banias* in the villages do not do it purposely. They cannot keep the cotton brought to them separate. The women who pick the cotton get one-eighth or one-tenth of it as their wages. They sell it to the *banias* irrespective of whether it is *deshi* or American. The *banias* collect it in one place and so mixing is partly done by the shopkeepers in the villages. Mixing cannot be done in the *mandis* as the carts come loaded into the *mandis* and the same carts go away loaded to the factories.

1201. I have been to the auctions myself. The people have come to know their advantages but up to date the Agricultural Department has been doing everything. The Agricultural Department classification is satisfactory. Even the Agricultural Department cannot say whether the percentage of mixture is one per cent. or three per cent. Their estimate of percentage is only approximate.

1202. When the cotton goes to the ginneries, it is mixed by the ginners. Some of them mix up to twenty per cent. and the difficulty is that when the cotton is sent to Bombay, no one can detect a mixture up to twenty per cent. I do not know what is going on in Bombay but I can say that they do not care. If they do not want this mixture, why do they not send a man to the markets to buy cotton for them? Unless there is a man who is an expert and can detect the percentage of mixture these things cannot be stopped. It is the big firms like Messrs. Tatas who can do something. Some sort of legislation is therefore necessary. If people came to know that they would be punished under that legislation, it would go a great way to remove

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the evil but there must be some expert to judge, as without expert opinion, legislation could not be worked. We cannot compete with other countries unless cotton is pure. What we want is some kind of arrangement under which the purity of the cotton would be maintained and our cotton would get its proper price. I cannot suggest licensing of ginneries by legislation, as I do not see how you could deal with those factories which are now in existence. If there is legislation for the licensing of ginneries, there should be a condition that those factories that will not work according to Government rules would be confiscated. If in a certain factory the cotton was mixed, then the factory-owner should not have a license to work.

1203. Owing to the existence of pools, the cultivators cannot realize the full value of their *kapas* and are bound to take Rs. 1 a maund less. Had the cultivators any sheds or markets, they could be able to say that they will keep their cotton rather than submit to a lower rate. I have suggested cotton markets for a long time past. Without such markets you cannot do anything. Buyers will come from Bombay and Karachi and they will be able to keep their cotton in these sheds and that will give them facilities. The *zamindars* in this Colony are not in the habit of keeping any stock. As the produce come in, they take it to the *mandis*.

1204. (Mr. Hodgkinson.) I am not satisfied with the weighing in the factories. I have actually not seen cases of false weighing but I have on several occasions heard complaints that the weights of such and such a man are unfair. I asked the complainants to lodge complaints in writing but they settled matters otherwise. We have not got standard weights. Even if you have standard weights here, the factories at a distance from the towns could arrange at any time for the *chankidar* to give warning and for the false weights to be hidden and the standard weights produced. There should be legislation, and there should be some special arrangement by which the *zamindar* could get the proper weight. I am in favour of standard weights which should be stamped and the factory-owners should not keep any weight but the standard weight. If any weights besides the standard weights were found, the owners possessing such weights should be penalised. There should be a law that there should be no weights in a factory except those which were marked by the Municipal Committee. That should be made a condition of the factory license.

1205. (Mr. Ashton.) If the supply in this canal were very largely increased, there is, of course, the danger of sugarcane cultivation and rice cultivation being increased but that would depend on the respective profits from sugarcane and cotton. If the income from sugarcane is less than that of cotton, then the cultivators will take to cotton. Cotton is easier to grow than sugarcane.

Lala BHAWANI DASS, Municipal Commissioner and Member, District Board, Lyallpur.

EXAMINED AT LYALLPUR, JANUARY 15TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

1206. (1) **Experience.**—I have been here in the Lyallpur District for twenty years. I possess some squares of land. Also I am holding very big tracts of land, on contract. I was also holding some land in Sind sometime back. I am specially interested in agriculture.

1207. (2) **Varieties.**—Before the introduction of American cotton, the following were the various varieties of short-staple cotton in this colony :—

- (i) *Hassari* cotton, seed for which was obtained from the factories.
- (ii) *Baroch* (a Sind variety). I tried it, but it did not prove profitable.
- (iii) *Chandausi*.

1208. (3) **Size of holdings.**—On an average the land, over which cotton is grown, is four acres to a square or about sixteen per cent. of the land under cultivation.

1209. (4) **Yields and profits.**—The average yields per acre are six maunds. The profit, of course, varies with rates, which are not fixed. During the last many years, the rate has been varying from Rs. 6 a maund to Rs. 12 a maund.

1210. (5) **Manures.**—Generally no manure is used.

1211. (7) **Conditions affecting increase in area.**—In Lyallpur District, the fluctuations in the area under cotton are not very large. The fluctuation is due to the inconstancy in the rates of cotton. Supposing in a certain season the cotton rate becomes cheaper, the next season people neglect cotton and pay more attention to sugarcane, maize (*makki*) and other crops of comparatively high prices.

1212. (8) **Uses of seed and seed selection.**—Seed is generally used as a fodder for the animals. Formerly it was the general custom with experienced landlords to collect big tufts of cotton from the cotton products of the middle of the cotton season. The seed obtained therefrom was considered a good one. But, at present, seed is generally bought from ginning factories though some people also get it from the Agricultural Farm.

1213. (9) **General economic conditions.**—In my opinion, the climatic conditions of the colony have been rendered unfavourable for a good cultivation of *deshi* cotton. Those of the landlords here, who are still growing the variety of cotton are doing so only out of ignorance and prejudice to the introduction of American cotton. Some cultivators of small and uninfluential landlords are rather averse to the growing of American cotton simply because they assert that the hand woven cloth can be made better if *deshi* cotton be used. This assertion, to me at least, appears to be quite erroneous and unreasonable. For, from my own experience, I know thoroughly well that cloth prepared out of American cotton is soft and durable. It is possible that a greater labour is required in the cleaning and spinning of the American cotton.

(2) The season favourable for the sowing of *deshi* cotton is the month of May. This variety can grow easily in an area from which the wheat has been just cut, whereas American and Egyptian cotton cannot grow there. On such an area from which wheat has been cut, there are fewer weeds. In the end, I may say frankly and out of no flattery, that my experience has made me a bitter enemy to the *deshi* cotton, since many years. Its yield per acre is quite uncertain.

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[Continued.]

(b) "Deshi" long-staple cotton.

1214. (10) **Experience.**—The question of the distinction between short-staple and long-staple has only appeared since the time American cotton has been introduced into the Province. Formerly, the only question in the selection of cotton was, as to which particular variety contained a smaller percentage of seed. The *Baroch* variety, that I introduced here from Sind, was of a big staple. I brought it on account of its greater yield, but I experienced that it was not profitable to grow it here in the colony.

1215. (14) **Manures.**—Some *zamindars* use animal's refuse as manure, while others grow cotton among sugarcane and maize plants (*makki*).

(c) Exotic cotton.

1216. **Definition of exotic.**—The word exotic cotton appears to me to mean American cotton and Egyptian cotton. Therefore my answers below will be based on this interpretation of the word exotic.

1217. (21) **Varieties.**—3-F cotton of the Agricultural Farm was the first variety of exotic cotton sown here. Its yield was good, but when, in one season, the variety suffered from the fungus disease, its seeds were destroyed altogether by the agricultural authorities. 4-F of the Agricultural Farm is at present cultivated. Its cultivation in the colony is increasing immensely.

1218. **Proportion of cotton.**—The area under cotton cultivation is ten per cent.

1219. (23) **Comparative returns.**—The average yield in the area under my control is about six maunds per acre. Its growth is regular and cultivators are certain of its profits.

1220. (24) **Rotations and manures.**—No manure is used. It is grown along with sugarcane and maize (*makki*) generally.

1221. (25) **Conditions affecting increase in area.**—The speed of the introduction of the American cotton is more than satisfactory. Its rates of sale are about twenty per cent. higher than that of the *deshi* variety. In many places, people cultivate a mixture of American cotton and *deshi* cotton. This is impeding the introduction of pure American variety. To my knowledge, the ginning factories gin a mixture of the two varieties.

1222. (26) **Suitabilities of existing varieties.**—If pure American cotton be sent abroad from India, it would, of course, fetch a greater price and this would encourage the production of pure American cotton in India and the total area under cultivation of cotton would increase. The people would recognise its value and would take all kinds of care for the better and unmixed growth of American cotton. They then would use manure also and spare more water for cotton at the expense of less profitable crops. I do not know of any other superior quality. The one generally cultivated is 4-F of the Agricultural Farm.

1223. (27) **Prevention of mixing of different varieties.**—The District Officer, by exerting his influence and attention, can discourage the mixture in the field. For example, if the members of the co-operative banks agree to go round and see that the cotton grown in the jurisdiction of the bank is unmixed and pure. The question about the mixing in factories is rather difficult to be solved. However, if the members of the co-operative banks be increased and if the Central Bank, which should be enlarged, takes the responsibility of buying the cotton grown in the jurisdiction of *mofussil* banks by making running payment to the cultivators at a certain fixed rate, the difficulty can be obviated in the following manner. A factory should be connected with the central banks for ginning purposes and the cotton ginned there may be exported directly. The profit obtained, thereof, may be divided among the owners according to the maundage supplied. A part of the profit may also be used for the improvement and enlargement of the bank. But this, in my opinion, can only succeed, if the Government themselves take an interest in the matter.

1224. (28) **Importation of seed.**—Many a times the importing of cotton seed has occurred to me and I had a talk on several occasions with some Agricultural officers at Lyallpur. Some time back, I was, however, informed by the Agricultural Botanist, that the seed was once imported, but it got very soon diseased by insects.

1225. (29) **General economic conditions.**—A few years ago, I was holding land in Sind. There I got Egyptian cotton cultivated. In certain years the yield was very good. But in certain other years the crop suffered on account of one defect. In the years, when the dewfall was very great, then, on account of the saltish effect of dew (due to the vicinity of the sea) the cotton plants were attacked. (The dew is called *makh* in Sind.) I had a talk also with some of the native officers of the Agricultural Farm, Lyallpur, with regard to the cultivation of Egyptian cotton. I was always told that an experiment was once tried but it proved a failure. In my opinion, the experiment may once more be tried for within the last fifteen years, the climatic conditions of the colony have greatly changed. Also, I would like to suggest that the Agricultural College authorities should pay greater attention towards the experiment on those of the foreign products, which are valuable; one failure should not stop their activities. The experiments must be continued and they should find out the circumstances that favour the growth of those particular things in foreign lands.

II.—COMMERCIAL ASPECT.

1226. (30) **Local trade customs.**—At present, either the landlords bring the cotton to the towns for sale, or some traders buy the cotton produce from the landlords in their own villages. I shall describe below as to how the sale is carried on at Lyallpur, Gojra and Sangla Hill. At Lyallpur, the carts carrying cotton are stopped outside the gates of the factories, the rate is settled outside and the cotton is then weighed inside. The factory people seldom buy from the market. The treatment of these people to the poor cultivators is very harsh and unreasonable. For example, when a part of the cotton brought by a certain cultivator has been weighed, the agents and labourers of the factory proprietors (with an idea of robbing those poor peasants) present many pretexts, for example, they say, "take away the rest of the cotton," "we do not require such wretched stuff," "the rate must be reduced if you want to sell," and so on. Poor *zamindars* have to agree to their demands, even though unreasonable. The weighings inside the factory are generally dishonest. The weighmen are the servants of the factory managers. The commission agents charge their commission from both the parties. The rates in all the factories, at a time, are the same, on account of the so called "pool" by which all the factories profit and *zamindars* are the losers. All the factories are to be equally blamed for this unfair dealing. Then, a trader from outside Lyallpur cannot dare to buy cotton at Lyallpur, for all the factories' managers have a private understanding, that they would not give the cotton purchased by any outsider. To remedy the latter defects, some law for factories be framed by which the contracts called "pools" may be rendered illegal. At Gojra and Sangla the same conditions, as described above, prevail, excepting that the factory proprietors also buy from the market and that the complaints about the unfair weighings are very rare.

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[Continued.]

V.—GENERAL.

1227. (48) **Desirability of alteration in water rates.**—In my opinion and knowledge, no change is required in the present system of water rate. The only point worth note is the following. If there be two crops growing in a certain area at the same time, then if one be cut and the other is left behind, then both the crops are charged water rates, although they were occupying the same area and although the remaining crop does not require any further water. For example, in the area of *chari* and gram grown together, the *chari* is cut first and water rate is charged for *chari*, then afterwards no water is required for gram, still the gram is charged extra water rate. The same is the case with the combined crops of *toria* and gram. It is desirable that, in such cases, the water rate may be charged only once.

VI.—IRRIGATION.

1228. (51) **Wheat *versus* cotton.**—During the last years, the people have been preferring wheat, but not much. The land allotted to wheat is about 48 per cent. of the total cultivated land.

1229. (52) (a) **Critical period in regard to water supply.**—The critical period is from the middle of August to the end of October.

1230. (52) (b) **Watering of cotton.**—Cotton is watered at least five times a year after sowing. In my opinion, if big tanks be dug by the cultivators themselves, and if water be stored there in time of necessity, that water may be used by means of *jhallars* (a Punjabi name) and cultivators should be granted concession in the charges for water rate, if they sow cotton over a greater area than at present cultivated. Allowances must be made for the fact that cultivators require bullocks for ploughing during cotton season and *rabi* crop and they shall also be required to draw water for the cotton crop.

1231. (54) **Improvement in duty of water by remodelling of outlets.**—The system of modules is very good, for water is equally distributed both near the head and near the tail of the canal.

1232. (56) (c) **Tube wells.**—In my opinion, if the Government adopt the following suggestion, a good portion of the land belonging to Government and suitable for cultivation may be brought under cultivation and landlords, whose lands are lying in a similar condition, would follow the example. First of all, a special enquiry be made as to what tracts of Government lands now lying uncultivated are suitable for agriculture. Then the Government should lease them out to certain people with further prospects of endowing the right of personal property, provided those people get the tube wells constructed in those areas at their own costs. The time has come that the old system of wells should give place to tube wells.

1233. (58) **Cropping and causes affecting it.**—Out of 100 acres of cultivated land—

- 16 acres are under cotton.
- 4 acres are under sugarcane.
- 8 acres are under fodder *kharij*.
- 6 acres are under *makki*.
- 16 acres are under *toria*.
- 48 acres are under wheat.

(2) There is little change in the above from year to year, due to the change in the rainy weather and fluctuation in rates.

1234. **Importance of cattle manure.**—The area under fodder has been reduced on account of the temptation offered by the high rates of certain crops. Consequently, an important thing has been overlooked by all the *zamindars* and authorities. The best manure is that of the animals' refuse. The number of the animals kept by a landlord depends upon the good quality of land and large quantity of water supplied. If his other crops are good, his fodder is also good. To increase the number of animals kept by *zamindars* is an important problem both for the Government and the people. The manure supplied would be of superior kind and the bullocks would become cheaper. By which both the parties, the Government and the people would profit in the long run. This can be effected, if out of each square of land, a fixed portion is set apart for fodder compulsorily. The water rate and revenue for that area under fodder be remitted whereon the loss may be made up, if necessary, by a little increase in the rates for the other crops. One who does not grow fodder on the fixed area may be charged four times the water rate and revenue for that area.

Lala BHAWANI DASS called and examined.

1235. (President.) I have worked for a long time in Sind. I consider that Sind cotton and Broach are in the same class. I have stated in my written evidence that better hand woven cloth can be made if *deshi* cotton be used. People ordinarily say that for hand spinning and hand weaving, *deshi* cotton is better than American cotton but, to my mind, the advantages of *deshi* are very much exaggerated. I keep about two maunds of *kapas* every year and have it hand spun and woven. I think the cloth woven from American cotton is softer, stronger and whiter than that from *deshi*.

1236. I have not seen the ginning factories mixing American and *deshi* cotton but everybody says they do it.

1237. I grew Egyptian cotton in Sind for several years. In some years, it was very good but in years when there was very heavy dew at the time when the seeds were ripening, the cotton was spoilt on account of the saltiness in the dew owing to the proximity of the sea.

1238. I have always sold my cotton at the Government auctions since they have been started. In my opinion, had these sales not been started by Government, there would have been no pure American in this country. I always bring my cotton in pure. My cotton is classed by the Agricultural Department as A.1. It goes to Gojra, Jaranwala, Lyallpur and Sangla. Very occasionally there might be a little *deshi* cotton mixed in it owing to all the *deshi* plants not being rogued out but I do my best to keep it pure in the field. I sold some of my cotton at the auction sale last Sunday which the Committee attended. I got a good price for it. It was bought by Messrs. Forbes, Forbes Campbell and Company. Delivery was given at the auction and it was weighed there.

1239. In Lyallpur there has been a pool for some time. The charges are different at different places. The factories not working get a profit. There are about ten or fifteen factories in Lyallpur of which only four or five are working. The profit that goes to the factories that are not working comes out of the pocket

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of the *zamindars*. It is the practice of the factory owners at Lyallpur not to purchase their *kapas* in the *mandi* but they buy it from the carts which pass their factories. The result of this is that it has become a custom for everyone who brings *kapas* in from the district to take it past the factories. It is for this reason that no merchants from Multan and other places come to buy cotton at Lyallpur as they know that no cotton can be had at the Lyallpur *mandi*, all of it being taken to the factories. This also means loss to the *zamindars*. The ginning factories settle among themselves the price they will pay for *kapas* and the same price is paid by all the factory owners. There might be a slight difference of an anna or two annas. When the carts have been taken into the factories, the factory people delay weighing until late in the day that is, until the time that they consider that the cartman will be put to considerable trouble to take the carts away. Then they start weighing the cotton and after weighing it, they say that the cotton is damp or dirty or inferior in quality and that the cultivator can take it away. They raise all sorts of difficulties in regard to weight. There is no arbitrator and the cartman is anxious to get away. So, as he is not able to reload the cart, he has to give way to the factory owners who take 41 seers and pay for 40. I have had no personal experience that weights are wrong but a commission agent told me a few days ago that he had caught a man using wrong weights.

1240. (Mr. Henderson.) I do not know the name of the Egyptian cotton that I grew in Sind but it was very white. I had no brown cotton. I have now no lands in Sind. The land I had in Sind was in village No. 314 and on the Daulatpur Minor. The Daulatpur Minor land was given out for temporary cultivation to good cultivators for the express purpose of growing Egyptian cotton. I had twenty-five to thirty squares on the Daulatpur Minor and I had also 26 squares in village No. 314 on which also Egyptian cotton was grown. I gave up the land on the Daulatpur Minor as there was too much *kalar* in it. The water available on the Daulatpur Minor was quite sufficient. I had the land for three or four years. Sometimes the yield per acre of Egyptian cotton went up to ten or twelve maunds an acre and in some years it varied between four, five and six maunds. The yield entirely depended on the dew I have already mentioned. The price that I got for my Egyptian cotton at the auctions at Mirpurkhas was Rs. 14 against Rs. 4 to Rs. 5 for *deshi*.

1241. (Mr. Roberts.) I am of opinion that though it is possible to increase the area of American cotton in this colony, it would certainly not be by more than 25 per cent. The cultivators mainly get their seed of American cotton from the Agricultural Department. If the cultivators can get seed from the Agricultural Department, they won't take it from anywhere else. In my opinion, *deshi* cotton is more liable to disease both from insect attacks and fungus than American.

The Hon'ble Mr. C. A. H. TOWNSEND, I.C.S., Director of Agriculture, Punjab.

EXAMINED AT LYALLPUR, JANUARY 16TH, 1918.

Written statement.

PART I.—GENERAL SURVEY OF THE PROVINCE.

1242. **Area under cotton in the Punjab.**—In the Punjab (including Native States) as a whole the area under cotton in each of the last ten years shows but little tendency to rise. Here are the figures under the crop in each year—

	Acres.
1908.	15,52,339
1909.	14,16,698 (a)
1910.	13,76,529 (b)
1911.	15,87,676
1912.	15,76,029
1913.	20,70,050 (c)
1914.	18,68,263 (d)
1915.	9,02,204 (e)
1916.	11,63,181 (f)
1917.	17,39,623 (g)
Average	15,25,250

(a) The preceding crop matured badly, and cotton was replaced by *toria* and food grains. The decreased area under the crop was specially marked in the central and north-west Punjab, where the agriculturists were very busy at sowing time in handling a heavy wheat crop.

(b) The season was adverse for unirrigated sowings.

(c) The steadily increasing rise in the price of cotton and exceptionally favourable climatic conditions in April and June (the seasons for irrigated and unirrigated sowings respectively) led to a large increase in area. The season was a record one.

(d) Season favourable except in the south-east of the Province, where the unirrigated area is important.

(e) The very marked decline in area was due principally to the very great fall in prices owing to the war (in April 1915, unginned cotton was selling at Lahore at 8½ seers per rupee, compared with a rate of 4½ seers per rupee in April 1913).

(f) Prices had risen since the previous year—in April 1916, unginned cotton was selling at Lahore at 5½ seers per rupee—and this encouraged sowings slightly, but the climatic conditions were adverse.

(g) The high price of cotton,—in April 1917, unginned cotton fetched one rupee for 3½ seers at Lahore—and very favourable climatic conditions at sowing time stimulated sowings.

1243. **Connexion between fodder supply and area under cotton.**—Apart from the considerations mentioned here, a very powerful factor with the Punjabi peasant in deciding the area, he will put under cotton, is the state of his fodder supply. Should he have a large stock of *chari* and *bajra* fodder over from his previous *kharij* harvest—and, especially in the south-east of the Province, these are often kept for years, particularly *bajra*—and an average amount of the straw of his *rabi* crops, particularly wheat—he will put a larger area under cotton than would otherwise be the case.

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[Continued.]

(2) Thus, in the spring of 1916, the peasant found himself short of fodder: the preceding *kharij* had been practically a failure, and there had been very little winter rains to ripen such wheat as had been sown: so he placed, roughly speaking, 2,300,000 acres more under fodder crops than in the preceding year. Even allowing for the fact that the area in the preceding year was low, considerably more than the average area was put under fodder crops. Had the fodder supply been normal, the Punjab peasant would undoubtedly have placed a larger area under cotton, the price of which was then steadily rising.

1244. *Crops which compete with cotton.*—The fodder crops are the principal rivals cotton has, as a *kharij* crop, in this Province. Indeed it would be of distinct advantage to the agriculture of the Province generally had cotton more rivals. Sugar-cane is grown only to a limited extent, is ten months in the ground, and requires better land, more cultivation, more manuring, and more water, than the average peasant can give. Maize also requires land and cultivation distinctly above the average. There thus remain, as groundnuts are not grown here, only the low class pulses (including *guar* and *bajra* for grain) for the *zamindar* to grow in the *kharij*, if fodder crops (including *bajra* for fodder) and cotton be put on one side.

1245. *Importance of the fodder problem.*—More than one Settlement Officer has recently emphasised the importance of the fodder problem in this province. Thus Mr. Whitehead, in his assessment report of the Rupar *tehsil* of the Ambala district (which has just appeared) says "the fodder problem is more serious now than formerly: every square yard capable of profit has been brought under the plough, no pastures worthy of the name are left, and the *zamindar* is compelled to sow more and more fodder in order to maintain his stall-fed cattle." In the all important (especially in the present connexion) canal colonies, practically all the cattle are stall-fed. Better cultivation, which the Agricultural Department is always preaching, to a large extent, means better tillage, and that needs good plough cattle: these in their turn need good fodder: and I must express a strong desire that no recommendations the Cotton Committee may make will, even indirectly, have the effect of decreasing the area now placed under fodder crops in the province.

1246. *Tracts in which an extension of the area under cotton may be looked for.*—In the Punjab, as a whole, considerable increases in the area under cotton can, in my opinion, only be looked for in the following tracts:—

- (a) the Lower Bari Doab colony, now under colonization;
- (b) the Sind Sagar Doab, if the scheme for irrigating it from the Indus, now under consideration, matures;
- (c) the Multan, Muzaffargarh and Dera Ghazi Khan districts, if the inundation canals now irrigating them are made perennial; and
- (d) the Bahawalpur State, if the scheme for irrigating it from the Sutlej (now under consideration) matures.

1247. *Objections to scheme for doubling canals.*—Mr. Roberts, the Professor of Agriculture at Lyallpur, and now a member of the Cotton Committee, has, I know, a scheme for largely increasing the area under cotton in the canal colonies by doubling the present canals in size. There is ample water in the Punjab rivers, of course, through the summer months to supply water for such canals. There is doubtless much to say in favour of the scheme: but there is, I think, also much to say against it. I have not had time to go into the case thoroughly, but the following points occur to me. Will not Mr. Roberts' scheme accelerate waterlogging? Will the average cultivator have sufficient labour and plough cattle at his command to put that increased area under cultivation which is meant to be part of the scheme? Most important of all, surely the decrease in the wheat area, which Mr. Roberts says is bound to follow the introduction of his scheme, is greatly to be deprecated? It is true that Mr. Roberts says the area under gram is bound to increase. This may well be, and agriculturally is of course, all to the good. Mr. Roberts appears to meditate the Punjab exporting gram to England in place of wheat, and the Punjabi clerk eating *chupatties* of gram. Personally I think both of these eventualities are a very long way off. Nor do I agree with Mr. Roberts that "the need both of India and the rest of the Empire after the war will be more urgent for staple cotton than for wheat." For the rest, I leave this interesting proposal. It will doubtless be fully considered by the Committee. The opinions of engineering officers on it will be particularly valuable.

1248. *Division of province from cotton growing point of view.*—So much for the province as a whole. From however, the cotton growing point of view it can, I think, be divided into more or less distinct tracts. Climatic and economic considerations have been those principally in my mind in dividing the province as follows:—

- (1) The Ambala Division (save Simla);
- (2) the Jullundur Division (save Kangra);
- (3) the Sialkot and Gurdaspur Districts;
- (4) the Lahore and Amritsar Districts;
- (5) the Rawalpindi Division (save Shahpur);
- (6) the Shahpur, Gujranwala, Montgomery, Lyallpur and Jhang Districts; and
- (7) the Multan, Muzaffargarh and Dera Ghazi Khan Districts.

1249. *Average annual rainfall.*—I commence my discussion on each of these divisions by giving the average annual rainfall (based on the last ten years' figures) at one important place in each of them:—

	Inches.
Ambala	30.31
Ferozepore	14.06
Lahore	20.5
Sialkot	28.16
Rawalpindi	34.6
Lyallpur	15.06
Multan	7.08

1250. *The Ambala Division.*—I now discuss the first of them, (a) the Ambala Division, excluding the hill district of Simla. This includes the districts of Ambala, Rohtak, Karnal, Gurgaon and Hissar. On the last ten years' figures, this tract contains 22 per cent. of the total area put under cotton in the province. S. Darshan Singh, Deputy Director of Agriculture, Hansi, in whose charge it is, will doubtless have explained to the Committee in more detail than is necessary for me its possibilities as a grower of American cotton. But I note a few points that occur to me. The rainfall figures given above would lead one to expect the unirrigated

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—that is grown without the aid of artificial irrigation—cotton crop to be of importance. This is the fact: 54 per cent. of the total crop grown in this division is grown entirely with the help of rain. I should, however, note that Ambala, my rainfall centre, has undoubtedly more rain than any of the other districts in the division. Hissar, an important cotton growing district, which is included in this division, practically grows no unirrigated cotton relying entirely on the Western Jumna Canal. Ambala, which grows a fair amount of cotton, relies practically altogether on rainfall for its cotton crop. Wells mature a fair amount of cotton in the Karnal district.

