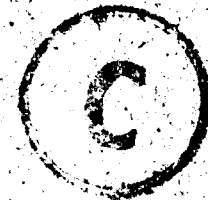


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Report is
on the
Operation of The Department of
Agriculture,
Madras Presidency
For The Official year
1916-17



REPORT ON THE OPERATIONS OF THE DEPARTMENT OF AGRICULTURE,
MADRAS PRESIDENCY, FOR THE OFFICIAL YEAR 1916-17.

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OFFICE OF THE
DIRECTOR OF AGRICULTURE, MADRAS,
Dated 28th July 1917.

R.O.C. No. 756 Gt. of 17.

ENCLOSURES—four printed spare copies.

From

G. A. D. STUART, Esq., B.A., I.C.S.,
DIRECTOR OF AGRICULTURE,
Madras,

To

THE SECRETARY TO GOVERNMENT,
REVENUE DEPARTMENT,
Madras.

SIR,

I have the honour to submit the annual report on the Agricultural Department for the year 1916-17.

I.—ADMINISTRATION.

A.—STAFF.

2. The permanent Director of Agriculture Mr. D. T. Chadwick, I.C.S., went on deputation to Russia and France in June 1916. He has since been appointed as the first Indian Trade Commissioner in England. Before his deputation he was on tour for 14 days visiting Tuticorin, Coimbatore and Kumbakonam. At the latter place he presided at the annual meeting of the Agricultural Association. I have been in charge of the department since the 14th June 1916. I was on tour for 142 days in all, and visited all the farms except Nandyal and Sirvel. During these tours I attended the annual meeting of the United Planters' Association, Southern India, at Bangalore, a meeting of the Chamber of Commerce, Tuticorin; gave evidence before the Industrial Commission at Coimbatore, attended the meeting of the Indian Science Congress at Bangalore and accompanied the Indigo Research Chemist and the Agricultural Adviser to the Government of India during portions of their tours in this Presidency. Most of the gazetted officers of the department with a few selected assistants attended the Indian Science Congress held at Bangalore in January 1917. The Government Mycologist, the Government Entomologist and the Deputy Director of Agriculture for Planting Districts attended the Mycological and the Entomological Conference at Pusa held in February 1917. The Government Mycologist also visited some of the rubber plantations in Cochin and Travancore with the Deputy Director of Agriculture for Planting Districts and attended the annual meeting of the United Planters' Association, Southern India, at Bangalore.

3. Mr. H. C. Sampson returned from one year's leave in November 1916 and M.R.Ry. K. Ramasastrulu Nayudu Garu thereafter availed himself of two and a half months' leave. Eight other officers took short leave for periods not exceeding one month each at various times during the year, their assistants being in charge. Mr. E. Ballard remained on military duty throughout the year. Mr. A. Carruth joined the department as Deputy Director of Agriculture for Live-stock at the end of April 1916. On the return of Mr. Sampson from leave the arrangement of Deputy Directors' charges was revised. The old three divisions—North, South and Central—have been distributed into seven circles, consisting of three or four

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districts each. There will eventually be a Deputy Director of Agriculture in charge of each circle with an Assistant Director under him and a staff of one Agricultural Demonstrator and two Assistant Agricultural Demonstrators in each district in addition to the staff employed in the farms. For the present the available gazetted staff is distributed as follows:—

Circle.	Deputy Directors.	Assistant Directors.	Districts comprised.
I	Mr. G. R. Hilson	M.R.Ry. D. Balakrishnamurti Garu.	Ganjām, Visagapatam and Odāvari.
II		M.R.Ry. K. Ramasastri Nayudu Garu.	Kistna, Guntur and Nellore.
III			Karnool, Cuddapah, Bellary and Anantapur.
IV	M.R.Ry. J. Chelvaranga Raju Garu (Assistant Director acting as Deputy Director).		Chingleput, Chittoor, North Arcot and South Arcot.
V			Tanjore, Trichinopoly and Salem.
VII	Mr. H. C. Sampson	M.R.Ry. M. Govinda Kildavu Avargal (since appointed).	Coimbatore, Nilgiris, Malabar and South Kanara.
VI	Mr. R. Thomas		Madura, Ramanad and Tinnevely.