(2) Rainfall being thus of great importance in this tract, the area under cotton naturally varies with the rainfall: in 1915, when the monsoon was very deficient, only 181,300 acres were sown with cotton, little less than half the average.

(3) The size of the average holding varies from five acres (in Ambala) to sixteen acres (in Hissar). Cotton is not generally manured: in Ambala it frequently follows cane, which is of course manured. In Hissar, which I take as the other extreme, and where, as already said, the crop is never, owing to the scanty rainfall, grown unirrigated, a not uncommon rotation is cotton: then fallow not only for the immediately following *rabi*, as is of course inevitable, but also for the *kharij*: then wheat and gram mixed: then cotton again: and so on. No manure is given, but the gram, of course, helps the cotton crop following it.

(4) Now American cotton, according, at any rate, to our present experience, has to be sown early: May 10th appear to be latest safe date. But it is only in most exceptional years that there is sufficient rain in April for this to be done: artificial irrigation has to be relied on: and this at once rules out as a possible producer of American cotton more than half the area now under cotton in this division which is at present grown entirely on rainfall. A small amount might, of course, be grown on wells which is now grown on rain water, but the additional amount that can be thus obtained would be so small that it should be disregarded in this connexion.

(5) Remains the Hissar district, and the neighbouring portions of the Rohtak and Karnal districts, which grow their cotton with the aid of the Western Jumna Canal. The obstacle that will prevent the growth of American cotton in the Ambala district, which I have just given, disappears here, it is true, but it is replaced by another, and that is the present agricultural practice of growing cotton after wheat, or other *rabi* crops. Such crops are not off the ground in time for American cotton to be put in, unless indeed it is put in without the land receiving any cultivation in between, which nobody will recommend.

(6) Another point to be brought out is that not infrequently cotton in this division receives a severe throw back from heavy monsoon rains. This happened in 1908: and the Cotton Committee itself saw on its visit to the Hansi farm in October how bad the crop was as a result of the heavy and long continued monsoon. Finally, I would bring out one other point, which relates to all the tracts I am discussing, save the canal colonies, that in none of them is what may be termed "commercial" agriculture followed, save on a small scale. In the canal colonies, the holdings are large; the whole area has been brought under cultivation by selected and energetic peasants in the last thirty years, who are not bound by local tradition as to what is the best crop to grow, or the proper proportion of one's holding, to put under cotton, and who are generally fairly free from debt. Facilities exist for them to buy everything they want, and large firms have agents in many centres ready to buy any new thing produced which is worth their while. In the rest of the Province, the case is different. Holdings are often small and subdivided—in the central Punjab extremely so—local tradition, as to the best rotation of crops to follow, and the best kind of each crop to grow, has often undue weight, the cultivators, especially the Muhammadans, are often anything but energetic, they are often very much indebted to local moneylenders, who provide them with seed, only too often mixed and inferior, and are entitled to the crop even before it has been sown. Again outside the canal colonies, much of the cotton grown is used for domestic consumption (not for export), and for this American cotton is not, as yet at any rate, as popular as country cotton. Finally, facilities to get full value for any new thing produced exist to nothing like the same extent outside the canal colonies as inside them. All these considerations are not without their weight in the present connection.

1251. *The Jullundur Division.*—I now turn to the second of the tracts into which I have divided the Province, (b) the Jullundur Division, save the hill district of Kangra. This includes the districts of Jullundur, Hoshiarpur, Ludhiana and Ferozepore. This is not an important cotton growing tract, containing only between five and six per cent. of the total area under cotton in the Province. The rainfall figures given earlier, those of Ferozepore (average rainfall 14.06 inches) are rather misleading. In the other districts of the tract, particularly in Hoshiarpur, the rainfall is higher than it is at that place. Of the total area under cotton in the tract, 65 per cent. is helped by artificial irrigation—the Sirhind Canal in Ludhiana and Ferozepore, and wells in Jullundur. The balance—35 per cent.—grows its cotton with the help of rainwater alone. Of the districts included in it, Hoshiarpur may be at once put out of account as a good producer of cotton: its rainfall is generally much too heavy. Nor do I think that the other districts will ever grow much long-staple cotton. Their soil is as a rule too light and sandy (this particularly applies to Ferozepore and Ludhiana) and much of the crop they grow at present is for their own consumption. The size of the average holding in the tract is only about five acres, though larger ones are to be found in Ferozepore.

1252. *The Sialkot and Gurdaspur Districts.*—In the third of these tracts, the Sialkot and Gurdaspur districts cotton growing can never be of importance, so heavy is the rainfall, and so small the holdings. This tract at present grows only between three and four per cent. of the average acreage put under cotton in the Province.

1253. *The Lahore and Amritsar Districts.*—The Lahore and Amritsar districts, the fourth of my tracts, are rather more hopeful. The rainfall is less, and holdings, especially in Lahore, are rather more considerable in size: they average about ten acres each here. This tract at present contains about fourteen per cent. of the total area under cotton in the Province: and of the total cotton crop grown, only five per cent. is grown without the help of artificial irrigation, the balance, 95 per cent., being matured with the help of artificial irrigation, almost altogether water from the Upper Bari Doab Canal, wells not being very important. But more hopeful though this tract is for cotton growing than those already dealt with, the only part of it which offers to my mind a promising field for American cotton is the not large Chunian colony in the Lahore district. A small amount is grown there already. This colony is, however, not large, containing, roughly, only 75,000 culturable acres. Conditions in it are more favourable to that "commercial" agriculture of which I have already spoken than in the tracts already dealt with.

1254. *The Rawalpindi Division except Shahpur.*—I next deal with the Rawalpindi Division, save Shahpur district. It may be at once put on one side in this connection. In the greater part of it the rainfall is too heavy: and the cultivation, principally by Muhammadans, too slack to ensure good staple cotton being

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grown. At present this tract grows between four and five per cent. of the total cotton of the Punjab, and three-fourths of that grown is matured entirely with rainfall. It is possible that a small area in the now developing Upper Jhelum colony of this tract, which is irrigated by the Upper Jhelum Canal, in the south of the Gujrat district, adjoining the Lower Jhelum colony, may grow staple cotton; but the area is not large. Government has agreed, I may note, to reserve an area of about 200 acres in this colony as a seed farm for the Agricultural Department.

(2) If the Sind Sagar Canal from the Indus, already mentioned, comes into being, it will irrigate large tracts of the Mianwali district, where rainfall is scant, and here doubtless American cotton can be grown at any rate on the better land.

1255. *The Shahpur, Gujranwala, Lyallpur, Jhang and Montgomery Districts.*—We now come to my fifth tract, containing the Shahpur, Gujranwala, Lyallpur, Jhang and Montgomery districts. This contains the Canal Colonies of the Province and contains practically all the area under staple cotton at present. The conditions are the most suitable to that crop that we can find in this Province. The rainfall is generally not excessive: the holdings are large: and the "commercial" agriculture already spoken of is practised. But even here I am inclined to think that on the inferior lands, and on the tails of the canals, a certain amount of short staple *deshi* cotton will always survive. This tract contains thirty per cent. of the area under cotton in the Province, practically all grown with the help of canal irrigation.

1256. *The Multan, Muzaffargarh and Dera Ghazi Khan Districts.*—The last of my tracts, the Multan, Muzaffargarh and Dera Ghazi Khan districts, is also suitable for cotton growing: some of the best of the country cotton now grown is found in it. This tract has an insignificant rainfall, and contains about twelve per cent. of the total area under cotton in the Province. Practically all of this is grown with the help of artificial irrigation, nearly all from inundation canals. If cotton that has to be early planted, as is the case with staple cotton, according to our present information, is to flourish here, steps should be taken to ensure a more regular water-supply. Inundation canals generally start running too early and stop running too soon for this crop. It must, however, be borne in mind that most of the peasants of this tract are Muhammadan, with a low standard of cultivation.

1257. *The Bahawalpur State.*—The large Bahawalpur State, which adjoins this tract, offers great potentialities of cotton growing, so far as soil and climatic conditions go, if the irrigation proposals now under the consideration of Government, come to anything. Mr. Renouf, formerly Director of Agriculture, and at present Resident in that State, might well, I think, be examined on this point. I imagine, however, that the cultivators are generally bad, resembling the Sindis, and that they are not very numerous.

PART II.—ANSWERS TO COMMITTEE'S QUESTIONS.

I.—AGRICULTURAL EXPERIENCE.

(a) "*Deshi*" short-staple cotton.

1258. (4) *Yields and profits.*—I have now surveyed the province as a whole: I will now go through such of the specific questions of the Committee as I have anything to say on.

(2) Mr. Hamilton, late Director of Agriculture, in a valuable note (I will give the Committee a copy), worked out a calculation to show that cotton gives a net profit per acre in the Lyallpur district of Rs. 42-9-6 per acre. He assumed a price of Rs. 8 per acre of *kapas*: the present price is of course much higher. I am inclined, however, to think that his assumed yield of nine maunds per acre is rather high as an all-round average.

1259. (8) *Uses of seed and seed selection.*—Seed selection is practised hardly at all outside the canal colonies. Mr. Fulkner and Mr. Fatehudin will doubtless have explained to the Committee the methods by which the Agricultural Department control their seed. In view of the great value of the cotton crop to the Province, I should like more seed farms, entirely under the Agricultural Department, and to be used altogether as such, than is at present the case.

(b) "*Deshi*" long-staple cotton.

1260. (11) *Varieties.*—No *deshi* long staple cotton is being pushed in this Province. I would most strongly deprecate doing so, unless absolutely necessary. The fewer kinds of cotton we go in for the better.

(c) *Exotic cotton.*

1261. (28) *Importation of seeds.*—Our experience recently on the Economic Botanist's section at the Lyallpur farm shows that the importation of cotton seed direct from America is far from likely to produce satisfactory results, at any rate at first.

II.—COMMERCIAL ASPECT.

1262. (30) *Local trade customs.*—The cotton auctions we hold undoubtedly have their value, as helping the smaller growers to get a full price for their cotton. But we cannot carry them beyond a certain limit. Sardar Jogendra Singh of Iqbalnagar tells me that he is going to hold a cotton auction there in January: his experience at it will be valuable. He has, however, asked me for the services of an agricultural assistant to help him in classifying the cotton. So he feels that he cannot as yet stand alone.

III.—STATISTICAL.

1263. (35) *Publication of Liverpool and Bombay prices.*—We have this year started publishing cotton prices at the principal markets. So far our experience of this work is satisfactory.

1264. *Control of ginning factories.*—Control of ginning factories is urgently required: whether it will be found possible to control those already erected, bearing in mind the fact that they are already in existence, and various other considerations (including political), is another matter. The case is different as regards those to be erected on any lands, but especially Crown Lands as in the Lower Bari Doab colony in the future. This Government is considering the case, and the Committee is already in possession of our proposals in the

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matter. The average ginner is a short-sighted man, not too scrupulous, whose one object is to make money. He does not object in the least to mixing cottons, if it pays him. I do not think, however, that he now damps his cotton, save in very exceptional cases. Much of the dampness found in cotton in factories is due to the habit the cultivators of some districts have of letting their picked cotton lie out in the field all night, and thus becoming weighted with the morning dew. This cannot be prohibited by law.

1265. *Prohibition of pools.*—I do not think it possible to prohibit *pools* by law. Mr. Low, however, of the Commerce and Industry Department tells me that the Judicial Commissioners of the Central Provinces have recently held that *pools* must be registered under the Companies Act. This, if correct, is important. The matter might be investigated further.

1266. *Establishment of Central Cotton Committee.*—If any form of Central Cotton Control Committee, such as the Committee have, I understand under consideration, comes into being, as at present advised, I consider it an excellent plan. It should undoubtedly have such say as is possible as to the cottons to be grown in Native States. Patiala State in this Province grows much cotton. So does Bahawalpur. In all probability, it will grow more in the future.

1267. (33) *Improvement of cotton forecast.*—The present system of cotton forecasts in this Province is undoubtedly defective. The matter is under the consideration of Government. I can show the Committee the papers on the subject, should it wish to see them. The present returns received from baling presses, of the amount of cotton handled being optional, are so defective as to be almost worse than useless. Thus there are in this Province 92 baling presses (that includes ten in Native States): only five or six are sending in the necessary returns this year, and even they irregularly. Even allowing that some in the east of the Province are not working at all, owing to the failure of the cotton crop, and many are busy baling *bhusa* (stalks of wheat or *juar* used as fodder) for the Army, it is impossible to avoid the conclusion that many presses that are working are not sending in returns.

(2) The Director of Land Records, who is, at present, primarily responsible for the various crop forecasts of this province—I see them before issue, and make any alterations in them I think proper, if time allows, which is seldom—has also asked the three spinning and weaving mills of the Province to send in fortnightly returns of the amount of cotton (ginned) received in the mill the preceding fortnight. Two of them do so, the third does not. The sending in of this return is also entirely optional. It is useful, and might well, I think, be made compulsory on all spinning and weaving mills through India. The returns from baling presses already mentioned must, of course, also be made compulsory, if they are to be any use at all.

(3) The Director of Agriculture should, I think, be responsible for all crop forecasts. He would build them up from the *patwaris'* returns of area (which are accurate, at any rate in the final forecast, within one per cent.), from the reports of District Officers, and of his own Agricultural staff, and from his own knowledge. At present, however, this is a counsel of perfection in this province, until a separate Director of Industries is appointed. I am, however, I may note, responsible for the wheat forecasts in it at present. I draw them up on the lines just indicated: and I think I may say they are an improvement on their predecessors.

VI.—IRRIGATION.

1268. (56) *Wells and tube wells.*—I do not think that our salvation is to be found in tube wells or wells without tubes. The water level is too deep in the best tracts for cotton growing for them to pay. Where the water level is sufficiently near, as say in Hoshiarpur or Jullundur, the rainfall is generally too heavy for cotton. Where a man goes to the trouble and expense of putting down a tube well, he generally will grow vegetables or fruit trees on it.

1269. (64) *Suitability of water rates.*—It would, I think, be well if Government were to let it be known that for at least ten years to come (Government cannot bind its successor for ever) no additional land revenue or water rates whatever would be charged on staple cotton as compared with short staple cotton. Of course, in any case the rates are low compared with the value of the crop. But last year, when the canal *patwaris* were kindly recording for me the areas under American and country cotton separately in the Gujranwala district, the Deputy Commissioner informed me that the peasants were showing a certain amount of alarm, thinking that Government was going to put a higher water rate on American cotton. Hence I make this suggestion.

I must apologise for this ill-arranged and disconnected character of this note.

ANNEXTURE I.

Statement showing figures of cotton (American and *deshi*) for Kharif 1917 by Canal Circles

Canal Circle.	American cotton.	<i>Deshi</i> cotton.	Total.	REMARKS.
	Acres.	Acres.	Acres.	
Lower Jhelum Circle	35,292	57,999	93,291	In this statement are not included canals, such as the Western Jumna Canal, the Sirhind Canal, and some other smaller canals, principally inundation, on which, as yet at any rate, no American cotton is grown.
Upper Jhelum Circle	3,181	22,684	25,865	
Upper Bari Doab Circle	1,257	9,675	10,932	
Lower Bari Doab Circle	90,342	65,846	156,188	
Upper Chenab Canal Circle	8,926	20,960	29,886	
Lower Chenab Canal Circle	137,209	101,577	238,768	
Derajat Circle (Sidhnai Canal)	743	42,382	43,125	
TOTAL	276,950	321,123	598,073	

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1270. (President.) I endorse the opinion of Mr. Calvert that the economic aspect of agriculture is of great importance and I am undoubtedly inclined to the view that the study of agricultural economics should be taken up. I may say, in this connexion, that we are embarking on a small scale on that line of work. Government has recently sanctioned the appointment of an Assistant Professor of English for the Agricultural college at Lyallpur. That is by no means a whole time job. We have got a man appointed who was strongly recommended by Professor Jevons for economic work, and, in addition to his ordinary work, he will devote special attention to agricultural economics.

1271. I take the view that in the Punjab a primary condition which any new agricultural scheme must satisfy is the maintenance of the fodder supply and that, secondly, the wheat crop is of greater importance in the Province than cotton. I have been very closely in contact with the wheat question during the last three years and I know how much importance attaches to it.

1272. I am pessimistic about cotton cultivation only in regard to certain tracts. The most favourable area for cotton cultivation is the canal colonies in which cotton is at present being pushed. As to cotton in Hissar, I have known three years in which cotton had a serious throw back. In 1905, boll-worm was very bad indeed; in 1909, we had very heavy rain and again, in the present year, we have had excessive rain. Another drawback to growing American cotton in the district is the fact that cotton is put in immediately after the *rabi* crops. As American cotton has to be put in earlier than *deshi*, the land is not ready in time. On the other hand, the holdings in the Hissar district are considerably larger than in the rest of the Province except in the canal colonies, but the standard of agriculture is generally low.

1273. The Punjab Agricultural Department has made considerable strides during the last few years, but it is undoubtedly very considerably handicapped by shortage of staff, both superior and inferior. Mr. Southern has been reported as missing and, at present, we cannot obtain any officer to replace him. A proposal has gone to the Government of India for two more Imperial officers and when I sent it up, I stated to the Punjab Government that my sole reason for asking for only two superior officers was the difficulty in supplying them with subordinate staff. Our capacity for absorption at one time is limited. If we were to be given four Imperial officers at once, it would be very difficult to absorb them, to train them and to give them sufficient staff. As regards the difficulty of giving them sufficient subordinate staff, I must point out that, a few years ago, the Agricultural College had practically no students. This is the first year in which we have had a fourth year class. A few months ago, Mr. Roberts told me that he could recommend me only two men for the posts that were vacant. I have at present a post which is empty and which I cannot fill. This of course is only a temporary and passing phase. I will wait till next May when the new class passes out. I should like to see a very considerable extension indeed of the Department. In this connexion, I should like to point out that, in addition to being the Director of Agriculture, I am also Director of Industries and Controller of Munitions. There is room for a whole time Director of Industries. In addition to this, I have got a larger veterinary staff than any other province in India which has considerably developed in the last few years. The Punjab Government is generous and any proposals sent up by me are generally sanctioned. There has therefore been considerable development in the last few years. But I find great difficulty in filling up the lower ranks of the Agricultural Department. That difficulty should disappear in the next few years. When the Agricultural College was started some years ago, there was then only one Deputy Director who was stationed at Gurdaspur. He had charge of the whole province. It was by subsequent development that the district work in these canal colonies was given to Mr. Roberts, Principal of the Lyallpur College. My predecessor gave him charge of district work of the Lower Chenab Colony and I subsequently added the Lower Bari Doab Colony to his charge. Another Deputy Director was appointed and he was placed in charge of the districts round Hissar. The Deputy Director at Gurdaspur has claimed to be in charge of the rest of the province and nominally he is so but I would point out that in many of the districts of which he is nominally in charge, there is no work going on. I would also point out that this division of the province is not entirely accurate. The Deputy Director at Hansi has charge of the circle, Hissar, Gurgaon, Rohtak, Ferozepore, Umballa and Karnal, six districts in all. The Deputy Director of Agriculture here is responsible for the work in the districts of Lyallpur, Jhang, the southern portion of Gujranwala, Montgomery, Multan and to a small extent, Lahore. I have recently added to his circle the districts of Muzaffargarh and Dera Ghazi Khan, because they link on to Multan. There is no work going on in them at present. At present the Deputy Director of Agriculture, Gurdaspur, has charge of the rest of the Province. A Deputy Director of Agriculture has been sanctioned by the Secretary of State for the north-west part of the Province, principally with a view to encourage wheat cultivation there and the primary idea underlying the appointment of Mr. Faulkner was that he should be in charge of that circle. I hope that he will be so in time but for the present it is necessary to keep him at Lyallpur to help Mr. Roberts in his work on American cotton. The arrangement, therefore, is that the Professor of Agriculture has a considerable amount of district work in which he is assisted by a Deputy Director. I am not prepared to say that this arrangement is ideal, but it is working satisfactorily.

1274. As to the point at which the work of the Economic Botanist should terminate, i.e., the stage at which he hands things over to the Deputy Director of Agriculture, my predecessor acted on the advice of Mr. Mollison who laid down that the Economic Botanist should only grow crops on half an acre of land, his view being that if a crop was worth trying on a larger area that trial must be made by the agriculturist proper. Mr. Milne frequently spoke to me about this limit and I withdrew it, adding to his area at the same time 27 acres of land. My view is, however, that experimental work on fairly small plots should be done by the Botanical Department and the trials on any large field scale should be made by the agricultural staff. Personally, I am by no means in favour of the botanical staff carrying our experiments in *zamindars'* lands. It appears to me that it would obviously be inadvisable. I know the system followed at Cawnpore. I should like to know how far the seed on Mr. Leake's seed farm is seed approved by the agriculturists. Mr. Leake has an area of 165 acres in all; 35 acres under purely experimental work at Cawnpore and 130 acres of seed farm at Aligarh. Mr. Milne has an area considerably smaller but very much more than other botanists. He has 87 acres. In Bengal, I find that the botanist has 19 acres. The Economic Botanist in the Central Provinces has an area of three acres and two additional acres lent him by the agriculturists, i.e., five acres in all. His staff at Nagpur consists of one half-time man for teaching and research, two men entirely on research and one man in charge of the garden. Mr. Leake's staff for his 185 acres consists of one Assistant Economic Botanist and one overseer. Mr. Milne's staff consists, apart from his teaching staff, of four whole-time men and one half-time man. My impression is that one of the whole-time men is used for teaching though

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he was given for research, but that is his own arrangement. If there is co-operation between the Economic Botanist and Deputy Directors, there should be no difficulty about the dissemination of the seed.

1275. I am of opinion that all work in connexion with crop forecasts should be taken over by the Agricultural Department, the area figures being continued to be supplied by the Director of Land Records. I would not require any increase in the agricultural staff merely for this purpose. I should compile the forecast as the Director of Land Records compiles it at present, where there is no staff available, from his own knowledge and from Deputy Commissioners' reports. I would not have an agricultural assistant for forecast only. As our Agricultural Department increases, we can make use of our Assistant Directors and other officers for the preparation of the forecast. We had a lot of trouble over our wheat forecast. For the last two years, I got figures from the District Officers and from Agricultural Officers. By comparing the two, I made up my forecast. The agricultural staff let me have their own outturn and the Director of Land Records got his figures from the District Officers. We made up two separate estimates. I do not think that there would be any objection to the Director of Land Records handing over all the work to the Agricultural Department. The Director of Land Records would do it very gladly. I do not think that the officers of the Agricultural Department would devote too much of their time to compilation of statistics. The principal statistical work is the acreage figure which, as hitherto, will be returned by the *Patwaris*, the Land Records staff of the province.

1276. I would have the ginning and press returns made compulsory. At present they are worse than useless.

1277. The suggestion in the last paragraph of my written evidence that Government should announce that, say, for ten years to come no additional land revenue or water rates should be charged on long-staple cotton as compared with short staple would have a reassuring effect on the cultivators. I certainly got reports from the Deputy Commissioner, Gujranwala, that the peasants were showing a certain amount of alarm, thinking that there would be an increase of assessment. There should be no increase. If there is any increase of land assessment, let it be the same for short staple as for long.

1278. I am in favour of a Central Cotton Committee with provincial branches and of annual meetings of agricultural experts and representatives of the trade.

1279. (Mr. Roberts.) Conditions since 1914 have been abnormal. At present they are marked by exceedingly high prices of cotton. Various landholders have told me that next year they will put a smaller area under wheat and more under cotton. Of course, that will lead to a steady development of cotton in the Lower Bari Doab Colony. With a steadily developing of the acreage under cotton in the Lower Bari Doab, if prices remain at their present level, it will mean 2,000,000 acres under cotton in the Punjab. The area has been rising fairly steadily outside the Lower Bari Doab and approached two million acres in 1913 and the extension in the Lower Bari Doab would tend to increase that figure. I should hesitate to say that, under fairly normal conditions, with the price of cotton somewhere in the region that it was in 1911 and 1914, we could expect two million acres of cotton. If prices were at the level of 1913-14, you would get a distinct throw back. In 1914-16 when prices were going up, we had only 1,100,000 acres. That was of course due to the scarcity of fodder. A great deal depends on the fodder supply. I should hesitate to put possibilities as high as two million acres if the price is on the level of 1911-14. It might go to 1,800,000 acres.

1280. I do not accept Mr. Hamilton's figures for the relative profit of cotton and wheat. His yields are a little high both for cotton and wheat. He takes twenty maunds as the wheat outturn. That is a high average in Ludhiana. For cotton he takes nine maunds. I think that is too high to be safe. On the other hand, I do not think he allows sufficiently for the fact that wheat gets better cultivation than cotton and he has not therefore allowed sufficiently for the expenses of cultivating wheat. Even with these limitations, his figures give a fairly good idea of the relative value of the two crops. It is very difficult to work out the cost of cultivation.

1281. I lay great stress on the competition of fodder with cotton. To a considerable extent these colonies are a drain on the cattle-breeding districts. As to the class of cattle that is brought here, I have not studied them in detail but they are a very mixed lot so far as I have seen in this colony. They are improving slightly. One reason why the cattle are so mixed is that the colonists come from different districts and so all sorts of cross breeding goes on. I am urging the District Boards to buy more bills. These colonies draw on the older tracts. I consider it would be sound if there were an increase in the fodder tracts in this colony from the point of view of making the colonies more independent and improving the breed of the cattle, on which after all the ultimate success of agriculture depends. I am undoubtedly in favour of it if it means an absolute increase and does not mean a decrease of the area put under other crops. If more fodder means less cotton, I would like to devote more consideration to the question. All these economic questions link up together.

1282. As to whether in the case of two squares, in one of which the intensity is ninety per cent. and in the other 120 per cent., the increased intensity would mean more fodder, I should say that it would in a village in the Sargodha colony where they keep more buffaloes than they do here. It is difficult to argue the question unless you know the cost of cultivation. The Muhammadan, as a general rule, would grow more fodder crops. If it is a Jat village in which the people come from Amritsar, they would put more under sugarcane and maize. The Muhammadans, as a rule, put a larger area under fodder crops than Sikhs. With crops like sugarcane and maize, you cannot increase the intensity to any great extent. Sugarcane cannot be grown without manure. It is very hard to get a *rabi* crops to follow maize. Very little maize is grown in these colonies. It is not by any means an important crop in them. The principal increase would be under wheat and cotton. With cotton and wheat, you cannot get over a hundred per cent. intensity. Any higher intensity must mean double cropping and that one of the crops must be a fodder crop which is all to the good.

1283. As to the question of cotton *versus* wheat, my own impression is that for several years after the war there will be an enormous demand for food grains throughout the world and that it will be more important to give people food to eat than cotton to wear. Taking the total production of wheat in the Punjab at three million tons, about eighty per cent. is used inside the province. Most of the wheat crop in the canal colonies is exported. The question becomes one of money values in the long run. The whole thing depends on the relative prices of cotton and wheat. As to whether this colony could not produce more wheat, we are getting great pressure put on us by the Secretary of State to increase the area under wheat; there has been on pressure to increase the area under cotton. Cotton is undoubtedly getting scarce throughout the world but wheat is also increasing in price. People are eating it who never ate it before. It is true that the price of cotton has gone up more than that of wheat. I do not know how far the relative prices of wheat and cotton are complicated by freight questions. The Secretary of State will provide freight to an unlimited extent

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[Continued.]

or wheat; but only to a small extent for cotton. The discretion exercised by the Secretary of State in regard to freight is in favour of food grains rather than of cotton.

1284. With regard to waterlogging, I should say that if you increase the canals, it increases the tendency to waterlogging. All the evidence of the engineers goes to show that waterlogging does not happen from the field-channels, but from the canals; unless you line the canals, waterlogging will therefore increase. If you line the canals, much of my objection on that point disappears. It is a very difficult question but new canals can be lined as they are made.

1285. In the event of this or any of the canal colonies producing more fodder crops, I do not think that there would be any less demand for *bhusa*. It is quite possible that it will not be required in its present quantity but I know an enormous lot of *bhusa* is being exported now for military requirements. Fodder crops would, however, be of more value than *bhusa* and would provide legumes. I think that Mr. Faulkner brought out in his evidence that we have reached a stage of equilibrium in the colonies according to the present capacity of the land, bullocks and labour. The cropping varies from *chak* to *chak* according to a man's experience but one would always like to see more leguminous crops grown.

1286. I have already said that there should be an increase in seed farms for cotton if cotton is to increase outside the canal colonies. There are no large estates in the Upper Jhelum Colony or in other parts of the province. I should always like to have a certain number of seed farms under our own control. The Sargodha farm is partly seed and partly experimental. I would like to have seed farms of 200 acres on which we could always rely. Control of seed to an extent sufficient for 20,000 acres would be better than nothing. I would like reserve seed farms always under our own control. As to whether I would emphasise the importance of seed emanating from one centre or would like seed farms selecting independently, I would leave it to the Deputy Director in charge of the work. So long as he was satisfied that the same type of seed was being selected, I would leave it to him.

1287. 4-F is not absolutely a pure line from the point of view of selection work. Selection in different places might lead to different results. That is a point which has to be watched very carefully.

1288. Great inconvenience is caused in sending seed from Lyallpur to Montgomery, owing to the difficulty of railway waggons. That is a temporary difficulty but it has to be borne in mind. We must always have a central seed farm, but I would rather have a certain amount of seed grown at Montgomery and Sargodha under our own control than import it all from Lyallpur. So long as the seed grown is of good quality there is no necessity to import it from Lyallpur. If Lyallpur gives better seed than Sargodha, I would certainly send for improved seed. I am quite prepared to put Montgomery and Sargodha in the same circle as Lyallpur. The Agricultural Department is always developing, and it is impossible to say what the agricultural position will be ten years hence.

1289. As regards the effect of *kalar* in the Punjab, I would not say that it is a very big question but it is a big one. Mr. Barnes worked on it at Narwala and we are waiting the results of the experiments there. Mr. Barnes was about to write a detailed report on them when he died. Personally I would not emphasise mole draining at all. Mr. Barnes himself admitted that it was unnecessary. The land is infinitely better than it was four or five years ago. There are very large areas of *kalar* land that might be taken up. There is a *kalar* problem in the United Provinces as well as in this province. For the last thirty years spasmodic effects have been made to deal with the problem but there has been no co-ordinating link. An enormous lot of spade work has undoubtedly been done by the various provinces. If there had been a co-ordinating link, the experience of other provinces would have proved of great use. I do not know whether the Government of the Punjab is in favour of a co-ordinating link, as I do not think that the question has been raised. I do not think that the problem should be left to each Provincial Government. I certainly think that the Imperial Agriculturist can give us most useful advice on the matter. There is a great deal to be said in favour of the view that the question is one of water supply. One fact that I should like to point out is that when I was Settlement Officer of Hissar, the *kalar* question was so serious in certain villages that the Punjab Government reduced the water supply and *kalar* entirely disappeared as a result of the decreased water supply.

1290. We do not know the amount of cotton that is baled, as we do not get accurate statistics. If it were made compulsory on all presses to submit their returns we should then be in a very much better position. We know the amount of cotton that leaves by rail.

1291. Whatever the figure of outturn is, it is fairly low. It is, in Hissar, 5½ maunds to the acre. We cannot extend our area very considerably except in the south-west of the province. The first thing there is to improve the outturn per acre. We always work out the correct rotation, but the difficulty is to get the people to adopt it. It is a fact that our water is more or less limited and we want to increase our intensity. The *rabi* intensity is very limited. As regards the *khari*, there is a great difference of opinion between the two schools of thought. One school maintains that there is no demand for more water and the other school maintains that there is an abundant demand but there is no supply. We are working at the improvement of outturn but it appears that it will take considerably longer to obtain such obvious results as have been obtained in improving the quality. I would not say that the future of the Punjab depends on getting out some suitable and economic rotations, though I quite agree that is very important. In Hissar, where fallows are frequent, I do not see any great signs of deterioration. Fallows are compulsory, owing to the absence of rain, in those parts of the Province which do not get artificial irrigation. In the Colonies, it seems an undoubted fact that the output per acre is not what it was twenty years ago. How far this is due merely to the fact that it was a virgin soil at the outset and how far it is due to deterioration, I am not prepared to say. Personally, I am inclined to the opinion that the first factor is the more important and that a position of equilibrium has been reached. I do not think that the outturn is less than it was five years ago. I have studied the outturns of wheat as compared with those in the United Provinces.

1292. (Mr. Hodgkinson.) As to whether I would advocate an increase of one hundred thousand bales of long staple cotton or an increase of half a million bales of short staple cotton, it all depends on which would pay the cultivator better. Our sole *raison d'être* is to bring more money into the pockets of the peasants. Our present experience is that the long staple cotton 4-F brings more money into the pockets of the cultivators and therefore we are pushing that. I think that in 99 cases out of 100, the long staple cotton would pay the cultivator better than the short staple and so long as it does so, I am entirely in favour of it.

1293. The question of the control of ginning factories is a difficult problem. Apart from other considerations, you have to bear in mind the political aspect. I would divide the matter into two parts, namely, ginning factories already erected and those to be erected in the future. Personally, I do not see how mixing can be stopped in an average factory if the factory owner wishes to do it. It is no good asking for legislation because you do not want to flood the country with an army of inspectors.

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[Continued.]

1294. Ginning and pressing returns together with railway returns would be of great use. We do not know the exact amount of cotton used in the province for domestic consumption and a certain amount of cotton leaves the province by road. Our statistical returns will not be complete until we get returns from presses.

1295. (Mr. Wadia.) The best expert opinion of the Irrigation Department is that lining of channel will prevent waterlogging. The best opinion is that waterlogging is not due to the water that has percolated from the fields but to the water that has passed from the unlined canals. Another evil is, according to the sanitary people, that the more you flood the country the more you bring mosquitoes and the more malaria you get.

1296. As regards the sub-division of holdings, a question which was brought up before the Board of Agriculture this year, I think that the matter is worth considering. It is not a thing in which you can go much in advance of public opinion. Take the case of the Hoshiarpur, one of the most congested districts in the Province. If a bill were to be passed and subordinate revenue officials were to be sent to divide the village up, there would in all probability, be a severe assault on the Government officials and the people would probably not agree to our divisions. It might be made voluntary to start with. There have been cases in this Province—in the Montgomery district for instance—where *killabandi* was carried out but the people did not work on it and preferred their own arrangements. You cannot go against public opinion. Public opinion is very slow in this matter, but it is developing. The matter is receiving attention, and the Financial Commissioners recently issued a revised circular on the subject, some of which I helped to draft. Legislation would be, at present, I think inadvisable.

1297. We are working principally on the improvement of *deshi* cotton at our Hansi farm at present. A certain amount of the area there is *barani*, that is unirrigated, and the Deputy Director is working out unirrigated cottons on that area. My principal reason against pushing *deshi* is that there is always a very great danger of crossing, if *deshi* long staple and *deshi* short staple are grown together. An effort is being made to find out a suitable strain of *deshi* long staple cotton but we have not found one yet.

1298. I do not see any method by which you can control ginneries already in existence except the provisions of the existing Factory Act in regard to the conditions of labour, hours of work and working on holiday. The whole question of adulteration is at present under the consideration of the Government of India. I think it must be left to the trade itself: if there were a law that any factory which mixed *deshi* with American cotton was to be prosecuted, there would be obvious difficulties in enforcing it. I deprecate strongly any legislation which cannot be carried out and the difficulty in India always is that you can pass laws but there are obvious opportunities for corruption.

1299. To a pool as such I do not take exception: after all it is merely a combination and combinations are to be found all over European countries. I object to a pool where it results in the *zamindar* getting less than the proper price for his cotton. One alternative that suggests itself to me in regard to ginneries is that the existing ginneries should be left alone. We cannot touch them but it might be possible for the legislature to say that no new ginning factories should be erected anywhere in the province without the sanction of a small board which should meet twice a year on which would be the Deputy Commissioners of the Districts concerned, representatives of the ginning trade and perhaps the Director of Agriculture. If they were to decide that a new factory was required, it would be allowed. It would have to be worked most liberally, i.e., factories in excess of requirements should be allowed. Another suggestion I would make is that whereas in Multan and Hansi, there are more factories than the cotton available, Government should offer some of the factory owners facilities in the way of sites in the newly developed tracts such as Chichawatni, in order to induce them to remove their factories. This would to a small extent relieve the existing congestion. Beyond that I cannot say how we can interfere with the existing factories. You may pass a law that no pools should be formed but there is nothing really to prevent its being got round. I think that the pools charge exorbitant rates for ginning and pressing and that the extra charges come out of the pocket of the cultivator. The total charge for ginning and pressing at Lyallpur amounts to Rs. 20 per bale whereas in other provinces it is Rs. 11 or 12. Messrs. Tatas estimated the actual cost at Rs. 9-8 to Rs. 10 per bale. I cannot see any remedy for this. A law fixing prices would always be got round. Assuming the figures to be correct, I agree that there should be a remedy for this if possible.

1300. It is quite true that if the *zamindars* are to get proper prices, it is necessary that their cotton should be marketed in as pure a condition as possible. I cannot see any obvious remedy for mixing. The thing may remedy itself, as the cotton gets better known in Bombay or it is possible that some such system as that advocated by Mr. Calvert under which ginning and pressing unions would have their own marks which would be officially safeguarded and those unions which sold pure stuff would get a reputation in the Bombay market, might be adopted. A law might be passed forbidding any ginnery or press to mix American and *deshi* cotton, but I see enormous difficulties in the way of carrying it out. As to the suggestion that separate ginning factories should be set aside for *deshi* and American, if that were possible, it might be better but I see great difficulties in that too because there will always be a certain amount of *deshi* cotton in this Colony and the factory owner confined to *deshi* would be aggrieved as he would not get the same profit as the man ginning American. I can suggest no very practical policy. I see great difficulties in the way of legislation. My only hope is that the spread of education among the people and a higher standard of morality may improve matters. *Prima facie*, the proposal to set aside ginneries for American and *deshi* cotton seems more feasible than any other. On the whole I am opposed to the licensing of factories and the withdrawal of licenses in the case of deliberate damping or adulteration. You have always to remember that the ginning factories in many parts of this province were erected some years ago and it would therefore be an interference with vested interests. Government at that time did not enter into any agreement with them that unless a factory worked in accordance with their wishes, no license would be granted. There are a good many strong grounds for not interfering with the factories in this manner.

1301. I have heard before of the proposal that no transfer by rail of *kapas* or ginned cotton except in pressed bales should be allowed. The proposal merits consideration, but I think there should be rules excepting small quantities not exceeding five maunds. I would like to point out that there are difficulties in the way. The factory at Kasur gets *kapas* from all over the province and gets it from as far as the United Provinces. I would not say that they get it for mixing.

1302. Coming back to the question of pools, you cannot do anything with the factories that are already put up. That is the position but I put forward the tentative suggestion that the erection of new factories for the purpose of sharing in pools might be forbidden in the future. I do not see how you can forbid pools among the existing factories. If licensing were brought into force under the control of a committee it might be

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[Continued.]

advisable to fix a maximum price for ginning and pressing. But the factory owners will always get round it in some way or other as for example by dealing through *aralyas*. It would be very difficult to work. I quite see the point of the proposal, but I see many difficulties in getting a remedy. I would leave things alone as regards the existing factories. The evils are perhaps less harmful than the remedies proposed for dealing with them.

1303. If pure cotton has to be grown all over India, the multiplication of seed farms would be a tremendous business for the time being. In this province, the work will be facilitated by the large estimates in the tracts where we are pushing on American cotton. The production of pure seed is eminently one of the functions of the Agricultural Department. Until seed farms are established, seed must be bought from the gineries. If the factory owners do not sell pure seed, the cultivators cannot get it. There is another remedy which is that you might get hold of some of the large estates such as we have and get them to sow pure seed. You might adopt another policy under which the ginning factory might be given a small premium for pure seed. Seed Unions with a small ginning factory of their own would be another way of dealing with the matter. There are several of them in the Central Provinces but I do not suggest that Mr. Clouston's methods there could be applied all over India. I agree that the production of pure seed is a most important question but I would hesitate to lay down any hard and fast policy. I would direct the attention of the Agricultural Department to it and let each province find its own salvation.

1304. As to the question of weights in the gineries, the Municipal Act of this Province provides for the inspection of weights and measures but it leaves it entirely to the municipal authority. The only Imperial Act, on the subject is the Weights and Measures Act which applies to the whole of India. So far as I can ascertain no rules had been framed under it by the Punjab Government and the Act is a dead letter in this Province. About four years ago, the Government of India appointed a Committee which toured throughout India to investigate the question. Unfortunately the Committee did not agree and there has been no result. The Inspector of Factories has no legal authority to examine weights. If he starts doing things outside his own work, he will at once get into trouble. If anything could be done to put the inspection of weights and measures on a better footing, it would be most advisable, especially, in the case of factories outside municipal areas. There are lots of factories outside municipal limits especially in the Hissar district. Nobody looks at them. The Municipalities can pass bye-laws for those in municipal limits but in most cases, they prefer to leave it alone. In some cases, bye-laws have been passed but nobody pays any attention to them. If gineries were licensed, one condition should be that only standard weights were kept.

1305. Even if the formation of pools were prohibited by law, a good many of irregular pools would be formed without anyone knowing anything about them, until the members fought among themselves and came into the law court.

1306. As to the auction sales, I am not prepared to say that the classification into A, B, C, and D classes made by the Agricultural Department at the auctions is always accurate, but in the majority of cases it is very fairly accurate, and I have been very much struck by the absence of complaints. The staff which goes round to these auctions gets fairly skilled in the work. According to expert opinion, it is exceedingly difficult to tell the percentage of *deshi* in American cotton in the case of a lint but in *kapas* it is quite easy for a skilled man to do it. The auctions work very fairly well as a whole considering the limited staff we have got and considering the hold that the brokers have over the peasants. The staff do their work very well indeed. It is carefully supervised by Mr. Faulkner and Mr. Fatch-ud-din and I get very few complaints.

1307. I have already said, in reply to the President, that we require an increase in the staff of the Agricultural Department. A Deputy Director for each district is not yet required. That would mean 29 Deputy Directors in this province. Our difficulty as compared with the Central Provinces is that there is no separate tract for each crop here as there, where they have rice, wheat and cotton tracts; we have got wheat all over the province. We certainly want more Deputy Directors. It is no good embarking on a seed farm unless you know what you are going to give out. You have got a lot of research work to do in the first instance. In the Ferozepore district, 4-F was a failure. We want staff in Jang and Gujranwala. I have got four additional posts sanctioned but I have not at present got the men to fill them.

1308. As to the facilities at present in the Lyallpur College for training Indians, we have remodelled our curriculum at intervals. We have a four years' course in English divided into two parts, two years in each. A man can enter the two years' course separately; the better men who go on for another two years' course are eligible for posts carrying Rs. 120 in the Agricultural Department. At present, I have no reason to complain of the stamp of men turned out. For the last two years we have had examiners in agriculture from other provincial colleges in India and they have always reported well on the teaching in the college. The college could not train men fitted for appointments in the gazetted grades of the Agricultural Department. I would not recommend that our college should give such a training. Our work is to provide agricultural assistants for the subordinate staff, to train men such as managers of estates and also to train *zamindars* who wish to manage their own lands. The recommendation of the Public Services Commission could not be carried out in this province. This is my personal view.

1309. I would develop the teaching side at Pusa more than is at present the case. There should be one central place for teaching for the whole of India. We sent some of our men to Pusa and they all came back better men. I should like the post graduate teaching at Pusa developed. Our research staff is mixed up with the agricultural staff and district work. The Professor of Agriculture, his assistant, and to some extent the Botanist and Chemist have research work as well as district work. The subordinate staff are practically entirely engaged in teaching. The Assistant Professor of Agriculture has no direct work on the farm. If the Principal of the College has an assistant, his relations with the students are not affected by the fact that he has outside work. The Principal is here for a good deal of time and takes an active part in teaching. I do not know the position in other provinces. I would deprecate the idea that the college staff should be restricted to the college farm and not have any district work. Mr. Roberts and I personally attach much importance to the connexion of college work with district work. It brings a man in touch with living problems. There are advantages in knowing what is going on in the district.

1310. As to the question of the prohibition of bone meal manure, the point was raised before by the late Mr. Barnes on the question of phosphatic manures. So far as experience goes with any artificial manures, it has been proved that it does not pay. Superphosphates generally accelerate the growth of the plant but in no case, to the best of my recollection, has the extra produce that has been obtained as a result of the manure paid for the cost of it. I have no sufficient data in regard to the prohibition of bone manures.

Punjab.]

MADAN MOHAN LAL, Esq.

Mr. MADAN MOHAN LAL, Assistant Professor of Entomology, Punjab.

EXAMINED AT LYALLPUR, JANUARY 16TH, 1918.

Written statement.

1311. *Insect pests of cotton in the Punjab.*—The cotton plant is attacked by a variety of insects: some of them are mere casual visitors; others occur only irregularly, taking a large toll when they come; while some are of regular occurrence, doing much damage by spoiling the yield of lint and seed. Of this last class of insects, the bollworms are by far the most serious. The two bugs which attack the bolls—ripe and unripe—come next; and then there are caterpillars (mostly *Sylepta derogata*, Fabr.) which attack leaves whole-sale and thus reduce the vitality of plants.

1312. *Varieties of bollworms.*—Of bollworms there are two main kinds:—

(1) *The spotted bollworms* consisting of two species—*Earias insulana* and *Earias fabia*. Here *Earias insulana* occurs mostly. Both these species are practically identical in habit. This kind is the bollworm of the Punjab.

(2) *The pink bollworm* (*Gelechia gossypiella*, Saund).—This occupies a minor position and is found mostly in the cold weather.

1313. *The spotted bollworms.*—The spotted bollworms attack the cotton plant from May to November early in the season buds and flowers are attacked: they dry and fall off. From August onwards the crops of bolls are attacked: they either do not open or yield bad cotton.

(2) The prevalence of bollworm appears to be dependent upon two factors:—

(i) The monsoon rains.

(ii) The parasites.

1314. *Effect of the monsoon rains upon bollworm.*—Data collected during the last six years show that rains during June and July are an important agency in controlling bollworm. It has been ascertained why it is so. The affected parts are washed off the plant by rains and the bollworms inside get drowned upon the ground. The result is that the early broods of bollworm are destroyed and much smaller numbers are left to continue breeding and attack. Thus it happens that—

(i) in years of good rainfall, the pest does not increase, as all tendency towards it receives successive checks;

(ii) in years of drought, the pest does much damage, as it increases brood after brood almost without any check.

1315. *Effect of parasites on bollworm.*—*Rhogas* spp. are the most important of them. Past experience has shown that those years have been bad bollworm years when this parasite has been absent. Our yearly observations show that in August and September the severity of bollworm attack depends upon this parasite—in those fields in which it is present, the pest is less and where it is absent, the attack increases.

1316. *Methods of controlling bollworm.*—We cannot be certain of the timely working of the above-mentioned natural agencies and hence, in order to control bollworms, we should attempt—

(i) to destroy its early broods in cottons buds and flowers and early bolls during June and July;

(ii) to introduce the parasite *Rhogas* in cotton areas in August.

1317. (a) *Destruction of the early broods of bollworm.*—Regular hand-picking of affected parts gives very good results but it is a slow and tedious process and people do not willingly take to it.

We have been now trying for some time the mechanical shaking of plants by drawing a rope over them and irrigating the fields afterwards. This produces artificially the same effect as that of wind and rain. By this means large areas can be gone over easily, cotton being mostly grown under irrigation.

1318. (b) *Introduction of the parasite Rhogas.*—In order to keep the parasite under control for introduction in good time the following measures have become a practice. A cotton plot in which both bollworm and *Rhogas* are present is selected in September and is allowed to stand till the next cotton season. Here additional food plants of bollworm, e.g., hollyhocks and *bhindi*, are grown, and to guard against any considerable diminution in the quantity of the bollworm by the more rapid multiplication of its parasites and the consequent destruction of both, the bollworm supply is throughout kept as high as possible by collecting them from outside and introducing their moths in this plot. In this way, bollworm and *Rhogas* are kept in equilibrium till about the end of November when the outside temperature is about 65° F. After that the climatic conditions become rigorous and they lead a hidden dormant life.

(2) Bollworm reappears about February. *Rhogas* appears in this plot normally in May or June on bollworm in *bhindi* pods. In case it fails to appear provision is made to obtain it from Pusa. When it is once got started, it is kept breeding under the most favourable conditions. Under natural conditions, it would be impossible for any large number of parasites to maintain themselves in this plot for any length of time. But we try to render the law that no species can multiply beyond the limits of its food supply practically inoperative in this case by artificially increasing the food supply of the parasites by the liberation of a large number of bollworm moths. Thus, regular supplies of parasites are invariably obtainable from this plot.

(3) *Parasite boxes.*—When the parasites are thus established, they are introduced in cotton-growing tracts early in August. Heavily parasitized bollworms are collected and despatched in parasite boxes which on reaching the destination are exposed in cotton fields. The parasites fly out and establish themselves. The parasites can be easily spread in a short period from locality to locality by the agency of these boxes.

(4) *Beneficial effects of parasite boxes.*—Parasites introduced in this way in August exercise a controlling effect upon bollworm. The results of the last two years' work show that—

(i) parasites are invariably established by the use of the parasite boxes;

(ii) bollworm attack is less in those fields in which the parasites have been introduced than in the adjoining fields of similar cottons grown under similar conditions from which the parasites are absent

The following data will give some idea :—

Locality.	Bollworm per cent. before parasite introduction.	BOLLWORM PER CENT. AFTER PARASITE INTRODUCTION.		
		After 15 days.	After 20 days.	After 30 days.
Sargodha	31 per cent. on 6th August.	22	17	7
Do.	17 do.	12	8	3
Do.	15 do.	13	6	5
Lyallpur	25 do.	18	11	5
Do.	17 do.	14	9	3
Do.	25 do.	19	7	2

When the parasites have had some time to work, the bollworm attack is reduced.
1319. *Relative intensity of bollworm attack on different kinds of cotton.*—This is another important line of work. We have not gone very far with this but comparative results obtained during the last years show at least this much that American cottons as a class are considerably less attacked than the *deshi* cottons. In normal years the attack is as follows :—

Time.	Attack in Americans.	Attack in <i>Deshis</i> .
August	3 per cent.	12 per cent.
September	5 „	15 „
October	7 „	19 „
November	5 „	17 „

The attack varies slightly in the Americans according to their proximity to the *deshi* cottons.
1320. *Other insect pests.*—(1) *Gelechia gossypiella*, Saund.—This is not a serious pest in the Punjab. It is found in the fields about the end of the cotton season—in October—bores into the bolls and eats the seed. It prefers the Americans to the *deshis*. In no case has a control measure been necessary.
(2) *Desidercus cingulatus* (Fabr.) and *Oxyeremus latus* (Kirby).—These are the two bugs. The first one attacks the green and open bolls and suck the juices out of the lint and seed. The loss becomes apparent when the cotton is picked and ginned. The second bug is found in large numbers in open bolls. Both these bugs are conspicuous and remain clustered together. They are easily dealt with by jerking them off the plants in basins of water.
(3) *Sylepta derogata*.—Mostly attacks exotic cottons by rolling up the leaves. Spraying with lead arsenate has given good result on experimental cottons. On field scale, the simple remedy of picking off the rolled up leaves as soon as they are seen is recommended. When it is done in time it is effective.

Mr. MADAN MOHAN LAL called and examined.

1321. (President.) Normally we find that there are certain conditions chiefly the (i) timely monsoon rains, (ii) natural presence of parasites, which will keep bollworms in check but when these factors fail they increase enormously. Damage by bollworm has not been serious since I came here. I have been Assistant Professor of Entomology for the last six years. During that time bollworm has never become serious. The last serious outbreak was in 1911, just before I came. I am working on that special line of work but I have been very short of staff, and the result has been that we had not time to devote ourselves whole heartedly to solving this problem. So many insect pests are appearing at different times of the year that we have to practically rush from one thing to the other. The remedies we adopted are the use of the parasite, *Rhogas* spp. and treatment at the beginning of the season in June or July either by hand picking of the affected bolls or by drawing an extended rope over the tops of the plants and then irrigating the fields. The effect of the latter is that when the plants are shaken in this way the affected bolls and buds being weak drop off and as cotton is mostly grown in irrigated area, the boll worms get drowned in the water. There is no insect pest so serious as bollworm. Sometimes we find the red cotton bug.
1322. I had one assistant on cotton work. His main work was the distribution of the parasite boxes in the cotton season. At other times of the year I had to put him on other work. I have got another assistant from Pusa, Mr. Umrao Bahadur: I have put him on to bollworm work. He will have to help me in class work in Entomology and whatever spare time he will have from it, he will give to bollworm work.
1323. We recommended hand picking for bollworm but the cultivators do not give much assistance either in that or in the rope work. It is rather tedious work finding out the infected bolls and picking them out.
1324. As to the parasitical work, the introduction of *Rhogas* in the infected areas is being done by the Department. We want a large extension of the subordinate staff especially of agricultural assistants. The agricultural assistants assist in this work and it is mostly being done where there are agricultural assistants with sufficient staff for district work. A lot of work is still required to be done in working out details regarding bollworm and the immediate necessity for that is the appointment of a whole-time assistant to work under me entirely on this problem. For the parasite distribution work in the districts additional staff should be given to the district agricultural assistants. The present staff under them is inadequate to meet even the agricultural requirements and in most cases they cannot take up this extra entomological work

Mr. W. S. HAMILTON, Deputy Commissioner, Karnal and late Director of Agriculture, Punjab.

THIS WITNESS WAS NOT ORALLY EXAMINED.

Written statement.

1325. *Prospects of cotton in the Punjab.*—I do not think the committee can want much evidence from me when Mr. Roberts is a member of the Committee and Mr. Townsend has been a witness. In the Punjab, there is no hope of increasing the area under cotton at the expense of wheat or fodder crops or indeed of any crop except sugarcane. Each acre under cotton means an acre unfit for wheat, and the cultivator does not obtain a larger net income from an acre of cotton than from an acre of wheat. Nor would it be to the advantage of the country that cotton should displace a food grain. The right policy is to discourage any increase in the area under cotton, and to encourage every improvement in the quality of the cotton grown in the present normal area. The present great fluctuations in the price of cotton are very disturbing and it is on the prices of the past harvest that the cultivator decides whether to sow more or less cotton. Abundance of irrigation or of rain at the sowing season influences the area but to a much less extent.
1326. *Necessity for improvement of indigenous varieties.*—So far as can be foreseen, most of the cotton grown in the Punjab will always be of the short stapled indigenous varieties. Therefore the most important work of the Agricultural Department is to improve these indigenous varieties by selection or breeding. The introduction of American cotton is more showy but should not be allowed to take the first place. The work in improving the indigenous cottons should be taken in hand not at Lyallpur but in small farms scattered over the cotton tracts. Climatic influences are all important.