During the year under report M.R.Ry. J. Chelvaranga Raju Garu was promoted to act as Deputy Director on probation and M.R.Ry. D. Balakrishnamurti Garu was confirmed as Assistant Director.

4. From the 1st November 1916 the Agricultural Department was removed from the control of the Commissioner of Revenue Settlement, Survey, Land Records and Agriculture, who is a member of the Board of Revenue, and placed under the direct control of Government in the Department of Land Revenue. At the beginning of August the "Pumping and Boring" section of the Department of Industries was taken in to form the basis of an Agricultural Engineering section of the Agricultural Department. Mr. F. T. T. Newland, who had been previously employed under the Madras Corporation, was appointed Government Agricultural Engineer in charge of this section with M.R.Ry. V. Ranga Achariyar from the Department of Industries as his Assistant. The Agricultural Engineering section as taken over consisted of ten supervisors in charge of ten circles, and twenty-two mechanics with a staff of boring maistris, clerks, draftsmen, accountant, etc. Since the close of the year under report the number of supervisors has been reduced to eight and their charges now correspond to the agricultural circles detailed above except that the IV Circle forms two supervisors' charges.

A new post of Inspector of Agricultural offices on Rs. 100-2½ 125 was created during the year to permit of the regular audit of the accounts of Agricultural Stations and subordinate offices. Eight offices were inspected during the year and audit reports submitted. A special Tahsildar was appointed temporarily in connexion with the loans work referred to in paragraph 59 below.

5. The Imperial Entomologist visited the Entomological laboratory at Coimbatore in December 1916. His Silk Assistant also visited Coimbatore and Kollegal, studied the silk industry in that district and wrote a report on it. Mr. Ansonge, Assistant to the Imperial Silk Expert Mr. H. M. Lefroy, visited the principal silk weaving and dyeing centres and Mr. Lefroy himself paid a short visit to the Presidency later on in the year. The Agricultural Adviser to the Government of India toured in this Presidency from 5th to 28th January 1917, visiting the Agricultural College and Research Institute, Coimbatore, and the Hagari, Nandyal, Koilpatti and Anakapalle Agricultural Stations. His tour note which concluded with a most welcome appreciation of the work that is being done by the department will be found printed in G.O. No. 1075, Revenue, dated 12th April 1917. The Indigo Research Chemist, Mr. Davis, visited

Coimbatore and Madras and toured in the Chief Indigo centres in South Arcot and Vizagapatam districts. As one result of his visit Dr. F. Marsden has been deputed for a year to enquire into the Indigo industry in this Presidency. The Hon'ble Sir Claude Hill, Revenue Member of the Government of India, visited Coimbatore in August 1916. The members of the Industries Commission devoted much of their time at Coimbatore to inspecting the Agricultural College and Research Institute.

B.—BUILDINGS AND LAYING OUT OF FARMS.

6. Four out of the five coconut stations on the West Coast were opened during the year. These consist of three unplanted blocks, Nos. I, II and III stations, situated in the neighbourhood of Nileshwar, on laterite, red loam, and sandy soils respectively, and of a garden fully planted with coconut trees from 20 to 40 years old, No. IV station, near Kasaragod, all in the South Kanara district. The fifth station, which is to consist of a mature plantation, will eventually be selected in the Malabar district.

The four stations were fenced and good progress was made with the necessary buildings and wells before the close of the year. In No. IV station the plantation was cleaned by felling useless trees, and the other trees classified and numbered. Regular agricultural work on the four stations will be taken up in the current year.