VI.—Sind.

Mr. C. M. Baker, Special Collector for Settlements, Sind.

EXAMINED AT KARACHI, JANUARY 19TH, 1918.

Written statement.

1327. (65) *Experience.*—I have served seventeen years in Sind and five in Nasik District. I have done a good deal of Settlement work and am doing it now. Nasik contains four *talukas* of the Khandesh cotton country and has a great deal of irrigation, some from Government canals and some from village dams. In Nasik, however, no one ever irrigates cotton, except occasionally in famine years. *Khaneshi* cotton does not want much water and they think the rain enough for it. In Sind, of course, all cotton is irrigated (though I have seen it grown on the banks of the Indus in Upper Sind on subsoil water alone).
1328. (67) *Cotton versus wheat.*—I had not seen the real cotton growing parts of Sind before the present cold weather. But from what I have seen on the Jamrao and neighbouring canals, I can safely say that Sindhis do not prefer wheat to cotton. On the contrary, the difficulty is to restrain them from growing too much cotton and neglecting the *rabi* supply. Elsewhere than on the Jamrao and Mithrao, cotton is grown on inundation canals, mostly by lift, so the wheat question does not come in.
1329. *Prospects of indigenous cotton in Sind.*—On the Jamrao, almost exactly half the annual cultivation is cotton—that is, about one-sixth of the cultivable area. As the canal is designed for cultivation of one-fifth of that area in *kharij*, there is not too much left for food and fodder crops. Consequently, it is not possible to expect much increase in the acreage of cotton here. The out-turn of cotton can increase, and certainly will do so as the population increases. The difficulty at present is to get labour for weeding. When this difficulty is overcome, there is no doubt that the Sindhi *blitshah* cotton is an excellent crop. The average outturn of the whole area is reckoned at six maunds per acre. But an ordinary good crop on ordinary good soil is, in my opinion, not less than ten maunds. At present price this is worth more than Rs. 140.
(2) If such prices continue, the cotton area may increase. At present it is nearly confined to the country between the Indus and the Nara from latitude 25 to 26 degrees north. If it spreads, it will probably spread northward through the Nawabshah district.
(3) But the increase is not likely to be great unless the Indus Barrage is made. A longer and more certain irrigation season is an advantage even to Sindhi Cotton. In Upper Sind, west of the Indus, I do not anticipate much increase. At present cotton is extremely rare there. The alleged climatic difficulty does not impress me much, because I am sure that it can be avoided by early sowings—though, of course, the Barrage is essential for this. But most of north-west Sind is rice country, growing heavy crops of excellent rice. That may pay less than cotton at present prices though hardly at normal prices. But rice is an extremely popular crop, because it has no enemies except drought, can be grown without fallows and does not mind a bit of alkali in the soil. It is always difficult to change agricultural customs: and in the present case, the difficulty is physical as well as normal, because much of the rice land is too alkaline to grow cotton.
1330. *Prospects of long staple cotton in Sind.*—To extend the growth of American or other long staple cotton is even more difficult. For this, of course, the Barrage is absolutely necessary. But after that it has to be proved that the American pays better than Sindhi. The *zamindars* seems to think that it is more difficult to grow and less prolific. How far this is true I myself cannot say, since there are only about three fields of American cotton in Sind this year, and those owing to want of early water are naturally bad. But seeing that the price of American is not more than 20 or 25 per cent. higher than the price of Sindhi, I think the *zamindars* will not trouble to change their custom unless they feel sure of getting almost as high a yield. It is less likely than ever now, when the price of Sindhi is so high absolutely as well as relatively.
(2) In new lands on the new Barrage Canals, *zamindars* would be less prejudiced by former habit, having mostly grown no cotton before. Thus they might be more easily induced to grow American. But they can be persuaded through the eye, not the ear. I suggest that Government should reserve certain areas for the growth of long staple cotton, either departmentally or through approved persons or companies. This

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[Continued.]

would teach the neighbouring *zamindars* and *haris* (tenants) how to do it and why to do it. Also, as American would be the only seed locally available, it would be actually easier for them to grow that than Sindhi.

1331. (74) **Effect of canal regulations.**—There is nothing in our canal regulations or rates of assessment to discourage cotton of any kind. In fact our cotton rates are extremely light even at normal prices. Even on the Jamrao, where cotton takes water for eight months, the highest rate is now Rs. 4. In the Barrage Project, I do not expect to estimate it at more than Rs. 6 on an average, though I consider Rs. 8 a fair rate, to which it may rise after a good many years. On the Lower Chenab Canal in the Punjab, the average is Rs. 7-12-0 and in Egypt I believe Rs. 15 is considered quite low.

Mr. C. M. BAKER, I.C.S. called and examined.

1332. (President.) I have been in Sind for a number of years. I have done some settlement work in Upper Sind and some in Nasik. There is little intensive cultivation in Sind. It is mostly very extensive. I should say that the people in Upper Sind are distinctly industrious. The average size of the holding there varies from five acres to ten thousand acres. There are big as well as small men. It is difficult to say exactly what the system of land tenure is but it answers to the *ryotwari* system, as Government deal directly with the holder of the land. There are some big men as well as small ones. There is very little absentee land-ownership. In some parts of Upper Sind, dry crops are grown without fallows. Elsewhere in Sind, two-thirds of the land are left fallow every year and only one-third is cultivated. In the rice country in Upper Sind, every acre is cultivated if the cultivators can get water. But, in Lower Sind, they cultivate rice every other year and the land is left fallow in between. In the cotton districts, the usual practice is to grow cotton every third or fourth year. The second year, the land is left fallow and the third year *bajra* or wheat is grown. If cotton is sown every fourth year, the land is left fallow for two years. The cultivator prefers cotton to wheat in Sind. I have practically no experience of American cotton.

1333. I am to be on special duty with reference to the proposed Barrage to examine the question of the fertility of soil and assessment. If the Barrage is constructed, there will be a considerable development of agriculture in the greater part of Sind. I have suggested that Government should reserve certain areas for the growth of long staple cotton, either departmentally or through approved persons or companies. I should think that land would be available for the purpose. There perhaps 800,000 acres of Crown waste land available.

1334. I think it would be a good thing to have at least one other Deputy Director for Sind and a botanist. I am in favour of a considerable expansion of the Agricultural Department in Sind.

1335. (Mr. Henderson.) Under the fallow rules, the cultivators can go on for four years without paying any assessment on the land but in the fifth year they must pay whether they cultivate or not. If they do not pay the fallow assessment in the fifth year, the land lapses to Government. I do not know the present rules and therefore cannot say how the fallow assessment compares with the ordinary assessment for wheat and cotton. The rules may have been altered since I have been out of Sind. They used to pay the assessment on the crop that was on the ground the last time the land was cultivated. For instance, if the crop last cultivated was rice, the rice assessment would be paid. Not very much land lapses to Government. The people are very keen on keeping the land even if they cannot cultivate it. In some cases the fallow rules have been suspended where there was great difficulty in getting water. The original idea in having the fallow rules was that otherwise a man could keep the land for ever without paying anything for it. There were men who would not cultivate even if it were possible to do so. The object in keeping land which is not remunerative is merely sentimental. The frontage rights are not clearly defined. There is no legal right, but only a principle by which the Collector is guided when he is giving out land. Frontage rights are rights under which when a piece of Government land is vacant it is given to the man whose land it adjoins. The size of the tract that would be given him would depend on how far his watercourse would go. I could not define the exact size. If there were a large bit of land which could be conveniently watered from one person's land rather than from anybody else's it would be only natural to give it him in preference to others. That is the principle of the thing. As to the application of this principle to the Rohri-Hyderabad Canal tracts, I should say that it is not clearly defined whether Government waste can be claimed under the system of frontage rights. It is not a legal right. If Government wanted land for some special purpose, there would be no difficulty in getting it.

1336. It is simply custom which restricts the cotton area in Sind to particular tracts. I have not been in Lower Sind until recently. I do not know any reason why cotton should not be cultivated in Upper Sind. It is not spreading at present but it might. I do not think that the remarks in Mr. Lucas' report in the Barrage Project that cotton could not grow in Upper Sind on account of hot winds from the Khirthar mountains is correct. It grows right under Khirthar mountains where they get water from the hill streams. I do not know whether it is a fact that before the construction of the N. W. Railway there was no cotton at all in Sind I think there must have been some for local consumption, but none to export.

1337. Some *zamindars* say that American cotton is a very delicate plant and that white ants attack it whereas they do not attack Sindhi cotton. If a *zamindar* were persuaded to grow American cotton, he would in many cases not take the trouble to see that it was grown properly but would leave it to his *haris*. He would not pay anything extra to the *hari* to grow it. He would give the seed to the *hari* and tell him to grow it. It would depend on what kind of man the *hari* was, whether it was successful or not. All the *haris* in Lower Sind are annual tenants. Usually they get an advance, which is recovered from the crop. They have no interest in improving the land. Any new crop is at the mercy of the *hari*. As a matter of fact, the *haris* generally do spend their whole lives farming much about the same land, two or three numbers in turn. The Marwari tenants are all new and not permanent. The system is a bad one. There are some fixed tenants called *maurasi* tenants in Upper Sind. They deal directly with Government, but have to pay some sort of manorial dues to the *zamindar*. There would be difficulties in spreading any new crop on account of the *hari* system. A large portion of the land is *jagir* land. The *jagirdar* may be the *zamindar* himself and owner of the land or he may simply take the place of Government, taking the Government share of the crop, in which case he will have nothing to do with the management of the land. There is a shortage of *hari* and so in some parts of Sind, the *zamindars* are more or less at the mercy of their *haris*. Where there is good land and a large population, it is not so. There they can always get *haris*.

1338. A good deal of the Rohri-Hyderabad Canal tract is already owned. There is a fairly large population now. They are all growing crops by lift now and my idea is that a man can grow twice as much on flow irrigation as on lift. It is all *kharij* cultivation now. If the barrage is constructed they will have two

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seasons. The existing population of the country is supposed to be sufficient, but I do not know much about that country, as I have not started my enquiry.

1339. In the present rice growing tracts such as the Larkhana district, the *zamindars*, certainly do not want to change from rice. I do not think there is any change of their growing cotton on their present rice lands because cotton does not pay as well as rice. I do not think they ought to be allowed to grow any irrigated crop in addition to rice in the same year even if they wanted to. The general opinion is that it would spoil the land, and waterlog the country. They get big yields of rice there. The highest yield that I have known was eight quarters to the acre—, i.e., 64 bushels which would be about 40 to 45 maunds. That was a record. The normal for Sugdasi rice in Larkhana district would be something like 40 *kasas* per *jirab*. 15 *kasas* are equal to eight bushels. This is equivalent to 80 *kasas* to the acre.

1340. (Mr. Roberts.) A good deal of the land under the Barrage Project is in the possession of big landlords. It would not be easy for the Government to acquire any portion of it except small bits required to make up compact areas of which the rest belonged to Government. That no doubt could be done. Of course people might be given land somewhere else in the same canal in exchange. That has often been done. Big men do not mind very much having another estate somewhere else. I think that it would certainly be a sound thing if Government could get possession of a part of the land, if necessary. There is a good deal of Government land already, though I cannot say exactly what the area is. The Government land is mostly in scattered patches. That could be colonized. I think it would not be a bad thing to have colonists scattered all over the tract as they would be wanted to show to local people how to grow *rabi* crops; the more there were, the more their example would spread. As to whether the big estates would make sufficient use of the water to yield Government a reasonable sum in a short time, no doubt at first there would be difficulties in changing their system, but they would take to *rabi* crops quicker than the people on the Jamrao. The people on the Jamrao are not cultivators at all, except the Punjabis and a few of the old cotton growing people. They are merely herdsmen and know nothing about *rabi*. The greater part of the area commended by the Barrage scheme is in Upper Sind where the *zamindars* are more used to cultivation.

1341. I have stated that it might be possible to grow American cotton through approved persons or companies. I could not say at present whether there is sufficient land available in compact areas to enable this to be done. If it could be done, it would be one good way of giving American cotton a start.

1342. I doubt if long fallows are necessary in Sind for other crops except *juar* which is rather exhausting. Where there is plenty of water, the fallow period is generally short. The fallow would do much good if the land were ploughed up but there is not the labour for that. It is an economic question. On the inundation canals, they cannot get water to soften the land at the right time. It would be easier to keep the land clean if the cropping were higher.

1343. There is very little cotton sown in Upper Sind. The usual time for sowing is March. Some of it is grown on inundation canals and there it is not sown at all until May or June. Some is grown on the banks of the river without any water at all just on the natural moisture of the ground. It may be flooded during the inundations. They give the land very good cultivation and wait until March to sow the cotton. They realise that if early sowing is useful if it can be done. I think that with perennial irrigation, the tendency would be to sow cotton early in March. I have often noticed American cotton growing amongst *deshi* and looking healthy. It does not generally grow so big as *deshi*.

1344. The land is very alkaline in places in Sind. There is really bad *kalar*; it occurs in much of the best rice lands and the worst land on which the rice is not actually grown is almost pure alkaline.

1345. (Mr. Wallia.) The Barrage will not affect Shikarpur at all.

1346. (Mr. Ashton.) I do not think that much could be done to increase the cultivation by wells. There is a great deal of well cultivation in Sind. In many places the water is apt to be salty and away from the river the water level is too low. In nearly all the Upper Sind districts there is plenty of well irrigation.

Mr. GUL MAHOMAD ABDUL RAHMAN, Acting Deputy Director of Agriculture, Sind.

EXAMINED AT KARACHI, JANUARY 21ST, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "*Deshi*" short staple cotton.

1347. (1) **Experience.**—I have some knowledge of all cotton growing districts of Sind and been in my official capacity in actual touch with cotton growers.

1348. (2) **Varieties.**—There is properly speaking no pure variety of short stapled cotton grown in Sind. The only variety which is a mixture of several types is known by the name of *bhit-shah*. It has derived its name from a village called Shah-jo-Bhit. In its proper home it gives a higher ginning percentage and higher yield and consequently commands from eight annas to at rupee more per maund than the crop grown from the same seed in other cotton growing districts of Sind. Seed selection by picking healthy looking bolls from the standing crop of cotton is carried out at Bhitshah and then hand ginned. The land is also carefully prepared and manured.

1349. (3) **Size of holdings.**—The sizes of holding in Sind vary from about fifteen acres to several thousand acres. The proportion of the holding under cotton is largely influenced by the availability or otherwise of irrigation water in the beginning of the season. Under favourable conditions, the figure may reach up to one-third of the total holding.

1350. (4) **Yields and profits.**—The average yield per acre is about five maunds. The profit would depend upon the market but with a price of Rs. 10 per maund of 82 lbs., the average net profit may come to Rs. 20.

1351. (5) **Rotations and manures.**—System of rotation is unknown in Sind. The lands are left fallow from two to three years to recoup their fertility before cropping with cotton. No manure, as a rule, is applied.

1352. (6) **Comparative returns.**—As noted elsewhere, there is only one kind of short stapled cotton grown in Sind, so no comparison of yields can be made between several *deshi* cottons. Cotton pays well but

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the cultivator would rather like to grow rice if he could help it, as the latter is considered to be less expensive, requiring less labour and being more paying. He would however prefer cotton to *juar* and *bajra* in cotton districts. The percentage of profit as compared to that obtained from the last named crops may be about thirty in favour of cotton.

(2) *Triumph*, the only exotic American cotton grown as field crop in Sind has so far never received its intrinsic value through the hands of buyers and, as *deshi* cotton under similar conditions often yields from five to ten per cent more, a much higher premium than so far paid for *Triumph*, viz., from Rs. 1-8-0 to Rs. 2-12-0 per maund, will be necessary to make it equally or more profitable.

1353. (7) **Conditions affecting increase in area.**—The factors which cause fluctuation in the area under *deshi* cotton are (a) irrigation, and (b) price per maund of seed cotton in the previous season. With good water supply in the beginning of the season, the area under cotton may reach its normal limit and if the prices in the previous season have been good the area in the succeeding year might increase.

1354. (8) **Uses of seed and seed selection.**—*Deshi* cotton seed is put to the following uses :—

(a) Sowing, (b) cattle feeding, (c) export.

There is no seed selection practised except in the Bhittshah tract where big and healthy looking pods are selected from standing crops and then hand ginned.

1355. (9) **General economic conditions.**—Hand hoeings in fields sown broad-cast according to the prevailing system is generally very expensive owing to the general scarcity of labour. This problem could perhaps be tackled by sowing cotton in rows to admit of hoeing operations being carried out by bullock power. Selection of seed and better cultivation are the other improvements for the better yield of the crop.

(c) *Exotic cotton.*

1356. (21) **Varieties.**—The *Triumph* variety of cotton is grown in Sind.

1357. (23) **Comparative returns.**—The average yield of *Triumph* American cotton is about four maunds of seed cotton; the profit depends upon the market value of the crop. Please see reply to question 6 (b) and (c) (paragraph 1352).

1358. (25) **Conditions effecting increase in area.**—The conditions affecting increase in area are the availability of irrigation water from April to the end of the *kharij* season and establishment of buying agencies with sub-agencies in the villages to enable cultivators to dispose of, as in the case of *deshi* cotton, their produce on the spot. These agencies should be prepared to make forward purchases also as the cultivators are in the habit of making forward sales long before the crop is ready in order to meet the current expenses of cotton cultivation. These agencies should have ginning factories of their own for the separate ginning of this cotton.

1359. (26) **Suitability of existing varieties.**—Comparative tests, so far carried out, on farms show that *Triumph* does best under irrigation in the District.

1360. (27) **Prevention of mixing of different varieties.**—To prevent mixing, there should be separate ginning factories for exotic cotton and the practice of mixing, if any, by *zamindars* might be discouraged by paying much lower prices for the mixture. As to the mixing in ginning factories, introduction of legislation may be necessary.

1361. (28) **Importation of seed.**—I am unable to give any definite opinion on this. *Triumph* cotton seems to have partially lost some of its characteristics after the fourth year of its growth. About thirty per cent. of the bolls have turned smaller in size. This may be seasonal only or there may be mixture in the seed.

1362. (29) **General economic conditions.**—Establishment of buying agencies and Government and private seed farms to produce pure seed in large quantities will be necessary for the development of exotic cotton. These farms should be under the supervision of a responsible officer of the Agricultural Department with the necessary number of assistants to help him. In fact the whole concern, viz., ginning, sale and purchase of cotton distribution of seed and the inspection of crops should be under the strict supervision of this officer.

II.—COMMERCIAL ASPECT.

1363. (30) **Local trade customs.**—When cotton crop is from two to three months old, large forward sales are made by cultivators at rates generally lower than the current market price and they obtain an advance of Rs. 2 for every maund of 82 lbs. sold, to meet their cultivation expenses. Messrs. Ralli Brothers do not, however, give any advance though they make forward purchases. When the crop is ready, sub-agents of local firms purchase cotton in villages and pay for it on the spot.

1364. (32) **Buying agencies.**—The present form of purchasing appears to suit the growers.

III.—STATISTICAL.

1365. (35) **Publication of Liverpool and Bombay prices.**—I think the publication of Liverpool and Bombay cotton prices will be of some help to cultivators provided they reach the very growers of cotton through village officers such as village school masters, *tapedars*, village pound *munshis* and heads of villages.

IV.—MANUFACTURE.

(a) *Ginning and pressing.*

1366. (38) **Saw gins versus roller gins.**—Saw gins are preferred to roller gins inasmuch as the latter are said to spoil the staple of American cotton.

VI.—IRRIGATION.

1367. (65) **Experience.**—I have some experience of irrigation under canals so far as it concerns [the raising of crops; but I have no experience of canal irrigation assessment work.

1368. (66) **Watering of cotton.**—Preliminary waterings for sowing of cottons are given from May till the sowings are over by the end of June. These waterings are heavier than the subsequent waterings. The first watering after sowing is given after one full month or a little more and subsequent waterings at an interval of about fifteen days. Each volume of water amounts approximately to 12,000 c. ft. The total number of waterings required is six to ten.

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[Continued.]

1369. (67) **Cotton versus wheat.**—As a rule, the cultivators do not prefer wheat to cotton, as cotton at present rates is more paying than wheat. Further, with the exception of one or two perennial canals, there is no *rabi* water available and in such tracts wheat is grown as *bosi* on retentive soils only. This *bosi* wheat is generally not so good as irrigated wheat.

1370. (68) **Fluctuations in river supplies and their effect.**—The increase and decrease are generally gradual but, if the decrease is sudden as is sometimes the case, all *kharij* crops including area under the ensuing *rabi* are adversely affected.

1371. (69) **Wells and tube wells.**—Wells which mostly exist in mid and north Sind are generally not utilized for irrigation during *kharij* as then the inundation canals supply sufficient irrigation water. They are, however, made use of for raising irrigated wheat and vegetables. The number of these wells, however, is very small. But for the extended irrigation in *rabi* more wells would be needed.

1372. (71) **Cropping and causes affecting it.**—On inundation canals out of a holding of 100 acres, 33 acres are cultivated annually according to the existing water supply arrangements. Of these one-third to one-half are put under cotton and the rest under cereals and oil seeds. If the water supply is regular and sufficient at the outset, more of cotton is attempted. On the Jamrao out of a holding of 100 acres, one-third, equal to 33 acres, is cultivated annually as follows :—

Kharij season (Hot weather)—

16 acres cotton.

1 acre *juar* for fodder.

3 acres *bajra* for grain and dry fodder.

Rabi season (Cold weather)—

12 acres wheat.

1 acre *senji* or other fodder crops.

1373. (72) **Adequacy of supply to increase in area.**—As a rule, areas under cotton or other crops are regulated by the availability or otherwise of irrigation water which depends on good or bad inundation. The Nasrat and Dad canals in Nawabshah district are designed to irrigate only one-third of the total holding in a year while the Jamrao canal supplies water for one-fifth of the holding in *kharij* and one-eighth in *rabi*. Thus no increase in area under cotton can be obtained with the present irrigational conditions.

1374. (73) **Deshi versus American cotton.**—Cultivators prefer *deshi* to American cotton because *deshi* is harder than the exotics and consequently the crop is more assured. Further, *deshi* cotton stands rough cultivation better and as the standard of cultivation, with a few exceptions, is very low in Sind, the Sindhi prefers *deshi* to exotics.

1375. (74) **Effect of canal regulations.**—Canal regulations do not create any difficulties in regard to American cotton, but the natural conditions with regard to the supply of irrigation water obtaining over greater part of Sind do not appear very favourable for the extension of American cotton cultivation. The inundation canals run only from June for three to four months and do not therefore supply water in April and May when this cotton ought to be sown. The Jamrao canal too, which is supposed to be a perennial canal, often fails to supply water in these months with the result that the late sown crops fall a prey to several diseases such as red-leaf blight and bollworm, etc.

Mr. GUL MAHOMAD ABDUL RAHMAN called and examined.

1376. (Mr. Henderson.) I have been in charge of cotton growing work in Sind since the beginning of 1906. Experiments were started with American cotton in the year 1905 and it has been grown on a field scale since 1910. I was also in charge of the Egyptian cotton work. The largest area of Egyptian cotton was about 5,000 acres in 1905 or 1906. We had Egyptian cotton for four successive years. I do not remember what premium it got over *deshi*. I think the price was Rs. 14 per maund when *deshi* was Rs. 7. It was decided to abandon the work on Egyptian cotton owing to water and marketing difficulties and to disease such as bollworm. It did not also receive good treatment at the hands of the growers. It had to be sown in March and as there was general deficiency of water in the canals at that time, it was given up as a failure. In the best years, the average yields obtained by the *zamindars* were about five to six maunds and sometimes as much as ten Bengal maunds. We never got a very high yield on the Mirpurkhas Farm, the highest was about eight to nine maunds. The crops have failed in the past and so the *zamindars* are prejudiced against it. If they see that there is an early supply of water and that the marketing facilities exist, then they will take to it willingly, but not as things are at present. Only a few *zamindars* think that the cotton was a failure on account of insufficient supply. The general opinion is that the crop was not successful because the climatic conditions were not suitable.

1377. I carried out experiments with practically all the indigenous cotton that I could get, and found that the local cotton was the best, taking all points in consideration. We tried Broach but it did not succeed because it was a late cotton and we also tried other cottons from different places in India. We got a collection from Mr. Gammie and grew all the cottons that he gave us. We found that the local cotton was the best suited to the existing conditions. By local cotton I mean the *Bhittshah* cotton.

1378. We tried several kinds of American cotton, Texas Big Boll Boyd's Prolific, Allen, Griffin, Cambodia Black Rattler, *Triumph* and some others. We got the seed from America. *Triumph* gave the best results. We put it out on the Jamrao first of all and on some fields the yield was about ten to twelve maunds. When I took over the charge as Deputy Director, the seed was as good as it was in the beginning. The staple was as good as before. I know that this is the case because we have been sending cotton to Liverpool and have been receiving favourable reports every year. These were forwarded by the British Cotton Growing Association. Of course, in some places where the cotton was grown by cultivators with *deshi* cotton there was a mixture but on the farm there was no mixture observed. The seed was quite all right. Of course it got mixed where it was sown along with Sindhi cotton by the cultivators. On the farm, where it was sown on separate plots, the seed was not mixed. I could not say whether the year before last there was a mixture or deterioration. Thirty per cent. of the bolls appeared to be smaller than the normal size. The plant appeared to be the same. We did not examine all the plants botanically; we simply looked at the bolls and found that thirty per cent. were smaller than the rest. The seed of these was just like the rest; red and fuzzy. It looked like American but was smaller in size. It was not *deshi*. A number of plants, about seventy per cent., were true to type, and about thirty per cent. appeared to be a mixture. There would be some difficulty

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Mr. GUL MAHOMAD ABDUL RAHMAN.

[Continued.]

1370. The largest area of American cotton on the Jamrao has been about 5,000 acres. The opinion of the Hon'ble Mr. Bhurgri, who is the chief cotton organiser on the Jamrao and has the largest area, appears to be in favour of American cotton provided there is water available for irrigation in the beginning of the season. He has indented for a large amount of seed. He sows a maund of seed on two to three acres. He indented for seed for 1,200 acres but we were only able to supply him with 300 maunds of 82 lbs. of seed. He thinks that, if the water supply at the beginning of *kharij* season is good, then the American cotton pays better than Sindhi.

1380. As regards the yield per acre, one *zamindar* obtained fifteen maunds on the Jamrao the year before last. It was obtained by Thakar Aidansingh in *deh* No. 243 Sanhro Minor, a distributary of the Jamrao. There is a good deal in the assertion that American cotton has not been given a fair trial but that is partly due to the tenant system because when the *zamindar* indents for seed, he has to distribute it among his tenants who are persons who cultivate. The cotton gets scattered in consequence and the seed is put in along side of *deshi*. When the two are picked, they necessarily get mixed up. The *zamindars* are not, as a rule, present at the time of picking and every thing is left to the tenants who do it as they like.

1381. As far as the Daulatpur Minor was concerned, where lands were given out on the condition that the *zamindars* should grow only such crops as were approved by the Agricultural Department, the *zamindars* purposely brought about the failure of American cotton in order to get the restrictions removed. They never weeded the crop. I remember to have shown a field of American cotton to Mr. Howard, when he visited Sind two years ago, where there was no trace of any crop but where weeds were growing. Side by side with it, Sind cotton was growing which had been weeded. I have no idea of the average yield of the 5,000 acres. In some places the crop failed owing to water difficulties and in some places owing to the land being saltish.

1382. *Deshi* sown in Sind yields about 20 to 25 per cent. more than American under given conditions. That figure is based on the figures available from the Mirpurkhas Farm and also from the seed farm and the cultivators' fields. The soil is not uniform. I have seen the figures for certain fields. I do not know whether they were selected fields or average ones but my impression was that from these fields the yield was from 20 to 25 per cent. more from local cotton than from American. The highest yield of American cotton obtained on the Mirpurkhas Farm was thirteen maunds. The highest yield of *deshi* since we started experimental work on the farm was seventeen maunds per acre. Mr. Bhurgri's opinion is that American cotton yields better than Sindhi. He probably cultivates his land better and the arrangement of his land is also better than that of many *zamindars* on the Jamrao. He thinks that American cotton does better on light soils than the *deshi*. He cultivates his land through *haris* but he supplies them with superior implements such as Egyptian ploughs, etc., as well as with iron ploughs and that they get more facilities than they get from other *zamindars* and their cultivation is therefore better.

1383. Inundation has been rather late during the past three or four years. Sometimes the water has risen in the canals as late as June so American cotton was not sown until the beginning of July. American cotton when sown late does not do so well as when it is sown in April because it suffers from dewfall.

1384. The sub-stations that we had were at Jacobabad and Kandhkote in Upper Sind Frontier District, Thariri Muhabat and Dadu in Larkhana district, Khairpur Daharki and Shikarpur in Sukkur district, Hala, Tando Mahomedkhan and Badin in Hyderabad district, Daur, Nawabshah, Kandiaro and Naushahro in Nawabshah district. These were demonstration plots where we demonstrated American cotton and improved implements, especially some superior ploughs. The plots were worked by *haris*. In these places, when the inundation was early or normal the American cotton did well. At Nawabshah, Daur and Kandhkote we got yields up to ten maunds. That was the highest. The sub stations have since been changed as follows: Shikarpur in Sukkur district, Khandkote in Upper Sind Frontier district, Nawabshah in Nawabshah district, Matli in Hyderabad district and Jamesabad in Thar and Parkar district.

1385. Under the present inundation canals, American has been rather unsatisfactory but if the inundation were early, then it might succeed on the inundation canals. Late inundation affects even *deshi* cotton, but when American cotton is sown late, i.e., later than May, it gets affected by red leaf blight favoured by the dew falls which begin in September. It gets diseased and suffers in yield. It sown early, the crop is practically ready by then and thus yield is not affected by disease. American cotton should not be sown later than the middle of May. Even if there is water in inundation canals at the middle of May, the cultivators may not be ready for it and the land may not be prepared. The land should be ready beforehand so that as soon as the water comes, the seed can be sown. The land must be ready by the middle of May, and the American cotton must be in the ground immediately after that and then it will be a pretty safe crop. The yield of *deshi* cotton this year is very low; on the average it is about a maund an acre all over Sind, including the Jamrao tract, due to unfavourable season. I think *deshi* is hardier than American. If American had been sown on the Jamrao this year, the yield would have been less than a maund; because, owing to the closure of the Jamrao, the water in the canal came as late as June and the sowing of cotton was not over till the beginning of August. If American cotton had been sown at that time, it would have yielded nothing at all under prevalent district conditions. I have the figures of the seed farm at Mirpurkhas showing the yield of the pickings so far obtained. The highest yield has been 260½ seers, i.e., 6½ maunds from plot No. 9 of series No. 10. The variety grown was Triumph. The size of the plot was an acre and a half. The second best yield was 238½ seers from another plot of the same series, also an acre and a half in extent. If American cotton is sown on good land in May and is given good treatment and careful husbandry, the average yield in a normal season would be about eight maunds. On the same land, the average yield of Sindhi cotton would be about ten maunds. Under present conditions, I do not think American cotton can be said to be a safe crop on the inundation canals because they have not been given a satisfactory supply. The supply always comes late in June and the canals do not flow after September. The Jamrao has not been working satisfactorily during the last ten years. There is much dissatisfaction among the *zamindars* and there is a feeling of insecurity.

1386. The cultivation of berseem is a very good thing. There is some difficulty in getting the seed and the Agricultural Department has to import seed from Egypt every year. This year the cost has come to twice the normal, i.e., Rs. 32 per maund which is beyond the reach of the ordinary cultivator. Green berseem is very popular and liked by almost all cultivators. There is a considerable demand for it at Sukkur and also at Mirpurkhas though at the latter place the demand for green fodder is limited. It is selling at six annas a maund. If we could get a supply of cheap seed, there would certainly be a demand for it everywhere for green fodder. It is more paying than wheat near towns. On Sukkur farm last year a plot of one acre yielded berseem worth about Rs 175 which was sold as green fodder. At Mirpurkhas and Sukkur, a one acre plot

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yielded about 1½ to two maunds of seed two years ago but in subsequent years, the outturn has in some cases been less than half a maunds and the highest has been two maunds and thirty seers on the Mirpurkhas Farm.

1387. Our present activities are confined to demonstration of improved implements and also of some superior crops. The staff appears to be sufficient for that purpose for the present. I have had a good deal of experience of graduates turned out from the Poona College. They did not show much aptitude for the work in the beginning. They wanted their own farms where they could use their scientific knowledge and did not like the out door work which the ordinary work of the department entailed. Consequently they were dissatisfied, but of late they have shown some improvement and are doing better than they did in the beginning. They also considered the prospects of the Department comparatively poor. I tour on an average eight months out of twelve, both in the hot and cold weather. In Sind touring is very difficult. Conditions are very hard and unhealthy. The officers of no other departments in Sind except the Agricultural Department tour in the hot weather. I do not advocate the strengthening of the Department for the activities which we have at present but, if the establishment were increased, then the activities would increase correspondingly. There is much scope for expansion. Our work is limited by the staff available. We were getting one graduate from Poona every year and sometimes two but this year the man has not come, as he was kept in Poona for the dairy.

1388. (Mr. Roberts.) The demonstration plots are run by the District Agricultural Overseers; they are supervised by Mr. Main and myself. There is always a District Agricultural Overseer, who is responsible for the work on the plots and remains on the spot. The man in charge of the plot at Nawabshah is a District Agricultural Overseer. The farm is only cultivated in hot weather as no water is available during the cold weather. He has two plots in his charge besides several experiments going on in cultivators' fields. We are experimenting with the drilling of cotton; and are introducing implements. The plots are run by the District Agricultural Overseer on the *hari* system. The *haris* cultivate the crop and the Overseer supervises them.

1389. People would sow American cotton in April and May if they had the water. Then the crop would be safe. The supply in the Jamrao is always deficient in March and April. It begins to fall from the beginning of January till the end of April. Then it improves with the rise of the river Indus. When the water supply is deficient, people hardly get water for their wheat crop; they cannot get water for the preparation of the land for *kharij* crops.

1390. The year before last, i.e., 1916, the area under American cotton was about 650 acres in different *talukas*, Sinjhore, Mirpurkhas, Jamesabad and Nawabshah. The seed was got from the Agricultural Department. Some *zamindars* sent their indents direct either to the Deputy Director of Agriculture or to me. Some sent them to the local men, i.e., to the District Agricultural Overseers who forwarded them to us. The Divisional Inspector of Agriculture arranges to supply the seed to each centre and from there it is distributed to the *zamindars*. We tried Punjab American this year with the result that it has yielded 600 lbs. per acre on the Mirpurkhas Farm as against 171 lbs. of Triumph which is partially mixed or deteriorated. It was grown at Mirpurkhas both on the seed farm and on the experimental farm.

1391. The effect of doubling the supply in the Jamrao would be an expansion in the area of cotton and also of wheat. At present only one-third of the area is cultivated. If the supply of water were increased to twice as much as we are getting now, only one-half the area would be cultivated. It would not be more than that because the land cannot stand intensive cultivation. There would have to be rotation or the land would have to be left fallow. There are no restorative crops grown at present. I think that they might take these up if there were more water. They grow things that bring them ready cash and do not as a rule grow much fodder. We cultivate practically all the Mirpurkhas farm every year with *kharij* crops and with berseem in the cold weather. So the intensity is very much nearly 200 per cent. There does not appear to be any appreciable falling off in the yield except in some bad plots which contain patches of salt. Whenever *kharij* crops are followed by berseem (Egyptian clover), there has been no appreciable fall in the outturn. We have not made any comparison between our land and that of the *zamindars* but I do not think that our crops are likely to be better than those of the *zamindars* under the present system as they let their land lie fallow for four or five years. The Sukkur experimental farm is very highly and intensively cultivated. That land was very salty and is being reclaimed. Berseem does very well there. Last year we had a very few acres under cotton as well as some *juar* and some sugarcane. The crops are still very patchy owing to *kalar*. The land was rank *kalar*.

1392. As regards ordinary cultivation, a great deal of time is wasted in clearing the land of grass and weeds, owing to its being allowed to remain fallow. The clearing is done with the plough and they do not do it by hand generally. They do some hand weeding for cotton. When cotton cultivation starts, the land is first irrigated in order to soften it and then is ploughed and sown. The rainfall this year has been abnormal, but even with an inch of rain, weeds grow.

Professor S. C. SHAHANI, M.A., Vice-Principal, D. J. Sind College, Karachi, and Zamindar, Jamrao.

EXAMINED AT KARACHI, JANUARY 21ST, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

1393. (1) **Experience.**—I have been stationed in the Jamrao tract in Sind from 1902 to 1917. I belong to a *zamindari* family, my hereditary lands being situated in the Karachi district.

1394. (2) **Varieties.**—Two varieties, ordinary *deshi* and *Shah Bhit*, are grown in the Jamrao tract. I have practical experience and special knowledge only of this tract.

1395. (3) **Size of holdings.**—Holdings in which cotton is grown in the Jamrao tract vary from two squares or about 32 acres to 15,000 acres. For want of accurate information on the point, I cannot give the average size of the holdings. The proportion of a holding to be put under *kharij* crops was at one time fixed

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at one-fifth of the whole, the Jamrao canal having been designed to irrigate during the *khari* season only one-fifth of the total area under its command, but the restriction was afterwards removed. In the Jamrao tract, a larger area is put under cotton than under *bajra*, another important *khari* crop. Exact information on this head could be furnished only by the Revenue Department.

1396. (4) **Yields and profits.**—The average yield of both the varieties now is about four maunds of *phuttis* per acre, (unginned cotton) and the average profit about Rs. 6 per acre.

1397. (5) **Rotations and manures.**—There being no intensive cultivation in the tract, no rotations are followed, and no manure except the farmyard, the supply of which is always limited, is used.

1398. (6) **Comparative returns.**—*Deshi* long staple cotton is not grown in the tract.

(2) *Bajra* is another *deshi* crop that is grown in the tract. Its average yield is very small, about two to three maunds an acre.

(3) American cotton (Triumph variety) has been grown in the tract but almost invariably late, on account of which its yield has been about half of the *deshi* short-staple cotton.

1399. (7) **Conditions affecting increase in area.**—The fluctuation in the area under *deshi* short-staple cotton is never large. But any fluctuation that there is, is due to the uncertainty of the water-supply from the canal. With adequate improvement in the water-supply, the area could easily be quadrupled.

1400. (8) **Uses of seed and seed selections.**—The seed is not pressed in the tract. Seed selection is practised only to a very limited extent. Messrs. Ralli Bros. at times employ labourers to remove diseased or damaged *phuttis* from the lot from which the seed for sowing purposes is derived, and supply the seeds so derived at slightly enhanced prices. Specially hand-ginned seeds was obtained from the Hala division, but the profit accrued to the owners of ginneries and not to the cultivators, and the practice has been discontinued.

1401. (9) **General economic conditions.**—The irrigation of the tract is very defective. The water-supply is inadequate and uncertain. The law favours the cultivators running away with the advances to them from the *zamindars*. This has made the cultivators dishonest and inefficient. The Sindhi cultivator is badly off and therefore improvident and idle.

(c) *Exotic cotton.*

1402. (21) **Varieties.**—One variety of American cotton, Triumph, is grown in the tract with which I am acquainted.

1403. (25) **Conditions effecting increase in area.**—Improvement in the available irrigation, command over the cotton markets, and improvement in the conditions of the cultivators' life will increase the area under exotic cotton—American, and Egyptian *Abbassi* and *Metaffiffi*, especially the latter. The American and Egyptian cotton will succeed, in my opinion, in the tract, if water for them be available from February each year, and if we can sell well the outturn.

1404. (26) **Suitability of existing varieties.**—Still superior types could be introduced.

1405. (27) **Prevention of mixing of different varieties.**—The mixing could be prevented with comparative ease by reserving those portions of the holdings (exotic cotton cannot be grown on all of those soils on which *deshi* cotton can), which are fit for the cultivation of exotics for those varieties alone, and by storing the yields in separate godowns. I have no actual and special experience of the ginneries.

1406. (28) **Importation of seed.**—It has appeared to me necessary to renew the seed every fourth year by importing it direct from America or Egypt as required.

II.—COMMERCIAL ASPECT.

1407. (30) **Local trade customs.**—Rallis are the chief buyers of *phuttis*. They make present and future contracts. The *banias*, who ultimately sell to Rallis and the other European cotton merchants in Karachi, give an advance of Rs. 2 per maund. Rallis give no advances.

1408. (32) **Buying agencies.**—A buying agency of the cultivators themselves that gins and then sells cotton to the European merchants is the best.

V.—GENERAL.

1409. (47) **Effect of water rates.**—The water rates charged hitherto have not had any effect on the cultivators' preference for a particular crop.

1410. (48) **Desirability of alteration to water rates.**—Improve the water-supply and charge more.

1411. (49) **Effect of tenure of land.**—Power to transfer the land held under Act III in the Jamrao will put the land into the hands of active cultivators and will thus extend the cotton cultivation.

VI.—IRRIGATION.

1412. (66) **Watering of cotton.**—Cotton should be watered on hard clayey land every week and on soft sandy loam once every three weeks.

1413. (67) **Cotton versus wheat.**—The reason of the preference for wheat to cotton is less water required for wheat.

1414. (69) **Wells and tube wells.**—As a rule the sub-soil water in the tract is salt. I have no experience of tube-wells. Wherever sub-soil water is sweet, tube-wells will be a desideratum.

1415. (72) **Adequacy of supply to increase in area.**—Sufficient water is not available, and the water available is not properly distributed.

1416. (73) **Deshi versus American Cotton.**—The cultivators prefer *deshi* cotton because under the existing conditions it yields better.

1417. (74) **Effect of canal regulations.**—The canal regulations create difficulties owing to water being not made available for irrigations in February each year.

Professor S. C. SHAHNI called and examined.

1418. (Mr. Henderson.) I am Professor of English as well as Acting Principal of the D. J. Sind College. My own idea is that the cultivation of Egyptian cotton was a success and I think it would be successful if an adequate water supply in the month of February could be assured. I used to sow it in March. Water was wanted in February to prepare the land for sowing. The best yield was about eighteen maunds an acre. I

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was the first man to cultivate Egyptian cotton in Sind and I cultivated it all the years that Government went on with it. I am not cultivating it now but am cultivating American. The difficulty with Egyptian cotton was bollworm on account of growing the cotton so late. When the dews set in, the bollworm begins; here the dews set in in October. Where there were favourable conditions and good land, the average yield of Egyptian cotton was about six to seven maunds. I grew both *Abbassi* and *Metaffiffi*. I prefer the latter as it was hardier but the former was silkier and more handsome. It was very difficult for us to sell Egyptian cotton as we had no market just as we now have no market for American. As a rule, it could not be sold for more than Rs. 12; though sometimes it got up to Rs. 14, whilst the lowest price for *deshi* at that time was Rs. 6. We finally gave it up as water was not available and there was difficulty in selling it. There were no buyers and but for the arrangements made by Government, we should not have been able to get more than a rupee a maund over the price of *deshi*. If there were a proper organisation and a good supply, I would still grow it, but there is one thing which has to be remembered. All land is not suitable for the cultivation of Egyptian cotton and neither is all land suitable for the cultivation of American cotton. The land should be selected land. If conditions were favourable, I would not despair. If the Rohri-Hyderabad Canal were to command the Jamrao tract, I can say with a fair amount of certainty that Egyptian cotton could be grown under favourable conditions over a very large area just as in the case of American cotton. If we got water early enough, we should prepare for *rabi* cultivation early in September. The Jamrao has sometimes worked very well, but it is now working very badly. I have great difficulties.

1419. I have got 3,500 acres, some on capitalist terms and some on *zamindari* terms. That is all permanent. I have only nine to ten squares on temporary lease given me for this year for the cultivation of wheat. It is essential to grow a great deal of berseem, if there is water available. I have tried it and found it very useful in improving very bad land. Fallows are not at all necessary and spoil the land. Our monsoon has improved and the result is that the land gets covered with weeds. Labour is very scarce. I am earning nothing on account of the contraction of my outlets and the dishonesty of the cultivators who run away with the *takavi* advances given them. No help is given to the *zamindars* in the matter of the recovery of his advances to the cultivators. The cultivators can run away with impunity and they do so. One thing that demoralises the cultivator and diminishes the agricultural return is the dishonesty of the cultivator which is stimulated by the fact that it is legally difficult for the *zamindar* to recover any of his advances to his *havis*. The *zamindars* should be helped to recover their rents in the same way that Government recovers its dues. They should be allowed to distrain through the *Mukhtarkar*. It takes months to recover anything through the civil courts. You have to neglect your work and run after pleaders and the like. Matters will never right themselves until there is a radical change in the statute law. There is only one other way of getting out of the difficulty and that is to determine not to give any advances under any conditions and this I am going to try.

1420. American cotton is bound to be a success if properly cultivated. It has a longer staple and is a very useful cotton and I do not know that the yield of American cotton which is grown at the proper time is in any way less than that of Sindhi cotton. It may be just a little less, because the *hari* is not very keen on it because he does not get any thing out of it. If it got its proper value, it would go ahead. I have seen the prices in the Punjab. Here we are getting only one rupee more per maund than for *deshi*. I sold my American cotton yesterday at Rs. 19-12 per maund, and *deshi* was sold at Rs. 18-12. It was a small quantity; I had only 25 maunds to sell and had that only because I did not like to discontinue the cultivation of American cotton. Messrs. Rallis obliged me by buying it. I sowed it in March. I sowed it before the Jamrao was closed and left it unirrigated until it was reopened. It was cultivated very indifferently; and so does not offer any standard for judgment. Other things being equal, *deshi* ripens in five months and does not suffer from dew. American cotton also ripens in five months but it does suffer from dew. If it was grown in time, I do not think it would give less than is given by *deshi*. American is always picked first; even when *deshi* and American are sown together, it is always American which is first picked. It is really earlier than *deshi*. As a matter of fact, I am distinctly pessimistic about the prospects of American cotton until irrigation conditions are altered. The Jamrao can give water but one does not always get it. There is one other difficulty: if only a few people cultivate American cotton and the rest close their outlets, then naturally the Irrigation Department does not allow enough water into the minors. The result is that you have to go without water even if it is available and you want to sow American cotton.

1421. (Mr. Roberts.) If the intensity of cultivation were higher, the labour conditions would improve as the cultivators could save more. We had no difficulty in the early days when water supply was better and the land was virgin. On 85 acres set apart for the cultivation of Sindhi cotton, I have been able to secure an average of eighteen maunds. That was in the beginning. That land was no better than it is now, but conditions were different. Under present conditions, even flow land has had to be converted into lift land. If the intensity of cropping were higher, people would go in more for restorative crops like berseem. They would certainly do so in place of fallows. With an assured water supply, the people could certainly pay more water rate. A consolidated rate of Rs. 8 per acre would then be quite equitable and reasonable.

1422. I have noticed that old seed does deteriorate. When I grow *Metaffiffi* and *Abbassi* I found it necessary to renew the seed. I often requested Mr. Henderson, the Deputy Director of Agriculture, to get me seed from Egypt and I sent for some seed myself.

1423. (Mr. Hodgkinson.) Egyptian cotton is more susceptible to boll worm than American cotton. If one could grow Egyptian or American in the beginning of March, then it probably would be less affected. American has been entirely free from bollworm but I have never found Egyptian cotton entire freely from it.

Mr. T. F. MAIN, B.Sc., Deputy Director of Agriculture in Sind.

EXAMINED AT KARACHI, JANUARY 22ND, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

1424. (1) **Experience.**—The questions set by the Committee have been dealt with by the acting Deputy Director of Agriculture, Mr. Gul Mahommed. I shall not therefore reply categorically to those questions but confine my remarks to a general statement of the cotton problem in Sind as I see it. My recent experience

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[Continued.]

of Sind extends over a period of some two years, but I served in this Province for eight months in 1906-07. The intervening period 1907-1915 was spent in the Presidency proper. I shall restrict my remarks to Sind where I am now serving.

1425. *Economic conditions of Sind.*—(i) *Land.*—There is no scarcity of land in Sind and the soil being alluvial is naturally good; sand and silt exist but are not relatively extensive, but the presence of *kalar* salts renders large areas infertile or inferior. There is still plenty of good land and this will be perhaps the last of the economic features of the country to set a limit on increased cultivation.

(ii) *Irrigation facilities.*—For practical purposes, Sind is dependent upon canals for its water-supply as the rainfall is almost negligible. The canal system of Sind has grown rapidly in recent years, the annual increase of cultivated area averaging about 100,000 acres. In the absence of a barrage, however, the water-supply is most irregular and uncertain. The agriculture of Sind is subject to all the vagaries of the river; if it rises timely, then only a good agricultural year can be counted upon. Sometimes crops are sown only to wither owing to a temporary fall, while a premature termination to the inundation season leaves crops unmaturing. All these occurrences are common experience and not the exception. For this reason, the area under cotton varies enormously, e.g., the 1916-17 crop was thirty per cent. below normal in spite of war prices, while the sowing of the 1917-18 crop was likewise seriously delayed.

(iii) *Population and labour-supply.*—Owing to the increase of canal mileage and the improvement in the design of pre-existing canals, Sind has, in many respects, the character of a new undeveloped country with its attendant disadvantages as well as advantages. Until about a quarter of a century ago, the population was principally confined to the lands lying immediately adjacent to the Indus River, but with the construction of the Jamrao canal and other works, cultivation has spread further afield. These new areas have had to be colonized and are still largely underpopulated and greatly dependent upon a floating labour population from Marwar which ebbs and flows with the monsoon conditions of that country. This economic feature of the Jamrao tract is of great significance as it is the prototype of the eastern part of the great Triple Canal scheme associated with the Sukkur Barrage Project. It is therefore necessary to emphasise the inadequate supply of labour now and in the future.

(iv) *Agricultural holdings.*—Sind is a *zamindari* country and large holdings are the rule, but *zamindars* do not farm their lands as single units. On the contrary the tenant (or *hari*) system everywhere prevails, the landlord receiving a share of the produce. Good tenants for the colonized tracts are difficult to secure or keep, and this is one of the chief complaints so commonly heard on the Jamrao canal. The agriculture of the country in fact is carried on on small holdings, each tenant possessing one or two pairs of cattle and the standard of cultivation varies considerably. This is an important consideration in its bearing on the introduction of agricultural improvements; if, for example, a *zamindar* is supplied with seed sufficient for fifty acres it may be found on inspection sown on fifty distinct areas, each surrounded on all sides by the *deshi* variety.

(v) *Standard of agriculture.*—This is distinctly low and improvement is difficult in view of the *zamindar* not being the farmer himself. It is common to hear a *zamindar* remark that he quite approves of improved implements but his tenants object to them on the ground that their cattle are weak. These tenants are all poor illiterate men and financially dependent upon the *zamindar* for carrying on their business from year to year; they are not therefore in a position to lay out much capital on cattle and implements, with the result that the conditions of a high standard of agriculture, viz., strong draught animals and efficient implements, are largely absent. Nor does the efficiency of the Sindhi labourer in any way compensate for these defects. In addition to the above, there are two distinct obstacles in the way of high class agriculture, viz., the absence of manure and the lack of a good restorative crop as the people do not eat much *dhal*. In spite of these adverse conditions, the crops are by no means universally bad; on the contrary, good crops are frequently seen, especially on the old non-colonized areas, where, however, the labour-supply is steadier. On the Jamrao canal, a good crop can generally be ascribed to a long fallow rather than to any other cause.

1426. (2) *Varieties.*—In the first place, I may point out that cotton has never held a predominating position in Sind agriculture. Even now the cotton area in an average season is about $1\frac{1}{2}$ lakhs of acres only, but the tendency in recent years has been strongly in an upward direction. There is only one *deshi* variety of commercial importance, viz., a mixture of several types of *neglectum*, a short staple cotton showing with “Bengals” the lowest position on the Indian market. On the other hand, this cotton suits Sind admirably, being hardy, early maturing and prolific, capable of yielding up to twenty maunds per acre under very favourable conditions and commanding last year a rate of Rs. 10 per maund. For this reason, there is no dissatisfaction among the people with the *deshi* variety. It, in fact, enables cotton to take a primary place in the agriculture of those tracts where cotton is cultivated, and rice is only the crop which the people would care to substitute for it, which, however, is not practicable owing to the limited water-supply.

1427. (3) *Size of holdings.*—A cultivator puts one-third to half or even more of his allotted area under cotton, but it is important to remember that only one-third of the occupied land on the Jamrao canal can be cropped in one year, so that if an area of eighteen squares be taken at random only two to three squares will be found cropped with cotton. The possibilities of increasing the cotton area are therefore two-fold: (1) by the introduction of canal irrigation into tracts not at present served and (2) by increasing the supply of water in existing canal areas.

1428. (4) *Yields and profits.*—The profits of agriculture under the share system are somewhat complicated because of the double claim upon them, by the landlord and by the tenant. For example, if a crop of cotton cost Rs. 25 per acre to produce and realized Rs. 50 (five maunds at Rs. 10) the profit would be Rs. 25, but the man who raised the crop would receive only Rs. 12½, which would leave little or no profit to him apart from his wages. The landlord, after deducting his minor contribution to the total expenditure would be left with some profit. The landlord's profit partakes of the nature of interest on capital invested in cotton land rather than in cotton while the tenants profit seems to be a more correct index of the profits of agriculture, in this case cotton. The tenant's profits are therefore a more important guide to the future prospects of any particular crop than are those of the landlord, but for general purposes the landlord's profits may be taken.

1429. (5) *Rotations and manures.*—It has been pointed out that there is no manure in Sind and no restorative crop. The former phenomenon arises out of the lack of any need for manure which has hitherto existed in Sind owing to the great surplus of land and the consequent facility for fallowing which serves the same purpose. When pressure on the land becomes greater, there will be more cattle and the people will take more care of it but this will not happen in the immediate future and an extension of cultivation

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will tend to extensive rather than intensive methods. As regards a restorative crop, my predecessor, Mr. Henderson, introduced *berseem* (Egyptian clover) which answers the purpose admirably in perennial canal tracts, but the cost of the seed is still very high.

1430. (8) *Uses of seed and seed selection.*—As regards seed selection, I have already mentioned that the *deshi* cotton of Sind is a mixture. It, therefore, follows that there is much scope for separating the constituents of this mixture and ascertaining by trial which is the best member. Work on these lines has been initiated at Mirpurkhas.