Certain forest reserves near Bantanahal in the Alur taluk of the Bellary district, which the Forest Department wished to give up, were taken over by the Agricultural Department for the purpose of a sheep farm and a cotton seed farm. The portion suitable for cultivation, which consists of some 500 acres of black cotton soil, will be used as a cotton seed farm and also for experiments in cultivation by power when machinery can be obtained. The rest which consists of babul scrub and grass land will be used as a sheep farm and for experiments in pasture production. The land was taken over in March 1917 and work will commence in the current year.

The Assistant Director of Agriculture, I Circle, toured in the Ongole cattle tract for two months to select sites suitable for a Government cattle farm and the sites were subsequently inspected by the Deputy Director of Agriculture, I to III Circles, the Deputy Director for Live-stock and myself. It was found very difficult to get a site embodying all the requisite features, and finally a site was selected in the Lam reserve forest near Guntūr town, which was suitable in all respects except for water supply, which was doubtful. Five borings were put down to test this point, but the only water found within reasonable distance of the site was extremely saline. The site therefore had to be abandoned and the Deputy Director of Agriculture for Live-stock is now engaged in looking for a site in the Nellore district.

Orders regarding the proposed potato farm in the Nilgiris were passed in G.O. No. 773, Revenue, dated 14th March 1917. This farm, however, is to be under the supervision of the Curator, Government Parks and Gardens, and this department is connected with it only in an advisory capacity.

The scheme for opening planting stations for the study of tea, coffee and rubber was hung up during the year pending the sanction of the Secretary of State and the appointment of a Mycologist for planters' crops. The site for the rubber station in the Mooply valley, Cochin State, has been definitely located.

The Samalkota farm was extended by leasing 16.42 acres of paddy lands for a term of 12 years, and at Nandyal 6.66 acres of wet lands near the farm were leased for five years for experiments on paddy manuring.

The Paddy Breeding Station at Coimbatore was extended by the acquisition of 2.35 acres of wet lands. Proposals have been submitted to Government for the extension of the lease of the Manganallur farm up to 1921. The question of starting an experimental farm in North Arcot is still under correspondence.

7. At Coimbatore the quarters for the Government Lecturing Botanist were completed and handed over. Similar quarters for the Assistant Principal and the

Senior Assistant to the Government Agricultural Chemist have not yet been commenced pending the administrative approval of Government. The combined games pavilion, students' reading room, and warden's office was nearing completion at the end of the year. The electric lighting installation was completed, but the electric pumping system is still incomplete owing to the loss of the motor at sea.

Plans for a bungalow for a Deputy Director of Agriculture at Trichinopoly were finally approved, but it has since been decided to use the allotment for a similar bungalow for the Deputy Director at Madura, where the need for accommodation is more urgent.

II.—AGRICULTURAL EDUCATION.

8. Two hundred and sixty-eight applications were received for admission into the Agricultural College and after the usual preliminary examination 42 were admitted in June 1916. Of these 17 were from the Telugu districts, which is an increase on previous years. A special selection class for Telugu students was held at Anakapalle by the Principal at which 26 candidates were examined.

The year opened with a total strength of 87 in the College and closed with 77 still in residence. The decrease in numbers as compared with last year is due to the change in the curriculum, there having been no diploma class in residence in the year under report.

The sixth College Day and Conference was held in July under the presidency of the Hon'ble Mr. Gordon Fraser. The Commissioner of Agriculture was also present. Many interesting papers were read.

The hostel continued to work satisfactorily during the year. It was found necessary to raise the monthly charges by Re. 1 per head owing to the increased cost of foodstuffs. There was a change of wardens in September, the present incumbent being M.R.Ry. C. Narayana Ayyar, the Chief Assistant for Agricultural Teaching. The foundation stone for the new reading room and games pavilion was kindly laid by His Excellency Lord Pentland on 23rd November 1916 and the building has since been completed. Much of the work was done by the students themselves.