1431. *History of exotic cotton in Sind.* The history of the department's present efforts to introduce stapled cotton into Sind goes back to 1904. For the first six or seven years, work was largely concentrated on Egyptian cotton but this was abandoned about 1912 when the decision was arrived at by Messrs. Henderson and Smart to concentrate on American cotton. The chief reason for abandoning Egyptian cotton was its long maturity period which necessitated sowing the seed in March, whereas the irrigation facilities existing in Sind are inadequate for cotton with this characteristic. Mr. Henderson left on record the opinion that *McIntosh* Egyptian cotton would do well in Sind or parts of it, granted improved irrigation facilities.

(2) During the last six or seven years, a great number of American cotton have been tested on Government farms, but Mr. Henderson soon made up his mind that *Triumph* was the most suitable variety for Sind owing to several characteristics, of which early maturity is perhaps one of the most useful. Accordingly arrangements were made in 1912 to import forty tons of *Triumph* seed from America and this was distributed in the following years to cultivators as part of a scheme entered into with a Bombay syndicate formed for the purpose of providing a buying agency which would pay the intrinsic value of this cotton. Recent years have shown that this cotton is very susceptible to red-leaf-blight and fields of it generally take on a very unhealthy appearance from August or September onwards. This cotton has also lost some of its special characteristics, such as big bolls, either because the original consignment of seed was not pure or the result of deterioration or both, but the writer thinks natural deterioration has been an important factor.

(3) It will thus be seen that the method adopted in Sind for ascertaining whether it is a long staple cotton country has been the “Trial and rejection” method of existing varieties imported from other parts of the world. As the province owing to financial reasons has not been equipped with a botanist, the more rational or scientific method of evolving a special cotton to suit the conditions of Sind by applying all the artifices known to the botanist profession has never been in force. From this it follows that no definite answer to the question “Can Sind grow a long staple cotton?” is at present possible. The method followed in the past is not capable of providing a final or definite answer and it remains with the Bombay Government to decide whether the importance of the problem justifies the expenditure of adopting the rational method referred to above which alone is capable of clearing up the issue, but no doubt that decision would be largely influenced by any recommendation made by the Cotton Committee.

II.—COMMERCIAL ASPECT.

1432. (32) *Buying agencies.*—If question 32 refers to *deshi* cotton I have no particular observations to offer, but if it refers to some improved or exotic cotton then I think the type of buying agency developed at Mirpurkhas by the Bombay Syndicate is a good one; provided certain additional precautions are taken to secure the interest of the cultivator and that the Syndicate guarantees to purchase improved cotton at its intrinsic value irrespective of small supplies, but in point of fact, some cultivators were able last year to obtain a better premium than others and it seems necessary to devise some means of exercising a check on the Syndicate's prices. The Syndicate should also develop greater touch with the villages; such an organization, as Messrs. Ralli Brothers possess, for penetrating the interior villages is necessary, otherwise growers will complain that it is easier to market *deshi* cotton than improved varieties.

III.—STATISTICAL.

1433. (33) *Improvement of cotton forecast.*—The forecasts are proverbially unreliable. Formula figures exist for each district whereby anna valuations are convertible into lbs., e.g., 800 lbs. per acre may equal a twelve-anna crop in some particular district. The weakness of this formula lies in the probable inaccuracy of 800 lbs. being a normal or twelve-anna crop. To prove it would require an immense amount of test work more than is practicable, but something in this direction is necessary if approximately accurate information is to be obtained. Then, again, the valuation of the crops is done by Revenue officers who are not expert valuers and hence a man may value a crop at eight annas when it is really ten. I can suggest no remedy for this difficulty, but as regards the next point, viz., whether twelve annas or sixteen annas is a normal crop, I think the matter should be investigated and definitely recorded for each district for the guidance of all concerned.

1434. (35) *Publication of Liverpool and Bombay prices.*—I am strongly in favour of such a scheme, but conversion to local terms would be necessary for cultivators to take full advantage of the information.

General.

1435. *Organization for handling cotton.*—In para. 1431 above I have indicated the need of a botanist to do the research work necessary to secure the best possible cotton for a given tract. This work should not form a part of the Deputy Director of Agriculture's duties because in my opinion the two duties are incompatible. Research demands a very great amount of attention to detail and almost daily observations, rendering it essential for the officer in charge to remain on the spot for long uninterrupted periods which, in the case of cotton, would in many provinces, coincide with the best touring seasons when the Deputy Director of Agriculture should be engaged on his district work.

(2) Seed farms under the Deputy Director of Agriculture for the multiplication and supply of pure seed are necessary and from the next step after an improved variety has left the experimental station. Before distributing seed among cultivators it is very desirable to have a certain minimum quantity in order to get that variety sown over continuous areas, if possible, and make it worth the while of cultivators to give it separate attention, but perhaps the chief need for seed farms lies in the fact that there is no other reliable agency for the production and multiplication of a limited supply of botanically pure seed, so that in their absence, the variety is liable to become lost or its quantity so reduced as to become negligible for agricultural purposes.

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(3) The stage beyond the seed farm takes the variety outside the sole control of the Agricultural Department. At this point it is necessary to devise some organisation which will admit of the extensive development of the new variety under some measure of Government control. This organization would include a district staff under the Deputy Director of Agriculture, each member of which would be given a unit area (say twenty villages) to operate in and his duties would consist of supervision and inspection as well as seed distribution. The seed would be supplied to selected cultivators who, by preference, should be registered as seed-growers for Government and subject to inspection. They would be under agreement as regards the disposal of the produce which would enable the department in the first instance to control the further distribution of the seed grown by them. Beyond this stage, the department's executive duties could not proceed and some form of co-operation would have to replace it. It should now be possible to form a group of registered seed-growers into a "ginning and seed-supply" co-operative society either owning its own gin or renting one, also owning a seed-farm and maintaining one or more trained agricultural overseers to watch over the society's interest by the inspection and supervision of the work of individual members. These overseers would in the first place be lent from the department and subsequently transferred so that the withdrawal of the department would be gradual and the confidence of the public would imperceptibly pass over to the society as a reliable and independent agency for the supply of good seed. The usual co-operative development would follow, such as the formation of unions, which would facilitate the marketing of the ginned cotton to the best advantage and the purchase of machinery on trade terms.

(4) The foregoing remarks assume that there will be a ready demand for seed of the variety in question. This may be so in the case of selected or improved *deshi* cotton but is not so probable in the case of an exotic against which all manner of prejudices arise. In order to break down such prejudices and to remove all obstacles in the way of the introduction of such a variety, the Agricultural Department must take suitable action. Such action might take the form of supplying seed at concession rates; compensation if loss is incurred but more important still, the establishment of a buying agency which would enable growers, without incurring grave inconvenience, to secure the proper rate for their produce. The type of buying agency which I would recommend has already been referred to in paragraph 1432 above, but where the trade are not inclined to co-operate in the establishment of such an agency then auction sales could be organized.

1436. (27) **Prevention of mixing of different varieties.**—As regards the field, the chief measure to be recommended to prevent the mixing of *deshi* cotton with an improved or exotic variety is the provision of a good buying agency for the supply of pure seed. In the early stages, such an agency must be in the hands of the department and the chief points to aim at are (i) the establishment of a sufficient number of distributing centres and (2) an abundant supply of seed so that a cultivator will not be tempted to fill up areas where seed has failed to germinate with any other variety more readily obtainable. In addition to this, so long as other varieties are largely grown, the inspection of the growing crop will be necessary so as to exclude the produce of mixed crops from reaching the gin intended for the pure variety. As regards the factory, I think the conclusions recently arrived at by the Punjab Government are sound, but the danger might be eliminated by the establishment of co-operation as indicated in paragraph 1435 above. The precaution originally taken at Mirpurkhas was to exclude all other cotton from the Syndicate's factory but this did not prove practicable, but would have done so had the American cotton been available in sufficient bulk.

1437. (28) **Importation of seed.**—This is a risky arrangement. As there is no certainty that a consignment of several tons of seed would prove botanically pure, there would probably be some admixture of other types than that desired which, in time, would affect both the crop in the field and the cotton in the mill. On grounds of expense also, this method should be avoided, if possible. It is, moreover, making rather a severe demand on nature to expect a cotton imported from America to maintain all its characteristics intact under totally new conditions.

VI.—IRRIGATION.

1438. (67) **Cotton versus wheat.**—Experience in Sind indicates that at the present time cotton is a more desirable crop than wheat in tracts suitable for cotton; the profits in a normal year for both crops are in favour of cotton, but this may not always be the case as wheat demands better tillage than it has hitherto received, while it is less exacting on casual labour. The main reason, however, why wheat is not such a desirable crop as cotton is because the *rabi* water-supply has proved so precarious.

1439. (69) **Wells and tube wells.**—I do not think there is much future for supplementing canal irrigation with well irrigation in Sind for staple crops like cotton. The difference between the cost of well water and canal water is enormous and any cotton dependent upon supplementary well water would be grown under a crushing disadvantage as compared with cottons requiring canal water only. Moreover, there would be no security for capital invested as canal water subsequently made available would render a well obsolete. I am aware that such an arrangement does exist in some parts of India, but am under the impression that in such tracts cotton occupies only a small percentage of the cropped area. It is difficult to see how the economies of any particular tract would permit of this dual-type of irrigation. The manual and bullock labour required to work the wells would presumably be more than required during the period when canals are open.

1440 (71) **Cropping and causes affecting it.**—On the Jamrao canal in a normal year, the cropping distribution has been estimated at—

44	per cent. cotton.
20	" other <i>kharij</i> .
36	" <i>rabi</i> (mostly wheat),

(2) If the Sakkur Barrage scheme is carried out (which I am strongly in favour of), then these percentages might be expected to alter in favour of wheat for two reasons, (1) wheat cultivation at present is restrained by the scarcity and unreliability of the *rabi* water-supply and (2) *zamindars* are experiencing great difficulty in securing enough casual manual labour for weeding and picking cotton. At present a good supply of water at the beginning of the *kharij* season guarantees a large cotton area because *zamindars* are uncertain whether the *rabi* supply will or will not enable them to grow wheat. The growing of fodder crops does not at present exercise much influence on the cotton or wheat areas as the people are careless of their cattle and trust too much in the fodder requirements being met by the weed growth in their cotton fields and uncultivated areas. Nor do rotations much affect the issue for reasons already entered into.

Mr. T. F. MAIN called and examined.

1441. (President.) I have been in Sind for the last 2½ years. Before that I served for eight years in the Presidency proper. My headquarters were at Poona and I was working very largely in the cotton tracts

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of the Presidency, e.g., Khandesh, Gujarat and the Southern Mahratta country. Cotton there is a dry crop. It has six districts in my charge in Sind. I believe the total area of Sind is about 30 million acres, of which the culturable area is about thirteen million acres. Agricultural work is going on in Thar and Parkar, Karachi, Sukkur and Larkhana; and there is a little in Nawabshah and Hyderabad. There is only one district in which we have not done anything, and that is the Jacobabad district. There were some attempts to start American cotton in Jacobabad some years ago but they were not successful.

1442. As regards Thar and Parkar, when the Department started work in 1903, a cotton plot was opened at Dharonaro but the following year all the work was transferred to Mirpurkhas where an experimental farm for Egyptian cotton was started by Mr. Fletcher. The work on Egyptian cotton went on for six or seven years, and was the chief work on the Mirpurkhas farm. When Mr. Fletcher left in 1907, Mr. Henderson took over and he worked largely on the question of rotations and producing leguminous crops. He introduced berseem from Egypt. His principal experiments on the farm were in regard to rotations. He had a two years' rotation and a three years' rotation, to see if he could get over the difficulty in Sind of having so much land fallow, i.e., two or three years' fallow to one year's crop. I reviewed some of these experiments a year ago. By cultivating berseem, it seems possible to crop continuously, but the crops are not so big. Subsequent to Mr. Henderson's taking charge, Egyptian cotton was discontinued and American cotton took its place. The reason for the discontinuance of Egyptian cotton was essentially irrigational. Water could not be got early enough for sowing, as water was required in March and April. Mr. Henderson realised that American cotton had a future in Sind and persuaded Government to open a seed farm of 200 acres about two or three miles away from the experimental farm. That farm was opened in 1912 and has been used principally for growing American cotton and demonstrating how it can be worked in with berseem. That is the principal work in the Thar and Parkar district. The result on the seed farm was that, two years ago, the average outturn of American cotton on 100 acres was just under eight maunds an acre, the variety being Triumph. According to the Liverpool reports, the staple was 1½ inch to 1¾ inch. One very important point connected with it was the ginning percentage. I sent two samples to Liverpool from the same plot; one roller ginned and one saw ginned. The staple of the saw ginned sample was classed as 1½ inch and that of the roller ginned as 1¾ inch. Mr. Hutton pointed out that that made all the difference as the staple of the saw ginned cotton came into the class which was most in demand in Manchester. He stated that if there were sufficient quantities available, the cotton would be in very great demand in the Lancashire market. In the first year, it was valued much too low, 1½d. below "Middling American." The next year it came up to "Middling." The last valuation was also about the same as Middling. Possibly the first year the cotton was not clean enough. Until this year we used to send bales. This year 1917 we sent only a small sample. The reason was that Mr. Keatinge was more in favour of marketing the cotton in this country than of selling it to Lancashire, but I preferred the latter course. We have no more farms in the Thar and Parkar district. We have a demonstration plot in Jamesabad which is worked by an ordinary cultivator, on the *hari* system under which we give him half the produce. We have to do more than the ordinary *zamindar* does in the way of supervision. It is very difficult to get *haris*. It is difficult to run the plots without a good deal of supervision. For demonstration purposes, I am rather inclined to favour complete control by Government, i.e., to have a trained *jamadar* or *kamdar* in charge because otherwise it is impossible to get a man who takes sufficient interest in the work and can demonstrate an improvement such as the use of an iron plough to the best advantage. The *hari* system has not this advantage. It is only a system of labour, and the *hari* has become a much more powerful man in recent years.

1443. In Sukkur, some rather bad *kalar* lands have been taken up on the banks of the Indus river. A pumping plant was installed there and the land was reclaimed. It is a farm on which we get absolutely certain perennial conditions because we pump the water ourselves. Rice and berseem were grown a good deal at first. On certain parts of it we can grow crops like cotton and wheat but there is still a good deal of salt. It is very difficult to reclaim the worst patches of *kalar*. We have got some results with cotton on a small scale. Triumph did fairly well but suffered a great deal last year from leaf blight. *Deshi* cotton has done well also. The outturn of *deshi* cotton in the Jamrao tract is about six maunds an acre but on the Hyderabad canals it goes higher than that. About twenty maunds of *deshi* per acre have been produced on the farm at Mirpurkhas. The point about the Sukkur farm is that post barrage problems can be worked out there: it is not suitable for present conditions as there is no perennial irrigation in that part of the province. The intention now is to work out post barrage problems and the use of cold weather water in rice tracts. It is practically an irrigation problem.

1444. In the Karachi district, we have an experimental farm at Landhi, situated in a garden tract along the Malir river. It is a big potato centre. We are working more on potatoes but there are indications that sugarcane is going to do very well. The water is provided by wells, as there is ample subsoil water in the subsoil. I tried cotton last year; and got a yield of nineteen maunds of *deshi*. American was tried for a few years but the farm is too near the sea and it did not do well owing to the strong breezes.

1445. At Nawabshah, we have only got a plot in Nawabshah itself near the railway station which is worked by a *hari*. It is very difficult to grow any crops in that tract owing to the great fluctuations in the river.

1446. At Larkhana, we have a farm situated on both sides of the canal. On one side rice is grown and on the other a dry crop, chiefly wheat. The farm is on the right bank of the Indus. The common opinion is that cotton cannot be grown in that tract, owing to the hot winds. We have grown it for a year or two and it seems possible to grow it.

1447. The position is that we have tried cotton more or less on all our farms and plots. My general impression as regards the possibilities of exotics is that Sind will be an American cotton country only if we get proper irrigation facilities. My view is that the whole future of the province depends absolutely on the barrage. Everything turns on the barrage. Given that, there does not seem any reason why it should not be an American cotton tract. The details, i.e., the best variety will have to be worked out.

1448. I do not find my circle so heavy as one in the Presidency but it is pretty heavy. I tour for fifteen to twenty days in the month, or say 250 days a year. As to whether the staff is adequate for the area, I should say that much depends on what the policy is to be and whether post barrage problems are to be worked out. There is a proposal to establish patches of perennial irrigation in central places so as to accustom people to the conditions which will obtain after the barrage is constructed. That might involve the opening of three more large farms, say of 200 acres each because the land would have to be worked on farming conditions rather than on experimental conditions. That would perhaps mean the appointment of another Deputy Director. Judging from my experience, there is enough work for two Deputy Directors if there is to be any development.

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Apart from this work, I am interested in wheat. Outside the barrage tract, the rest of Sind is largely a wheat tract. We have recently got money out of the wheat profits scheme which will enable us to take up work on wheat. Single handed as I am at present, I give most of my time to cotton. I try to avoid what I call fine work.

1449. I consider that a Deputy Director should not attempt to do very fine botanical work so that my efforts have been more or less of a rough character, just block selection, to see whether American cotton will generally do. There is justification for a botanist for cotton work in Sind. That has been our trouble; we have had to do our own botanical work. Neither of the Bombay Botanists does much cotton work. I do not think that a botanist should be permanently stationed in Sind to make investigations into the American cotton question. He should investigate the question, say for five or ten years, if necessary and then the Deputy Director should take it off his hands. The indications are that a great deal of careful work is necessary. Triumph suffers a good deal from disease. We want a research officer who could remain in the Province for some time.

1450. The question of forecasts is rather a difficult one. I do not think that the Agricultural Department can assist much in the compilation of forecasts because there is not a big enough staff for the work. At present my fieldmen and I make general observations when we are on tour. The fieldmen send in reports to me and with the help of these reports and my own information, I write a very brief report and the Director of Agriculture refers to that but it is only for a rough check of the figures submitted by district officers that this report is made out. The officers of the Land Records Department deal only with areas.

1451. I have got one Divisional Superintendent, recently called Superintendent, and ten fieldmen who are graduates. The other fieldmen are merely local men picked up and trained. I am inclined to favour having our men trained in the Punjab because the conditions here approximate much more closely to those of the Punjab than to those of the Presidency Proper. My view, after having been both in Sind and in the Presidency, is that we can never recruit men from the Presidency for Sind as they do not like serving in Sind. The Punjabis have not the same objection. We send two men up to Poona every year and the same arrangements might be made with the Lyallpur College.

1452. I am against the importation of seed on a large scale as one does not know what one is getting. I would rather build up my own strains. I have recently been promised about 100 lbs. of pure Triumph seed from America. That is about just the amount which it is worth while bringing in in order to multiply here.

1453. Cotton is a favourite crop with the Sindhi where he can grow it. I think the Sindhi cultivator is quite as bad as he is made out to be.

1454. (Mr. Henderson.) The graduates from the Poona Agricultural College are well educated men but are not well equipped to face really practical problems. They are not quite all that we could desire. It is rather difficult to get rid of them once we have got them. I would not go in for getting rid of too many but would get rid of a small percentage. We must make the best of what we have got. I do not think the Poona training is ideal for Sind. There is too much college work as opposed to farming. Once or twice I have recommended a man for training at Poona but the Commissioner very frequently selects a man on his own initiative. I have never been back to Poona since I left it. I think it would be a good thing if the Deputy Directors were kept in touch with the training of the men at Poona. The conditions in Sind are very hard from the point of view of climate. It is a particularly malarious country. In the Punjab, the Deputy Directors get two months' hill leave: there is no hill leave attached to Sind. I certainly think two months hill leave should be given in Sind. I should prefer to send men from Sind to Lyallpur rather than to Poona.

1455. As regards intensive cultivation, I think fifty per cent. is the maximum limit you could work up to. We could work the ryots up to one fallow in two years of cultivation. That is my opinion as regards a new project. There is no chance of working considerably beyond that figure for the next generation or perhaps two. Under intensive cropping with rotations, the crops would be rather smaller than the crops that would be produced after a two or three years' fallow. I do not think that the system of rotations has had a fair trial because the *rabi* water supply is very uncertain.

1456. The system at Mirpurkhas involves the cultivation of berseem. There is now great future for berseem for some considerable time to come. The demand for it has been limited. The stumbling block is the price of the seed. The price of berseem is six annas a maund delivered at Mirpurkhas. If grown on a large scale, the price of green berseem is very small. It is a question of demand and supply. There will be a greater demand for berseem when more land is taken up for irrigation. I am rather inclined to favour the view that berseem should be fed on the land rather than exported. It would be perhaps the best arrangement to do both, i.e., to export some and to feed some. That might bring about a great increase of stock and might lead to an increase in sheep industry. We have yet to prove that the people will take up berseem growing on a large scale. If they have to pay a high price for their seed it is doubtful whether they will do so. Under existing conditions it would not be safe to estimate on a large area of berseem. The yield of seed over large areas does not exceed a maund an acre but on small areas we have got up to three maunds. Taking a crop of seed means sacrificing a very good cutting—perhaps worth Rs. 50, and if the cultivator only gets one maund of seed in exchange, that is not paying proposition. If he got three maunds, that ought to satisfy him but if the price of seed went down, he would not take it, but would rather sell the green berseem. It is rather a slow business thrashing berseem. I am not in favour of allowing a large area for berseem on new canals—not for the first thirty years.

1457. The Jamrao canal is designed for one-third of the area to be cultivated. I think the proportion could be reduced to one-half. The main crops are cotton and wheat, which is undoubtedly an exhaustive combination. Irrigated wheat grown continuously went down to 300 lbs. an acre after about four or five seasons. We grew wheat on the Mirpurkhas experimental farm last year after constant wheat growing with the above result. On the seed farm, the crop was watered only once after it was sown; the normal number of waterings is four. That was on the seed farm on a fairly big scale. We had about sixty acres of wheat last year. The wheat was Pussa No. 12 and the yield was 16½ maunds per acre. On a few plots we tried the effect of growing it without watering at all after sowing. We got fairly good results but not as good as those obtained by one watering. I am inclined to think that two waterings would give the best results. It is difficult to carry out experiments owing to the unequal distribution of *kalar* soils. It is rather difficult to generalise on these results except that the area included a very large portion of stiffish soil.

1458. The last date for sowing Triumph is usually the end of May but it can be sown later. This year all our Triumph was sown in June. I do not think there is much difference in the length of the *deshi* and American cotton seasons. I should certainly say that American is not longer in maturing than *deshi*. Sow-

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ing is so precarious on the inundation canals that one can never be certain of sowing American in time. It is safer to stick to a cotton that will stand fluctuations better. *Deshi* is subject to fluctuations but it is not generally considered that sowing in June is responsible for them. There were some unfavourable climatic conditions. We must go on the results of a number of experiences on the Hyderabad Canals. With sowings on the second fortnight of May, excellent outturns of *deshi* can be got. We had a crop wiped out as the river went down for a fortnight just at the critical moment. In similar circumstances, *deshi* would hang on longer than American. *Deshi* is very much hardier than Triumph. I believe the highest premium of Triumph over *deshi* has been fifty per cent. which was obtained three years ago but prices have been upset owing to the war. Last year people got rather under 25 per cent. One man who was able to bargain got thirty per cent. Mr. Bhurgri's estate appears very favourable for American cotton. In my opinion, it has a much freer working-soil, which suits American cotton. He indented for a large amount of seed from the Mirpurkhas seed farm. I think he is quite favourably disposed to substitute American for *deshi* but this year gave a shock to every body including him as he found that it was not possible to grow any. I think the Triumph variety has nearly all the characteristics of the American cotton that we want and one of the strongest points in its favour is that it has fibre which suits the trade. Sir Bezonji Mehta of the Nagpur Mills thought that Triumph cotton was superior to the Punjab cotton. The Triumph was saw ginned and the Punjab was not. It is a mistake to suppose that saw gins cut the fibre. That may have happened in a particular case owing to a defective gin. When I took over charge, I found the Triumph seed very much mixed. It had been ginned at one of the factories at Mirpurkhas and given out and the result was that the crop was very much mixed. Afterwards we distributed only home grown seed from our own seed farm and the resulting crop was not mixed although it was grown in very small patches surrounded on all sides by *deshi*. I do not think that Triumph is now true to type. Some of the plants take on the appearance of Allan's Hybrid. There has been a distinct tendency for the boll to decrease in size. The same thing happened in Dharwar and I think it must be due to deterioration and not to hybridization. I think there has been a general falling off in the size of the bolls, and that it could not have been due to mixtures with other types of American. I specially investigated that point and I found that the Triumph seed had been imported direct from American and had never been grown near any other American cotton. This particular seed had not been grown on the Mirpurkhas farm. The first year it was sown, I believe, on the Daulatpur station. It was never sown with other American cottons. We discovered on one occasion only that two acres of this strain of cotton had been grown near another variety of American at Mirpurkhas, but I consider that for practical purposes we can eliminate this.

1459. I think where there is an obvious aim then hybridization is desirable. Where, for example, in two cottons, you have every character you want, hybridization should be tried but otherwise I prefer selection. I am in favour of pushing a strain of Triumph. As I have said before, I am just getting a hundred pounds of Triumph seed which is said to be botanically pure. I would much rather start with that. I am not in favour of selecting from the existing supply. The objection to that is that a definite type of Triumph has still to be settled. We have to find out what is Triumph. If we have to make a beginning, I am in favour of beginning with something that is certified to be pure to start with. Supposing I start now with something which is not admitted to be pure Triumph I might discover in a year or two that I had selected what was really a cross and my work would be useless. We have got a good deal of seed from the previous year. There is no certainty that in forty tons of seed, all will be pure, but with 100 lbs., I think, there is a fair reason for assuming that, if it comes from the American Department of Agriculture, it is certainly pure.

1460. If the Jamrao fails again as it did last year, then American cotton will have no future. I think it is only worth while working with this American cotton on the assumption that the barrage scheme is going to be pushed through. I do not see any prospect of American cotton on the inundation canals. They are much too unreliable.

1461. (Mr. Roberts.) The most probable cause of the diminution in size of the bolls of Triumph was deterioration. The fibre may not be affected. Very likely it may be a case of adaptation to the drier atmosphere. My experience with Cambodia cotton at Dharwar was that the bolls were very big at first but they gradually fell off in size. That being the case, I think, there is a good deal in the suggestion that it would be sounder to try and work up from the partially acclimatised types of Triumph which we have now. I do not see why the two work should not go on together. I have to a certain extent studied the history of the development of American cotton in the Punjab. To my mind, the main feature about the Punjab is that the work was started from an acclimatised American cotton. I think there are possibilities about working with the existing material and pushing that. One of my objections is that one might go off at a tangent with a wrong type—not pure Triumph. Except that it was the opinion of my predecessor that Triumph had special qualifications for Sind, I do not suggest that Triumph should be the limit of improvement but it would be a very intricate matter to get something more suitable. The plant might turn out to be a cross and then the work would be lost. It would have to be multiplied and tested in the second year.

1462. I think American cotton ought to be sown early. The most favourable time would be any time in March or April so that it would not be damaged by rain in August. On the Jamrao, that is not feasible. The water supply there is too irregular and is too scanty, and is sometimes wanted to mature the wheat crop. No great advance is possible until an assured supply in April is available.