Prizes kindly offered by the late warden stimulated a taste for gardening among the students and improved the appearance of the hostel surroundings.

For the reasons explained in last year's report changes were made in the teaching staff at the beginning of the year, the Chief and Second Assistants for Agricultural teaching and the Engineering Assistant being replaced. The result has been satisfactory.

9. Owing to the change in the curriculum there was no examination for the diploma during the year. The usual examination at the end of the first course was held in March. Out of 32 students who appeared 23 were successful in obtaining certificates. Twelve of these have been selected for the higher course and six of the remainder have since joined the department in the Lower Subordinate branch.

The students of the second year were taken on two tours, one in South Coimbatore and Kollengode and the other in Tanjore, South Arcot and Chingleput districts.

The lectures on dairying were given by the Deputy Director of Agriculture for Live-stock and for the first time lectures on the principles of land revenue settlement and administration were given. These lectures were prepared by me and given by my Personal Assistant. As in last year lectures were given on the Principles of Co-operative Credit by M.R.Ry. C. N. Krishnaswami Ayyar Avargal, M.A., to whom my thanks are due for the trouble he has taken.

A demonstration of well boring was given by the Government Agricultural Engineer for the benefit of the students of the Agricultural and Forest Colleges.

The staff deserves credit for having been successful in keeping plague out of the College estate although it was severe and prolonged in the surrounding villages. Simple preventive measures were promulgated and enforced by public opinion. As it was found that private stocks of firewood were apt to harbour rats a co-operative fuel depot was started and is working successfully.

III.—RESEARCH AND EXPERIMENT.

A.—AGRICULTURE.

10. An attempt is made below to collect most of the important or interesting results obtained from the work on the agricultural stations and to indicate the main lines of work there in progress. For greater details reference is solicited to the reports of the different stations. Speaking generally the season was marked by excessive rain in the north especially in the Ceded Districts and deficiency of the north-east monsoon in the south. In the central districts the season was good except for the cyclone in November 1916 which did great damage to trees, plantations and garden crops in the South Arcot, North Arcot and Chingleput districts, but did not seriously affect the main staples, paddy and groundnut. At Anakapalle the season was normal except for unevenly distributed north-east rain which damaged the pulse crops. The same was the case at Samalkota and in addition the main paddy crop was damaged by heavy rains at harvest time. At Hagari the rainfall which was 50 per cent in excess of the normal proved favourable to early crops; but the cotton crop was seriously damaged by heavy rain in February, which is quite unprecedented. On the other hand this same rain saved the cholam crop. At Nandyal the rainfall amounted to 73.50 inches against a normal of about 30 inches and all crops were adversely affected. The cotton crop was very poor both in quality and quantity all over the Ceded Districts. At Sirvel the season was even worse, the rainfall amounting to 83 inches which is three times the normal for the locality. The Cuddapah-Kurnool canal breached as in the last two years. In consequence the crops were miserable and some fields failed completely. At Palur the season was favourable except for some shortage in the hot weather rains and the cyclone in November which has already been mentioned. This was not accompanied by exceptional rain, the damage being done by the violence of the wind. The actual damage on the farm was small being confined to the unroofing of the cattle shed and the breaking off of tapioca plants. At Manganallur the season was very favourable. At Koilpatti the rainfall was short and badly distributed. The 1916 cultivation season opened well but the November rains were poor and December was rainless. The rains in January were too late to save the cereals and fodder crops but saved the cotton. Unfortunately unusual rain in February and March caught the cotton crop in full flower with the result that this year's crop of 'Tinnies' is much below the average both in quality and quantity. At Taliparamba the season was favourable for all crops except that the rains continued somewhat too late for the pepper crop. At Coimbatore the season was entirely favourable.

Crops—(a) *Sugarcane.*

11. *Varieties and cultural methods.*—There was comparatively little disease at Samalkota this year, but what there was, occurred mainly in the variety B 3412. This variety again topped the list in yield of raw sugar, giving some 4.6 tons of jaggery per acre. The variety J 247 gave a yield of 4.2 tons per acre however and was quite free from disease. It was decided in 1915 to distribute B 1529 in the uplands and J 247 in the deltas as the latter is more resistant to disease in the water-logged deltas. At the end of the 1915-16 season this decision was modified by my predecessor on the representation of the Assistant Director of Agriculture that the delta ryots were clamouring for B 3412 on account of its high yield. It is already apparent that this latter decision was unwise. The high yield of B 3412 is discounted by its delicacy and tendency to disease. The ryots themselves are discovering the real superiority of J 247 in delta conditions and this variety will be distributed more widely in future. At Anakapalle the disease, red-rot, was severe, and of the seven varieties tested all suffered except J 247 which was entirely free. It is evident that this variety is going to prove a most valuable cane in the Circars owing to its hardiness. Sixteen varieties were tried on wet lands at Palur. They were planted somewhat too late and the plots subsequently became water-logged. The yields were therefore poorer than usual, the best being B 3412 which yielded 21 tons of cane per acre. Out of five varieties

tested in irrigated dry lands Red Mauritius gave a yield of 36 tons of cane per acre. The variety J 247 which did so well last year fell to 24 tons this year. At Taliparamba seven standard varieties were compared. So far the indigenous 'Vellai' cane of Coimbatore has given the best milling results, but the acre yield is low. In addition several varieties were grown for the Government Sugarcane Expert for observation by him under West Coast conditions. At the Coimbatore Central Farm five varieties were tried of which Mauritius 55 gave the best yield—55 tons of cane yielding 4.8 tons of jaggery per acre. One of the new canes from the sugarcane breeding station M 326 was tried for the first time and gave a fair yield. An experiment has been in progress at Samalkota to test the necessity of wrapping and propping the canes. The results up to date are in favour of this practice though in 1915-16 the difference was only 613 lb. of jaggery per acre. In 1916-17 however the difference was 3,640 lb. of jaggery in favour of wrapping and propping, the unwrapped plots having suffered badly from the heavy north-east rains.

12. *Manurial*.—The experiment at Samalkota to test the advisability of substituting cattle manure for a part of the usual dressing of 10 bags of castor cake, was continued. The dose of castor cake was raised to $7\frac{1}{2}$ bags for the reason explained last year. It was found that $7\frac{1}{2}$ bags of castor cake plus 10 tons of cattle manure gave a yield of some 1,200 lb. of jaggery more than a dressing of 10 bags of castor cake. The experiment will be continued. At Anakapalle an experiment was started to ascertain whether the local practice of applying cattle manure initially, followed by wild indigo later, can be improved on by giving oil cake either in addition to, or as a substitute for, the local manure. The results were vitiated by disease. The experiment will be continued.

(b) Paddy.

13. *Spacing and cultural*.—The spacing experiment at Samalkota was discontinued—the results were summarised in last year's report. The similar experiments at Coimbatore will be concluded in the current year when only final conclusions can be drawn. The average seed-rate used at Coimbatore for producing excellent paddy crops on some 30 acres of wet land works out at $16\frac{1}{2}$ lb. of seed sown on $7\frac{1}{2}$ cents to transplant each acre of crop. At Anakapalle Hoogli jute and local gogu (*Hibiscus cannabinus*) were tried as a rotation with paddy. It was found that these crops exhausted the soil to the detriment of the succeeding paddy crops. At Samalkota experiments were in progress to test the value of hot weather cultivation for dry paddy. The results up to date are in favour of such cultivation. The experiment at Sirvel to compare drilled versus transplanted paddy was spoilt by the wet season which made drilling impossible.