1463. American cotton so far tried in Sind is rather apt to suffer from leaf disease in September or October. It usually comes a little while after rain. It seems to be associated with something that moistens the leaf. Whether that is the indirect cause or the direct cause is not quite clear but I think it is partly both because we get green fly afterwards: There are distinct differences, in this respect between 4F and Triumph both in time and degree. 4F is attacked later and to a less extent. 4F is going to give about five maunds an acre this year. It has only been grown on a small scale.

1464. I think one year's fallow is necessary. I believe it is largely a physical question and that the land will not stand continued irrigation, without manure or green cropping. A high intensity of cropping, say 150 or 200 per cent., must depend on the growing of berseem. My experience of the people is that they are not likely to grow berseem as long as they get just enough fodder to pull on with. A very great difficulty is that it requires a great deal more water than any other *rabi* crop. There is no prospect for a crop requiring *rabi* water at present. With a perennial system things would be much easier. Then there would be an inducement to double the crop; there would be the inducement of cotton profits and of wheat profits. There is one point which I did not mention in this connexion and that is the labour supply. The cheapest way to prepare a field is to leave it fallow. Sind fallow does not imply cultivation as the English fallow does since the population is small and the land extensive. The two factors are interdependent. I do not

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take the view that if land is kept fallow, the cultivation charges are increased. I take the opposite view and I think it is the other way round. What happened on the seed farm this year was that a certain area was cultivated: there was weed growth and some of the weeds could not be removed until they had seeded. Now if a crop were taken on such land in Sind the following year, the weeds would grow again. My experience of continuous irrigation is that weeds become more difficult to control than they do on land that gets starved of water. The cost of weeding cotton in Sind is very heavy. It is perhaps the most formidable item in the cultivation charges. It is essential but hand weeding is very expensive. It costs Rs. 6 or Rs. 8 in the season. The cultivator would not do it more than twice and many only once. Intercultivation is not known in Sind. They do not even run the plough through. One of my lines of work is to introduce line sowing and I am still trying to discover the best way to do it. It implies drilling and that implies previous cultivation which the Sindhi cultivator knows nothing about. I have been trying some of the Presidency drills. I am in favour of the following in existing conditions under which leguminous crops and manure are non-existent. It would be more convenient to concentrate labour on a smaller area and to crop it more intensely. In countries where there is more land than there are people, the type of agriculture is extensive and not intensive. I think the number of cattle must be measured by the amount of water available for cultivation. Upper Sind, which is the best cattle breeding tract, will continue to breed cattle. I do not say that the cattle will be sufficient for the whole of Sind but at present a large number of cattle came from Upper Sind. The cattle are weak which is largely due to feeding under the present conditions. No fodder crops are grown for them. I do not think that that is entirely due to the system of extensive cultivation.

1465. (Mr. Wadia.) Some years ago, about 1911, Mr. Keatinge prepared a note in which he stated what the Department had done for cotton, the stage it had got to and the difficulties. The chief difficulty that he particularly brought out was the marketing of improved strains. He circulated this note to the Chambers of Commerce and he sent it home to Manchester and the result was that Manchester moved very quickly and went to the Secretary of State. A proposal was set going that the British Cotton Growing Association should establish some form of buying agency in Sind to buy up to the American cotton. The Bombay Cotton Trade Association also moved in the matter and Government thought it reasonable to support the proposals of the Bombay Trade rather than those of Manchester. As a result, a Syndicate was formed in Bombay to establish two buying agencies in Sind. Several conditions were laid down, the Syndicate put up its gins and the Department distributed the seed. The cotton however did not come in and that was why the whole thing broke down. The Syndicate wanted the Government to stand half the loss. I was not in Sind at the time. The Shikarpur factory never worked and it had to be given up; the machinery had to be sent to Bombay to be resold and the building was taken over by Government at half price. The settling up of the Shikarpur business took place in my time. This year, the Mirpurkhas factory was closed because there was no cotton. At the same time the Mirpurkhas factory can work on *deshi* cotton. It did so last year. The arrangement was that when the cultivator delivered his cotton he was to get the Liverpool price less expenses. He was to get half the amount as an advance and the balance due to him was to be worked out later. It was very difficult to make the cultivator understand that. He was accustomed to getting his money at once for his cotton. So the arrangement had to be altered. The present proposal which is one of the chief conditions on which the Syndicate has been re-organised is that the price should be really the intrinsic value of the cotton, regardless of the small amount. Although last year was a great improvement on previous years, this was not quite realized. The premium was Rs. 2-5-6 and that was not quite the proper premium. The cotton was picked as well as one could expect in Sind and I do not think it was much mixed. It was not more leafy than normal. If saw ginned cotton were sent to Liverpool, it would give the intrinsic price but to send roller ginned cotton to Liverpool was to court disaster. Therefore Government advocated saw gins. My opinion is quite the reverse. I think the cotton last year was leafy but not more leafy than one gets in Sind. I do not know why the leaf could not be got out; there was not more leaf in it than in *deshi*. The crop was about 500 bales. The crop of American in 1914-15, was not all grown on the farm. Some of it was grown on the Jamrao Canal by *zamindars*. The crop averaged between 500 and 600 bales for two or three years. There was practically nothing from the farm. The farm is only 200 acres and half of that would be under cotton. The farm produced about thirty to forty bales; the rest were produced by the cultivators. The year that I am speaking of is they are in which the Syndicate did not operate. The Syndicate operated last year it was the year before that that we produced forty bales from our own land. Thirty bales were sent to Cawnpore, and ten bales were sent to Nagpur. I understand that last year the Syndicate got all the cotton. The management of the Syndicate has been taken over by Messrs. Tatas and is much better. One of the conditions is that the cultivator should be paid when he delivers his cotton. It is the business of the Syndicate to arrange to get the Liverpool valuation; we can only check the results. The Syndicate must be guided by the judgment of the men sent out to buy. One of the difficulties is that Pomar is now insisting on roller ginned cotton. That means that some one must take less money. I had one sample of saw ginned American Triumph cotton sent down to Bombay this year (1917 crop) and it was valued at Rs. 525 per *khandi* against Rs. 475 taken as the standard of the comparison by the Bombay Cotton Trade Association for M.G. Sind American which shows Rs. 50 per *khandi* in favour of saw ginned cotton. The cultivators have to stand the less Bombay values the roller ginned cotton at Rs. 50 more than the saw ginned but won't take it. The first pickings are very good and so are the second and third but you will always find that at the end of the season the pickings are inferior.

1466. The licensing of ginneries would act as a check on mixing but, I think, that the conditions would have to be easier than that the license should be withdrawn if cotton were mixed. Regulations might be made by which valuable cotton would not get mixed up with the *deshi* types, on conditions of the withdrawal of license. I think action would have to be taken very carefully. An example might be made.

1467. (Mr. Hodgkinson.) According to the British Cotton Growing Association, the saw ginned sample of Triumph measured $1\frac{1}{8}$ inch and the roller ginned sample $1\frac{1}{16}$ inch. I have copies of that correspondence. According to their valuation, the saw ginned cotton had a longer stapled cotton than roller ginned.

1468. (President.) I do not think there is much scope for exotics in the Presidency.

1469. (Mr. Wadia.) I know something about *goghari* cotton. It apparently came from the Jambusar Taluk in the northern part of the Broach district. It is botanically the same cotton as Broach or Surat but it has an agricultural difference; it has a higher ginning percentage. There is more of it mixed in the cotton round about Surat than there used to be. I think the staple is $\frac{1}{8}$ th inch shorter than Broach. I have found fifty per cent. mixture of *goghari* in Broach now. It will bring down the quality of Broach. If it go

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down to Navsari, it would seriously affect the Navsari cotton. It will not be in the interest of the trade to have this cotton growing side by side with Navsari cotton. It is spreading south of the Narbada. I should be inclined to keep it north of the Narbada if possible but there is at present no machinery for doing so.

Mr. G. E. CHATFIELD, I.C.S., Collector of Ahmadabad and formerly Colonization Officer, Sind.

EXAMINED AT AHMADABAD, FEBRUARY 9TH, 1918.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

1470. (1) Experience.—I have served in cotton-growing districts from 1900 to 1907 and from 1914 to 1916, but my chief experience of cotton, both indigenous and exotic, was gained on the Jamrao Canal in Sind, where I was Colonization Officer from August 1903 to October 1907 (with a short interval of five months in 1906). When I was Colonization Officer of the Jamrao Canal, I had a number of perennial and inundation canal tracts in my charge, on all of which cotton was the main crop grown. From the year 1904 to 1907, I was also in charge of the operations to introduce long-stapled exotic cottons into Sind. It fell to me to persuade cultivators to experiment with seeds supplied by the Agricultural Department, to visit the area sown, to see that methods of cultivation and measures against boll-worm were carried out according to instructions and finally in 1906-07, I had to organize and carry out measures for collecting and auctioning the produce for the cultivators, since the local middlemen refused to buy it.

1471. Condition of agriculture in Sind.—Before proceeding to answer the questions set by the Committee, I will briefly describe the condition of agriculture in Sind. To begin with, the country has no rainfall on which the cultivator can rely and everything, therefore, depends on irrigation by canal. Canals for the most part—in the cotton-growing tracts—are inundation canals and the supply from them is fitful and precarious. The few perennial canals like the Jamrao and, to a less extent, the Mithrao have fairly constant supply, though it is insufficient to irrigate more than about forty per cent. of the area which they command.

1472. Agriculture on inundation canals.—These flow for a period which differs considerably from year to year according to the nature of the inundation. The normal inundation canal is supposed to have a supply sufficient for one-fifth of the occupied area depending on it. As may be imagined where there is such scanty and precarious irrigation, the standard of agriculture is extremely low. No careful cultivation pays. The one idea of the cultivator is to break up as large a surface as possible when the water rises, sow his crop and trust to luck. The land is left full of bushes and trees, manuring and weeding are rare and a rotation of crops absolutely unbrought off. The aim in fact is to cultivate in the roughest manner the largest possible area of fresh land every year.

(2) The water is generally lifted by wheel for at least a portion of the inundation season and generally for the whole season. The common custom is to sow several different crops in each survey number, the most valuable nearest the wheel. This generally consists of cotton. The only cotton grown on inundation canals in Sind is the short-stapled Sindhi variety. This is very hardy and matures rapidly—a point of great importance when the water-supply is so precarious. The cotton is rough, coarse and very inferior in quantity. It used before the war to be exported in large quantities to Belgium and Germany, there to be made up into shoddy imitation wools.

(3) There cannot be said to be distinct varieties of Sindhi cotton though it differs in quality in different parts of the country. The best is that grown at Bhitshah in the Hyderabad District; the worst is that grown on the Jamrao Canal.

1473. Agriculture on perennial canals.—These are of two kinds—those that always have some water in them but do not profess to supply it throughout the year at a fixed level; and those which maintain a constant level of supply. The former (like the Mithrao and Fuleli) do not differ much from the inundation canals so far as the quality of their cotton is concerned. Where the water-supply is good rice is generally grown and cotton is relegated to high lands and land where the supply is precarious. The only canal which is truly perennial and maintains (or professes to maintain, for there are lapses) a constant level of supply is the Jamrao. This canal is the only one on which exotic cottons have been grown on a large scale with any degree of success.

(2) I must observe that, throughout Sind, there is a serious shortage of labour which affects agriculture adversely both upon inundation and perennial canals. The *zamindar* has great difficulty in procuring cultivators and is consequently at their mercy to a great extent. The cultivators, sure of obtaining work when they want to, are careless and untrustworthy and resist any pressure put upon them to improve their methods.

(3) When a new capital is opened, it generally draws away the cultivators from the old ones in the neighbourhood. It has been found impossible to attract good cultivators from neighbouring countries like the Punjab unless they are given grants of land. They will not leave their own country to work for a master in Sind. Famine-stricken emigrants from the neighbouring deserts stream into Sind when there is a drought in their own countries. Their methods of cultivation are worse than those of the Sindhi (who is at least used to the management of water) and they are apt to return to their countries without notice at the first news that rain has fallen there. I have seen magnificent crops of cotton standing unpicked for sheer want of labour on such occasions to the immense loss of the *zamindar*.

1474. (3) Size of holdings.—These are of all conceivable sizes both in inundation tracts and on perennial canals. Some *zamindars* will own half the country side, while others own a single survey number only. On the Jamrao Canal, colonists are divided into three classes, capitalists, yeomen and peasants. The first buy full rights in the land and no limit is set to the area of such grants. The yeomen purchase the right to cultivate but not to alienate land; and a yeoman grant is usually limited to 192 acres; a peasant receives gratis the same rights in the land as a yeoman; his grant does not ordinarily exceed 32 acres and he is supposed to cultivate it himself with the help of his family.

(2) As to the proportion of each holding which is put under cotton, the question is difficult to answer so far as the inundation canals are concerned. To begin with, only a fraction of the holding is cultivated annually—ordinarily not much more than one-fifth. The proportion of this fifth which is put under cotton

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varies in accordance with the nature of the inundation. One may say that every man will put as much as he dares under cotton; and, given sufficient water, would grow nothing else except a little *bajra* for food and fodder. Owing to the custom of sowing many different crops in the same survey number, the information on this point is bound to be inaccurate, being based upon rough guess work.

(3) On the Jamrao and Mithrao Canals, information is far more definite, inasmuch as this custom does not prevail there (there is a separate and higher rate of assessment on cotton than on other dry crops). The Jamrao Canal is supposed to supply sufficient water to irrigate one-third of the occupied land commanded by it. In practice, *zamindars* cultivate rather more than this—say, forty per cent. The Punjab peasant colonists, who are good cultivators, and whose lands are favourably situated, commonly cultivate fifty per cent. annually. The proportion under cotton varies in different parts of the tract. It is highest in the purely Sindhi villages. The Punjabi has brought with him from his land his affection for wheat and does not therefore go in for cotton to the same extent. On an average, however, cotton is about 45 per cent. of a *zamindar's* cultivation, wheat 35 per cent. and other crops twenty per cent. Supposing a *zamindar* to own forty acres, he would commonly have eighteen acres under cotton, fourteen under wheat and eight under *bajra* and other crops.

(5) As regards the relative merits of large or small holdings, I would remark that amongst Sindhis, whose methods are generally bad, the best cultivation is generally found in large estates. The big *zamindar* is most likely to be enlightened and to have sufficient influence with his cultivators to insist upon a certain standard being maintained. Amongst the Punjabi colonists, on the other hand, the peasant proprietor cultivates his land far the best. The Punjabi yeoman and capitalist, who gets his land cultivated for him by others, is handicapped by the dearth of labour and is in no better position than a Sindhi *zamindar*.

1475. (4) **Yields and profits.**—The yield fluctuates enormously with the nature of the season and inundation. A good crop of cotton on the inundation canals might, however, be expected to yield ten maunds (of 80 lbs.) per acre. On the Jamrao, where the land is cropped more frequently and the cultivation is worse than elsewhere, the outturn is lower—I should say that a good Jamrao crop brings in eight maunds per acre. The *zamindar* takes one half of the produce in flow land and one-third in lift land (and two-fifths when the flow irrigation is supplemented by lift). The prices of cotton vary so enormously that it is difficult to estimate the profit. In 1904, six rupees per maund of seed cotton was a fair price. The price has since risen to Rs. 10 and Rs. 12, and is liable to continual fluctuation. Taking Rs. 10 as a fair average price now-a-days, a good crop on the Jamrao must bring in the owner Rs. 80. If the land is flow, the owner takes Rs. 40; if lift Rs. 26-10; if betwixt and between, Rs. 32. From this must be deducted the consolidated assessment and water rate (maximum Rs. 4, minimum Rs. 2-14) and the expenses of keeping up the boundary marks and bunds. The net profits on a good crop must be considerable.

1476. (5) **Rotations and manures.**—Manures are rarely used. The commonest form of manure (so-called) is the silt cleared from the beds of water-courses. The earth from old village sites is also used with good results. Farm-yard manure is very seldom used except for tobacco and sugarcane. I do not remember seeing cotton so manured. It must, however, be remembered that the Indus water contains a very large proportion of silt, especially in the inundation, and if this can be got on to the land and not dropped in the water-course, it acts as a natural manure.

(2) Rotations are not understood or followed. This is chiefly due to the fact that the water-supply is insufficient for the area commanded. The Sindhi has been brought up to rely entirely on fallows to re-invigorate the soil. Even the Punjabi rings the changes on cotton and wheat with an occasional turn of oilseed or millet. No leguminous crop is grown. The Agricultural Department has for many years endeavoured to introduce berseem, but the crop has not proved as success. It grows well but there is not a sufficient market for it and there is a difficulty in obtaining seed for distribution.

1477. **Comparison of Sindhi with exotic cottons.**—After many years' experience of the attempt to popularize exotic cottons in Sind, I am of opinion that it has not been a success. Egyptian and American cottons can be grown with excellent results, and it is not difficult to induce *zamindars* to grow them in limited areas. Some educated *zamindars* have even shown enthusiasm over the experiment and put large areas under cotton, but the bulk of the *zamindar* class is indifferent and would not touch exotic cotton except under official pressure or encouragement.

(2) I have no personal experience of the matter later than 1907, since in 1914, when I returned to the Jamrao as Collector, the cotton market collapsed owing to the war and all attempts to popularize exotic cottons were temporarily abandoned. But I have met and talked with *zamindars* on the subject of Egyptian and American cotton; and, of course, I had considerable experience of the difficulties involved when I was Colonization Officer from 1903 to 1907.

1478. **Causes of failure of Egyptian cotton.**—Egyptian cotton failed definitely for several reasons. In the first place, it required more care than could be expected from Sindhi cultivators. Secondly, the method of sowing (on ridges) rendered it liable to attack by white ants. Such at least was the popular belief, which I shared. Thirdly, it suffered terribly from boll-worm. Fourthly, it is an eight months' crop and the last pickings are liable to be cut off by frost in the months of December and January. I do not think that Egyptian cotton will succeed in Sind until the standard of cultivation has risen immensely; and until the management of perennial canals has so far improved as to allow cotton to be sown on a large scale as early as March. Egyptian cotton sown in June will always be likely to suffer in December and January from frost.

1479. **Difficulties in the way of the extension of American cotton.**—American cotton has, I understand, done well on the Jamrao though I have not seen it grown on a large scale by the *zamindar*. It is pity that the war brought the experiment to an end. The chief difficulties with which it has to contend are as follows:—

- (1) Bad agricultural methods, due to the traditions brought from the inundation tracts, the scarcity of labour and consequent inability of the *zamindar* to exact good work from his cultivators; and finally the sheer laziness of the Sindhi, content with a low standard of living and sure of obtaining work and maintenance. Everything new demands more trouble and the Sindhi does not like to take trouble.
- (2) The enormous prices paid for the indigenous Sindhi cotton. In 1906-07, a maund of Sindhi cotton would perhaps fetch Rs. 6-8-0 or Rs. 7, while a maund of Egyptian cotton would fetch Rs. 13 or Rs. 14 at the auctions, which I used to hold at Mirpurkhas. These auctions were discontinued later, as was inevitable. When the price of indigenous cotton rose to Rs. 11 or Rs. 12 per maund, the inducement to grow exotic cotton was diminished. American cotton had been substituted for Egyptian and the cultivator only received a rupee or two above the price of ordinary cotton for what had cost him more trouble to grow.

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(3) Difficulty of disposing of exotic cotton. In 1906-07 and 1907-08, this was done at auctions held by the Colonization Officer and the arrangement was satisfactory to the cultivator. But this could not continue. Agents had to come from long distances to bid, and in time the less keen competitors dropped out and left the field to the firm on the spot, Messrs. Ralli Brothers had a virtual monopoly. Later on Government made an arrangement with Messrs. Greaves, Cotton, and Company which was thoroughly unsatisfactory to both sides and was finally abandoned in 1914 when the market collapsed. The amount of American cotton produced was insufficient to attract competitors from any distance. The business inevitably tended to fall into the hands of one firm and the natural result was that the cultivators did not get a fair price and were treated without consideration.

(4) I believe I am right in saying that even American upland cotton is not as hardy as the Sindhi variety though harder than the *Metaffifi* and *Aba-si* which were tried in the beginning. The fact that the crop is more likely to fail in quantity or quality on that account detracts considerably from the advantage which it derives from fetching a slightly higher price.

(5) Exotic cottons would do better (American as well as Egyptian) if they were sown in March or the beginning of April. It is unfortunate that the Public Works Department generally close the canals partially or wholly for about six weeks at this particular time, which from every other consideration is the most convenient season for the purpose. The particular reasons for which it is desirable that cotton should be sown as early as possible are (a) because the crop is generally better if it deeply rooted before the intense heat and violent winds of the summer begin, (b) because the late sown crop is liable to be damaged by boll-worm in autumn and frost in winter and (c) because the late watering of cotton interferes seriously with the cultivation of wheat, an important crop on perennial canals. I must, however, add that, when the cotton season and wheat season overlap, the wheat is generally neglected in the interests of the cotton.

(6) The southern portion of the Jamrao tract, which is more fertile than the northern, is also more liable to suffer from fogs in the autumn—a condition favourable to the spread of boll-worm. I think that the lands in the Hyderabad and Nawabshah Districts will be superior cotton-growing areas when provided with perennial irrigation. This scheme is already under consideration.

1480. (26) **Suitability of existing varieties.**—The American upland cotton has been proved by experience to be the most suitable for Sind. For reasons already stated, I consider that Egyptian cotton has no real chance of succeeding in present conditions.

1481. **Remarks on cotton-growing generally in Sind.**—The great ambition of every Sindhi *zamindar*, if he has abundance of flow water available, is to grow rice. The reasons for this are various. The crop is immune from the main dangers which threaten other crops in Sind—(a) damage from salt, (b) damage from birds, (c) deterioration owing to exhaustion of soil. As however the crop is unremunerative to Government from an irrigational point of view, the assessment (inclusive of water-rate) not being proportionate to the amount of water utilized, it is strictly forbidden on all the new canals and especially on the perennial canals. The next most popular crop is undoubtedly cotton, owing to the enormous profits which can be made therefrom. I do not think that any measures need be taken to encourage cotton in Sind or to increase the area under this crop. The only factors which limit the extension of cotton (assuming that rice is forbidden) are (a) scantiness or uncertainty of the water-supply, (b) want of labour, (c) exhaustion of the soil by unskilful methods of cultivation. As the area under perennial irrigation is increased and the population increases, so undoubtedly will the area under cotton increase, with the single exception of rice; no good crop can compete with it in popularity in Central Sind. (It is not grown in Upper Sind. The people assert that the climate is unsuitable; I do not know whether this is correct or not.)

Mr. G. E. CHATFIELD, I.C.S. called and examined.

1482. (*President.*) I had a long experience of colonization in Sind though I had no personal knowledge of the first beginnings. I was connected with Jamrao Canal for a long time. The tract through which the Jamrao Canal passes was not absolutely barren to start with. It was already supplied, though very imperfectly, by a number of inundation canals. There were a great number of land-owners who owned scattered fields in the tract. When the tract was divided up into villages, vacant villages were kept as far as possible for colonization by foreigners, chiefly Punjabis, and the villages in which there were already Sindhi *zamindars* were kept for Sindhis. There were a number of villages in which there were scattered bits of land mixed up with holdings which were already given out. In those villages if the vacant land was not in very large blocks, it was given out to the people who had frontages on that land according to the ordinary Sindhi system. In one tract, the Digri Taluka, all the Sindhi *zamindars* were induced to throw up all their holdings and to trust to government to give them a *quid pro quo*. The object of this was to introduce the square system of survey which could not be introduced in tracts where the people already owned lands surveyed under the trigonometrical system. As regards colonization by foreigners, who, as I have already said, were chiefly Punjabis, the principle on which we went was to divide them into three classes, capitalists, yeomen and peasants. The capitalist was given a large grant; the yeomen was given twelve plots of sixteen acres each and the peasant as a rule got two such plots. If a big company wanted a large area of land for growing long staple cotton, there would not be any difficulty, as the capitalist idea is not new in Sind. The capitalist is very much in the position of the ordinary *zamindar*. There is nothing inherent in the land revenue system of Sind which would militate against capitalists holding large grants of land with a view to the expansion of the area under long staple cotton. The land on the Jamrao was given out under a special Act, III of 1908.

1483. The construction of the Sukkur Barrage and the consequent security of the crop due to a permanent water supply might bring about an improvement in the inherent laziness of the Sindhi but it would take a long time. It is a matter of pressure of population on the soil. The population at present is very sparse. My experience of the Punjabi colonist is that he tends to fall to the Sindhi standard. The Sindhi pays no attention to the example set by the Punjabi cultivator, but simply looks on him as a man from the Punjab who cultivates in a different way from his. The Punjabi has deteriorated to a certain extent but still there is a very great difference between the worst Punjabi and the best Sindhi. To begin with, the Punjabi levels his land, which is a very important thing in Sind and thereby enables it to be irrigated without waterlogging. The Sindhi never levels his land and the result is that one corner of his field gets water and the other no water at all. The real fact is that he can get a comfortable living without any exertion. Owing to the

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small amount of labour available, he can always rely on being employed by a *zamindar* who will feed him throughout the slack season on the understanding that he will work for him during the next monsoon. He is so certain of getting employment that he can dictate his own terms. The real difficulty is an economic one, i.e., sparsity of population and extensive cultivation. I think that Egyptian cotton in Sind can be ruled out under present conditions. No preferential treatment of cotton in the matter of assessment would have any effect. The assessment is extremely light and it includes water rate. I do not think that such a light assessment and water rate combined are to be found anywhere. Cotton does not want encouragement. Until we get an increased population and until the existing character of the cultivation is altered by security of irrigation, things must remain as they are and progress must be extremely slow.

1484. (Mr. Roberts.) So far as the reliability of the water supply in the Jamrao Canal is concerned, conditions were very much better in my time than they became later on. I was there from 1903 to 1907 and, in the flood of 1906, the supply channel was badly damaged and it was beginning to give a poorer supply, in my last year. I believe after that there were very serious troubles. It was also the practice then to have closures for silt clearance in April and May. As far as I can remember, the whole canal was closed for a short time. That was very largely due to the fact that nobody wanted water at that time except for Egyptian cotton. There were a few Sindhis who used to sow their cotton in March but they could tide over the time if there was no water. There was usually a long period between sowing and the first watering. Generally speaking, there would be great difficulty in regard to water in sowing cotton in April and May.

1485. The Egyptian cotton went on after my time. We did wish to get the cultivators to sow it in March or April but were content if they sowed it in May or June. No particular effort was made to make them sow it early. They used to sow their own cotton early to a certain extent. The cotton which was sown in March was called 'arhari' cotton. It was of the ordinary Sindhi variety. It was the case that if Egyptian cotton was sown late, it suffered a good deal from fog and from boll-worm. The fog and the boll-worm go together. The strong point against Egyptian cotton was the extra labour required for cultivation. The Department recommended ridging. That was quite unknown for Sindhi cotton.

1486. I have seen the American cotton grown in Sind. I have seen it on the farms and in 1914, I saw the crop which was sown before the war outside the farm. It looked very fine in comparison with the Sindhi cotton, but was also somewhat injured by boll-worm. The cotton market had just collapsed and there was no sale for it. There was practically no sale for cotton of any kind, so much so that the people could not get labour to pick it, it being the custom to pay the pickers in kind. So practically speaking the whole of the crop was left unpicked.

1487. The Punjabi colonist cultivates fifty per cent. of his land. He has two blocks but only one block is cultivated as a rule. Generally he had one acre under sugarcane and one block is left fallow. The higher proportion of cultivation amongst the Punjabis is due both to the greater industry, and greater skill as well as to better water supply. He has a better water-supply because when the land was given out, it was known that the Punjabi would not take to lift irrigation. He must have flow and so it was very much easier for him in the way of rotation. Probably also the whole level of the land being lower, he gets a better water supply. It is also due to the fact that he levels his land and keeps up his water courses. He manages his water supply better in every way. It is the case that when a man cultivates a fairly large proportion of his land, it becomes a more paying business to level, but that is not the reason why the Sindhi does not level. It is simply due to slackness.

1488. Long fallows in Sind are due to want of sufficient water to cultivate more than a fraction of the land. Where the supply is sufficient, there is no reason for long fallows except bad cultivation. I doubt whether with more intensive cultivation, they would go in for more leguminous crops. Some of the people near Sukkur cultivate 120 per cent. of their land but even there they do not go in much for leguminous crops. They manure very heavily. They generally grow *juar* and wheat and a certain amount of garden crops. It is near Sukkur that berseem is doing so well. At present, there is no need at all for rotation in Sind or to cultivate fallow land owing to the fact there is so much land in comparison with the cropped area. On the whole the land does not suffer from being fallowed. There is a very strong sun which kills off the weeds. If the amount of water given were sufficient to enable the Sindi to cultivate 100 or 120 per cent. of his land, he would not adopt himself to such a system in present conditions but he would merely waste the water. In time when the population increases and there is more pressure on the land, necessity will force him not to waste water but I do not think there is any prospect of his doing so out of enlightenment. Those who are enlightened live near towns. Near Sukkur they make enormous profits out of *juar* because they can sell the *karbi* (stalks) as fodder at a great profit. The cultivators there are mostly Hindu *banias*, whereas the majority of cultivators in Sind are Muhammadans and very much lazier. The Musalman would be slow to respond to profit. If he get the chance, he would let his land to the ordinary *hari* or cultivator who would sublet it to the famine-stricken people from the desert. That actually happened on the Jamrao. The *zamindar* let his land out to the *hari* who sublet it to any labourer that he could get.

1489. One of the difficulties with Punjabi colonists is that they want to go back to their own country to get wives. It is rather difficult to keep them in Sind.

1490. No cotton is grown in Northern Sind. I suppose there must be some reason. I cannot say whether it can be grown. Frost would come but not earlier than in the Punjab. It would depend on inundation water. Water is not available to get the crop over before the frost. The water supply is as good as it is in most of the Hyderabad district or in the Nawashah district. The difference in climate is not great so far as frost is concerned between the north of the Hyderabad district and Sukkur so that I do not think that frost can be the reason. I do not see any reason why cotton should not grow there.

1491. I know the country south of the Jamrao and down to the west of Cutch. There are a few villages there which we always intended to bring under the Jamrao when we got water but there was no water.

1492. I know the Begari tract. The Begari canal affects the Sukkur District. They do not grow cotton there but they do grow rice, *bajra* and *juar*. The cultivators will always grow rice where there is flow irrigation and when they are allowed to do so. There is plenty of cotton on the Fuleli. Cotton is grown on lift land on the Fuleli, on lift land on the Begari it is not.

1493. I do not see any objection from the agricultural point of view to doubling the size of the Jamrao Canal so as to increase the intensity of cropping, but there would not be the population to cope with it at first and there would be considerable difficulties. It should be worked up to. The first thing to do would be to try to remodel the canals so as to do away with the lift areas which are a great curse in the way of rotations.

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1494. Generally speaking, the Sindhi prefers cotton to wheat. He prefers all *kharij* cultivation as a rule as he is not used to a *rabi* crop. He always regards *kharij* as his main crop.

1495. I conducted the Egyptian cotton sales. We used to advertise them in the Gujarati and Sindhi papers. We got a good many agents from Karachi and some from Ahmadabad. All the sales were held at Mirpurkhas. We undertook to collect all the cotton; we had various depôts in the Jamrao tract. I did this as Colonization Officer and held the sales. We had a system of accounts. A man was put in charge of the depôt and when the cotton was brought in the man who brought it was given credit for so many maunds. One of the drawbacks was that all cotton whether good or bad was lumped together and all the cotton of one depôt was sold together. There was no grading; tall although there was a good deal of difference in the way the cotton was picked. It was brought to Mirpurkhas and was sold in heaps; the agents came and looked at it. We sold each heap by auction.

1496. (Mr. Ashton.) There is a good deal of cotton on the Mithrao. The Mithrao tract is fairly suitable for cotton. The Mithrao differs from the Jamrao in having a good deal of rice. All the flow land is rice land. The next biggest canal is the Thar, the land under which is almost all rice land; there is no cotton. The Hiral canal is more or less modern and dates from about twenty years ago. The land is squired on the same lines as the Jamrao. But owing to its very bad construction, it has become water-logged, and some of the land has been given up to rice as an experiment. The Eastern Nara district is largely rice. The Jamrao is a part of the Eastern Nara system. The supply channel is not supposed to be dependent on the vagaries of the river. It suffers from floods sweeping across the country and filling the supply channel with silt. There is no water in the supply channel in winter so that the channel supply can only give full supply to the canal when the river is high, but I am not quite certain on that point. I think the barrage is necessary to give all these tracts an assured water supply. I am not an expert but I should not care to put the tract under the Rohri Hyderabad Canal without a barrage. If the assessment were raised to the Punjab level, the project would pay. I think cotton could pay very heavily. I think if they were given an assured supply, the *zamindars* would be glad to pay an increased rate but it would take some time to work up to the Punjab level. The *zamindar* is rather at the mercy of the *hari* (cultivator) and that is a difficulty, but no doubt he would pay a great deal for an assured water-supply.

1497. The best time for closing the canals is about March or April, after the last watering of wheat. If the canals were closed in January or February, it would hit the wheat very hard. The usual time for clearances is April and May and it is the time at which people are not working on their crops and labour can be got.

1498. There is a good deal of wheat on the Jamrao except when the confidence of the cultivators is shaken by the failure of the canal. That sends down the area under wheat the next year. The area under wheat has gone up on the canal of late years. If the barrage is completed, the wheat area will go up. Cotton rather keeps wheat down at present owing to the late watering. Even if the barrage were constructed and there were an assured supply, I do not think that wheat would gain at the expense of cotton owing to the profits of the latter being greater.

1499. I do not think there is any danger of waterlogging on the Jamrao or that there would be such a danger if the size of the Jamrao were increased. It depends on how much it is increased. The depth of the subsoil water differs greatly in different tracts. The country is very heavily watered at Badin. There was no escape to the Fuleli till about twenty years ago so that the Badin country used to be practically water-logged. The ordinary methods of irrigation are cheaper than pumping. There is lift irrigation all along the banks of the Fuleli. In my opinion, the ordinary bullock lift from wells is a great deal cheaper than pumps. There are a good many pumps on the Fuleli in the neighbourhood of Hyderabad. It is only near towns that pumps pay.

1500. (Mr. Hodgkinson.) With an assured water supply, I think that Upland American would grow well in Sind. I would be in favour of increasing the area of Upland American at the expense of Sind *deshi* cotton. As the area increased, the cultivator would get a better price for it. The difficulty is that when there is a very small area, the agents of the big firms do not bother about the cotton. The local firms get it all. If there was a larger market and if the cultivation were taken up seriously the people would get a proper price for it.

1501. There is no chance of Egyptian cotton succeeding under present conditions. There are two difficulties; one is that the methods of cultivation are so very bad and that the cultivators won't really put themselves out about it and cultivate it as it should be done. The second difficulty is that it is an eight months' crop, and so wants to be sown earlier but owing to clearances it cannot be given a long enough period. If it is sown in May or June, it is liable to suffer from frost or from boll worm. Even with an assured supply, I should not be in favour of increasing Egyptian cotton. I think American has a better chance.

1502. (Mr. Wadia.) As regards the difficulty in supplying cotton to the Bombay Millowners' Syndicate, when we collected the cotton for the auctions it was a purely voluntary thing. People were going to get say, Rs. 12 to Rs. 14 per maund at the auctions whereas, if they had sold it to the local *bania*, they would have got the price of Sindhi cotton only so that there was no trouble in getting the cotton. In the case of the Syndicate, Messrs. Greaves, Cotton and Company were offering Rs. 11 and Rallis' perhaps were offering a few annas more and the cultivators naturally went to the firm which gave them the better price. I think it was the Agricultural Department who promised Messrs. Greaves, Cotton and Company to collect the cotton. It was not the Collector or the Colonization Officer as they knew that they could not bring any pressure to bear on the people as to how they should dispose of their cotton. When I was at Sukkur, I pointed out that no cotton was grown in that part of the country and that it was a very doubtful speculation to build a ginning factory there. However the Agricultural Department insisted and it was one of the grievances of the Company that they were induced to buy land for a factory at Shikarpur in a country where not cotton was grown. I certainly was not consulted. I believe also that the Collector of Thar and Parkar was not consulted.

1503. If a sufficient amount of exotic cotton could be produced, there would be no difficulty in attracting agents to bid for it. The difficulty we had to contend against in Sind was the smallness of the outturn. Had it not been for the war, I think that American cotton would have been quite an appreciable success. I think it is a good thing to go on with it and to keep people interested in it. I do not think closures of the Jamrao would disgust the *zamindars* in regard to American cotton. Most of the cotton is actually sown later. The great difficulty there is the labour difficulty.

1504. (President.) No doubt the prevalence of malaria has an effect in reducing the labour supply. I would not, however, put the deduction as high as one-half. Malaria is a very serious factor in the months of

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September, October and November and the people are considerably weakened by it. I do not think that this prevents outside people coming in and settling there.

1505. It would be an advantage from the economic point of view if the system of extensive fallow were modified and the land were more intensively cultivated. From the agricultural point of view, as I have said, there would be confusion at first until the people got accustomed to it. I do not think that if the land was more intensively cultivated salt efflorescence would increase. All the high land tends to become salt as it is cultivated last. The most intensive cultivation on the Jamrao is in the Punjabi villages where it is fifty per cent. In the lift land round Sukkur it is even greater; also in most rice tracts.

1506. (Mr. Roberts.) There is a great deal of fever in the rice tracts. Experience shows that settled conditions on perennial canals do not tend to diminish fever. Mirpurkhas used to have the name of being a very healthy place before the Jamrao was opened but now it is regarded as a fever stricken spot. At the same time the worst part of the Jamrao tract is not so bad as a rice tract like Badin.

1507. (President.) I do not think that the Agricultural Department can do much on the inundation canals near Hyderabad where the conditions are so very rough. I do not think there is anything very much to be done. It can only be of use on a canal like the Jamrao. I think the present staff of the Department is sufficient for existing work. I do not know the whole of Sind. The barrage would change things and make a much larger staff necessary.

Mr. S. N. DAMALA, Agent, Messrs. Ralli Brothers, Mirpurkhas, Sind.

THIS WITNESS WAS NOT ORALLY EXAMINED.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short-staple cotton.

1508. (1) **Experience.**—I have been stationed in the cotton growing districts of Sind for eleven years, viz., one year at Tando Adam and ten years at Mirpurkhas. I also have been stationed for about ten years at Lyallpur, Multan, Ludhiana, Raewind, Changa Manga, Forzepore, Hansi, etc. I have been in touch with the cotton cultivators in Sind, but not with those of Punjab, owing to my frequent transfer from place to place.

1509. (2) **Varieties.**—There is practically only one variety of *deshi* short-staple cotton grown in Sind, with the exception of the *Shah-ko-bit* rougher variety grown at Shakabit (thirteen miles from Tando Adam) and at Kotlalo (25 miles from Nawabshah). This variety gives nearly sixteen seers of lint per maund of 41 seers against thirteen to fourteen seers of the ordinary variety. It is rougher than ordinary Sind, but the production hardly exceeds one per cent. of the whole crop of cotton.

1510. (3) **Size of holdings.**—The size of holdings varies from ten to twenty acres up to thousands of acres. One-third of the holding is supposed to be cultivated every year, but, owing to scarcity of water and labour, I doubt if actually more than one-fifth is cultivated.

(2) Out of the area cultivated on the perennial canals in Sind, I estimate the cotton crop to represent fifty per cent., the remainder being thirty per cent. wheat and twenty per cent. fodder crops.

(3) On the inundation canals, the area sown with cotton represents a larger proportion, as there is no water for *rabi*. I estimate this proportion at seventy per cent., the other thirty per cent. being fodder crops.

(4) There are lands, especially on the old Sind canals (lift irrigation lands) of exceptional fertility, yielding up to twenty maunds of *phutties* (unginned cotton) per acre with ordinary cultivation (viz., two ploughings, one weeding and seven to eight waterings) and other lands, especially on the Jamrao track, yielding hardly $3\frac{1}{2}$ to 4 maunds per acre, with the same system of cultivation, etc.

1511. (4) **Yields and profits.**—The profits of the cultivators, it is very difficult to estimate, but roughly, taking the expenses of the cultivation (labour, seed, weeding, cattle, revenue, etc.) at Rs. 20, the yield at five maunds and the average rate of *phutties* at Rs. 9 per maund of 40 seers, the profit will be Rs. 25 per acre, viz., 5-9-45-20-25.

1512. (5) **Rotations and manures.**—No scientific rotations, as understood in other countries, for the enrichment of the soil, are followed in Sind. Usually cotton is succeeded by one to three years fallow and then the same land is sown with wheat, *guar*, *bajra*, etc., all exhausting crops. Leguminous crops such as *chowla* (beans), gram, *mung*, *moh*, *guar*, which improve the soil are cultivated on an insignificant scale.

(2) The only manure, applied to the land, is cow and goats' dung from the few animals in the possession of each cultivator but most of the cow dung is used as fuel. Near the towns, some of the cultivators buy occasionally cow and goats' dung, also sweepings, but the areas so manured are inconsiderable.

1513. (6) **Comparative returns.**—As above stated, there is practically only one variety of short staple *deshi* cotton in this district. Exotic cottons have been tried during the last twelve years in this part of Sind, viz., the Egyptian (white—Abassi and yellow—Metaffifi). This cotton has been very unfortunate. It was attacked by bollworm and, if I am not mistaken, had suffered from scarcity of water and from alkali in the soil. The American *Triumph* variety has been tried during the last two seasons. The yield per acre was, I think, 25 per cent. less than that of *deshi*. The second year the stuff was rather too much admixed with *deshi* cotton, the seed distributed the second year being admixed with *deshi* seed.

1514. (7) **Conditions affecting increase in area.**—There is some fluctuation in the area sown with *deshi* cotton due to lower or higher rates. If in a previous season, the rates of cotton are high, cultivators sow more cotton during the ensuing season and vice versa. The same is done for wheat.

1515. (8) **Uses of seed and seed selection.**—The seed is partly despatched to Karachi for export from India or in order to be sold locally at Karachi to native speculators and partly is sold locally up-country to native speculators, who export it to Karachi, Marwar or Punjab for feeding cattle, or sell it in Sind for the same purpose. There are no cotton oil mills in Sind.

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[Continued.]

(2) Hand ginning has died out in Sind, consequently hand-ginned seed for sowing is not available. Ten years ago all the *Shakabit phutties* (unginned cotton), above mentioned, were hand-ginned and native cultivators were paying for such seed a premium of about Rs. 2 per maund over ordinary seed. They were under the impression that machine-ginned seed did not germinate well, because they believed that the point of the seed breaks when ginning. Now all the *Shakabit phutties* are bought by the Tando Adam factories and ginned like ordinary *phutties* on single roller gins and the seeds still command a premium of Re. 1 to Rs. 2 per maund.

(c) Exotic cotton.

1516. (21) **Varieties.**—No exotic cotton is growing in Sind.

1517. (25) **Conditions affecting increase in area.**—Length of ginning season, climatic considerations, competitions of food crops, limitation owing to necessity of observing rotations and labour supply: all the above mentioned in the questions put forth by the Committee will not affect the cultivation of exotic cotton to any appreciable extent. It is only the irregularity of the water supply of the Jamrao and only this irregularity will affect the exotic cottons more than the *deshi* one, especially in the case of inferior alkali soil, bollworm, unfavourable winds, etc.

1518. (26) **Suitabilities of existing varieties.**—The *Triumph* American variety was a good one. In my opinion, it is unadvisable trying more than one variety with the cultivators, lest the seed of several varieties gets mixed. Two or more varieties should be tried only at the Experimental and the Seed Farms.

1519. (27) **Prevention of mixing of different varieties.**—Prevention of mixing of exotic cotton with *deshi* one can be assisted by the *phutties*' buyers only. For instance, if a buyer offers Rs. 20 per maund for pure American *phutties* and Rs. 15 only for American *phutties* with an admixture of ten to twenty per cent. of *deshi*, certainly cultivators will be careful not to mix anything in the American *phutties* either intentionally or out of carelessness. But if the buyer pays Rs. 20 for the clean stuff and as much as Rs. 18 or 19 for the admixed, certainly no one would take the least care to grow pure American. The same applies to cotton buyers buying American ginned cotton pure or admixed from ginning factory owners.

1520. (28) **Importation of seed.**—In my opinion, fresh seed must be imported every year, instead of relying on selected India grown seed. Last season, the American *Triumph* seed given to the cultivators was badly admixed with *deshi*. There is a good opportunity for Government to push the introduction of American cotton by making some sacrifice, viz., to import every year American seed and give it to the cultivators at the average rate of *deshi* seed, viz., for about Rs. 2-8-0 per maund of forty seers instead of selling it at Rs. 5 to 6 per maund.

II.—COMMERCIAL ASPECT.

1521. (30) **Local trade customs.**—Factory owners and merchants advance to the cultivators Rs. 2 per maund and buy the *phutties* in advance of the crop or even after the crop begins to come in. Occasionally they advance the total value of the *phutties* and buy them Rs. 2 to Rs. 3 less than the market rate ruling at the time of buying. If cultivators fail to deliver the whole or a portion of the quantity contracted for, the same is delivered during the ensuing season. Messrs. Ralli Brothers buy by contract before or after the crop begins to come in, but make no advances.

1522. (31) **Standardization of commercial names.**—There are no special names for the Sindhi *deshi* cotton, excepting the unimportant variety of *Sai-ko-bit* mentioned above.

1523. (32) **Buying agencies.**—The existing form of buying is the best.

III.—STATISTICAL.

1524. (33) **Improvement of cotton forecast.**—The Government cotton forecast have so far turned out rather incorrect. Messrs. Ralli Brothers' forecast are, in my opinion, more correct. I cannot suggest any way in which it could be improved, but I think that the Revenue, the Agricultural and the Irrigation Departments ought to be more in touch with the cultivators and know what is going on.

1525. (35) **Publication of Liverpool and Bombay prices.**—It would be a good thing to publish daily the Liverpool and Bombay cotton prices at up-country markets, to enable the cultivators to follow the course of the market, instead of being mostly in the dark, as is at present the case with them.

IV.—MANUFACTURE.

(a) Ginning and Pressing.

1526. (36) **Type and number of gins and presses.**—In Messrs. Ralli Brothers' Factory at Mirpurkhas there are 62 single roller gins, 24 double roller gins and a small American saw-gin. There is also a cotton press by Henry Berry and Co., Leeds, turning out 250 to 300 bales in twelve hours.

1527. (37) **Size of bale.**—The size of the bales (400 lbs. to 460 lbs. net weight) is—

22½ × 22½ × 26 inches	} Shipping measurement 20 up to 25 tons per 100 bales.
up to	
22½ × 22½ × 32 inches	

1528. (38) **Saw gins versus roller gins.**—Ordinarily saw-gins are not suitable for *deshi* cotton. They make it very fluffy.

1529. (39) **Effect of saw-gins on Indian cotton.**—When seven years ago I was at Multan, I bought some saw-ginned *deshi* cotton, ginned at Messrs. Sukhdevbux Multanichand's ginning factory at Multan. (Besides their ordinary single roller gins they had imported a system of four saw-gins with elevators worked by vacuum similar to the four gins system Messrs. Ralli Brothers have erected this year at Nawabshah.) The cotton was of a very high class, say choice, but the staple so poor and fluffy that the cotton was found at Karachi unfit for shipment.

1530. (40) **Factory labour.**—There is great difficulty with labour at Mirpurkhas. We actually depend on labour from Marwar. Good rains at Marwar means scarcity of labour at Mirpurkhas.

1531. (41) **Condition of cotton.**—There is rather too much leaf in the *phutties* that reach the factories of our district, but this can be remedied by passing the *phutties* twice through the openers.

1532. (42) **Effect of replacement of short staple cotton by long staple.**—Certainly if fifty per cent. of American cotton were to replace fifty per cent. of *deshi* cotton, Messrs. Ralli Brothers would be compelled to replace the half of their ginning power by American gins.

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V.—GENERAL.

1533. (46) *Attitude of buyers to improved cottons.*—Buyers have offered a premium for improved cotton.

1534. (47) *Effect of water rates.*—I do not consider the water rates charged have any effect on the cultivators' preference for a particular crop. In cultivating, the Sindhi *zamindar* takes into consideration; firstly, his personal requirements (*viz.*, *bajra* seed for himself and his family and *bajra* and *juar* fodder for his cattle) and secondly, the safety of each crop and its monetary return. This is the reason why *til* seed being being a very delicate crop is now hardly cultivated in our district.

1535. (48) *Desirability of alteration in water rates.*—I do not consider that any changes are called for in the schedule of water rates at present in force. *In my opinion, the cultivators could easily pay even higher rates, provided the Cotton Committee could induce Government to improve radically the precarious conditions of the water supply of the Jamrao canal.*

Mr. CHANDIRAM LALSINGH, Zamindar, Jamesabad, Thar and Parkar District, Sind.

THIS WITNESS WAS NOT ORALLY EXAMINED.

Written statement.

I.—AGRICULTURAL EXPERIENCE.

(a) "Deshi" short staple cotton.

1536. (1) *Experience.*—I have been growing cotton and have been in touch with some of the cotton cultivators on the Jamrao Canal in the Mirpurkhas and Jamesabad Talukas, of the Thar and Parkar District in Sind, for the last sixteen years.

1537. (2) *Varieties.*—The *zamindars* in the district are familiar with the *deshi* short-staple cotton only.

1538. (3) *Size of holdings.*—I cannot say what the average size of a holding is. But the proportion under cotton is roughly fifteen to twenty per cent.

1539. (4) *Yields and profits.*—The average yield of cotton per acre is about five maunds. Taking about Rs. 8 to be the average selling price per maund, the total yield in rupees comes to Rs. 40. Allowing for the following expenses and contingencies, the net profit to the *zamindar* roughly is Rs. 10 as shown below—

	Rs.	A.	P.
1. Jungle clearance and uprooting average	2	0	0 per acre.
2. Ploughing, four turns, average	3	0	0 "
3. Seed, thirteen seers, average	1	0	0 "
4. Weeding, average	8	0	0 "
5. Picking, four pickings, average	5	0	0 "
6. Waterings, ten waterings, average for lift and flow	5	0	0 "
7. Excavation and after clearance	1	0	0 "
8. Supervision, average	1	8	0 "
9. Assessment	3	8	0 "
Total	30	0	0

1540. (5) *Rotations and manures.*—Cotton is generally preceded by wheat and is followed by fallow. The Jamrao Colony is a new colony and practically no manure is being used. Breaking the soil as much as practicable and exposing it to sun and air is considered sufficient.

1541. (6) *Comparative returns.*—*Deshi* short-staple cotton compares favourably with other *deshi* crops and exotic cottons, because the former is more paying and requires less trouble and anxiety. There is no *deshi* long-staple cotton in the district.

1542. (7) *Conditions affecting increase in area.*—The area under *deshi* short-staple cotton has remained sufficiently steady during the past ten or twelve years ending 1913. Owing to the war, in 1914, the price of cotton suddenly failed owing to the closure of markets and the *zamindars* suffered a great deal. The effect of this was that cotton received a rude set back and the shrinkage of area was reflected in the next years' returns. *Zamindars* were afraid to put more area under cotton lest it might fetch the low price of the last year. Fortunately, the price recovered itself and consequently, more area was put under cotton during the next season. During the year 1917, the Jamrao Canal was closed for 2½ months, the season for the cultivation was sufficiently advanced and consequently a smaller area was brought under *kharij* crop. Unfortunately for the *zamindars*, though the prices for cotton have risen considerably during the current year, the yield of cotton, which was calculated to vary from six to eight annas in the rupee, has suffered recently owing to untimely late and heavy rains and frost, and the yield is scarcely two maunds per acre.

1543. (8) *Uses of seed and seed selection.*—The seed is generally used as fodder for cattle, and oil to a very small extent is extracted from it, though there is no industry in it worth the name. The second picking of cotton is considered to be the best for the extraction of the seed by ginning it in the factories. Seed is not extracted by hand-ginning.

1544. (9) *General economic conditions.*—The condition of cotton-growers is by no means very satisfactory. They have to combat with various unforeseen factors, *e.g.*, white-ants, blight, boll-worm and frost. The labour difficulty is not easy to overcome; of late years owing to copious rainfall, the labour, which is generally composed of Tharis and Marwaris, has left the Jamrao Tract, owing to prospects of good crops in the desert. Consequently the labour has been scarce and fetches a very high wage. The scarcity has become chronic owing to the effects of malaria too.

Sind.]

Mr. CHANDIRAM LALSINGH.

[Concluded.]

(c) *Exotic cotton.*

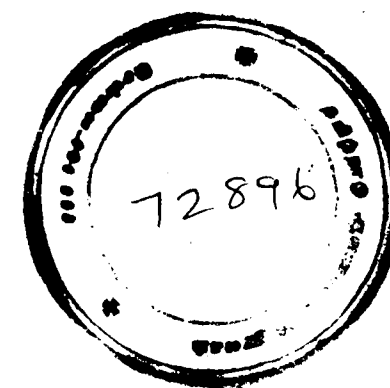
1545. (21) *Varieties.*—Egyptian and American have been the two varieties of exotic cottons grown in this district. There is not a large cultivation in these crops as they are yet grown for the sake of experiment. The result has been that Egyptian cotton has been ousted because it is more susceptible to white-ant and bollworm. Though every endeavour is being made to grow the American cotton, there is no very great prospect of its living long. The difficulty of market and the uncertainty of water-supply are the two main causes of its not being grown to a great extent. Moreover so long as the difference between the price of *deshi* and American cotton is only about Rs. 2, while the yield of the former is greater, *zamindars* will take to the cultivation of *deshi* cotton in preference to American. As long as the war lasts and the markets remain closed and unsettled, there would be difficulty in extending the cultivation of American cotton. In fact the restriction on the Daulatpur Minor (Jamrao Canal) on *zamindars*, who were bound to cultivate a portion of their holdings with American cotton has been removed during the last two seasons.

V.—GENERAL.

1546. (46) *Attitude of buyers to improved cottons.*—The only buyers for American cotton were Messrs. Greaves, Cotton and Tata, who established their agency in Mirpurkhas. The premium they offered was about Rs. 2. The price which we got for American cotton in 1914 or 1915 was Rs. 6-4-0 only. This was not high enough to encourage the growth of the American variety. *Zamindars* would have required a higher premium than this. I have referred to this in the preceding paragraph.

1547. (47) *Effect of water rates.*—There is no separate charge for water. The water-rate is included with land revenue under combined assessment.

1548. (49) *Effect of tenure of land.*—I do not think the tenure, on which land is held, would affect the extension of cotton cultivation in this district.



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