14. *Manurial*.—The new series of experiments at Coimbatore to test the conclusions to which Dr. Harrison's work on paddy soils has drawn attention will be started in the current year on land which has been carefully tested for standardization for the last five years. It has been found that by taking duplicate plots the probable error of an experiment can be reduced to 3.2 per cent. This means that any variation over 12 per cent in the yields of two series of plots may be safely taken as representing a real difference due to the factors under test, while any difference in the neighbourhood of 3 per cent means nothing at all as it is just as likely that it is due to chance. This is the first time that the probable error of a series of experiments has been worked out in advance and our thanks are due to Mr. Parneli and Dr. Harrison for drawing attention to the importance of doing this. It is probably due to failure to realize the importance of working on these lines in the past that several series of experiments have had to be abandoned without definite results. At Coimbatore a new experiment consisted in stacking a green manure crop (daincha), covering it with earth, and allowing it to decompose under anaerobic conditions for a month before applying it to the land, instead of ploughing it in green which is the usual practice. This method, which was suggested by a bulletin of the Imperial Bacteriologist, promises to give useful results. A gratifying feature of the work at the central farm is

the steady increase in the average yield of paddy over the whole of the 40 acres of wet land. The figures for the last four years are as follows: 2,570, 2,700, 2,870, 3,200 lb. per acre. This general increase has been brought about by steady improvements in cultivation and the continued application of phosphoric and green manures. That this improvement is a real economic success and not a mere increase in gross yield regardless of expenditure can be proved from the records of the cost of cultivation of each field which show a profit of at least Rs. 100 an acre in almost all cases and in some cases as much as Rs. 150. An experiment on manuring with superphosphate was started at Anakapalle. The series of manurial experiments at Samalkota was continued in order to test the residual effects. A new experiment was started here to test the value of calcium cyanamide as a nitrogenous manure for paddy. The results indicate that it is of value but the experiment must be repeated for a series of years before conclusions can be drawn.

At Sirvel in spite of the bad season it was shown that superphosphate invariably increased the yield of paddy. At Palur the effect of continuous green manuring with daincha has resulted in a steady increase of yield from 2,528 lb. of grain per acre in 1913-14 to 3,920 lb. last year. The experiments on the use of artificial manures to supplant green manuring were continued. Fourteen different experiments on paddy manuring were in progress at Manganallur. It is found difficult to get comparative results on these heavy delta soils owing to the great effect of the capricious hot weather rains on the texture of these soils, an effect which persists throughout the subsequent cultivation season and greatly affects the yields. The results of the experiments are discussed at length by the Deputy Director in the Report of the Agricultural Station and cannot easily be summarized here. Speaking generally soluble phosphatic manures have given markedly increased yields, especially when used in combination with either green manuring or ammonia salts. Experiments of special interest were started at the suggestion of Dr. Harrison to test whether ammonium sulphate or cyanamide can replace green manuring. The results were inconclusive as these concentrated nitrogenous manures caused the paddy to grow so tall that it had to be cut back to prevent it becoming laid before it was in ear. The experiments will be tried again with smaller doses of these manures.

15. *Varieties*.—The work of evolving and preliminary testing of new strains of better paddy is being done by the Government Economic Botanist whose work is dealt with in paragraph 30 below. These new strains will be further tested on a larger scale on our farms before being given out. A start has been made with this testing this year; some of the old selected strains are still being tried on the several farms; and comparisons are also made between the yields of unselected seed of various local and foreign varieties. Of two new strains tested on the Central Farm, Coimbatore, one, No. 24, was a success, yielding 3,600 lb. per acre and giving a grain yielding a high percentage of husked rice. The other selection proved a failure as it ripened very early and so suffered from the depredations of birds. Six of the old strains were again tested at Coimbatore and the best of these, Sadai Samba 20, gave the magnificent yield of 4,800 lb. per acre of paddy on a 10 cent plot. A comparison at Anakapalle between four local varieties and Gōdāvari konamani was in favour of the latter, the yield being just under 3,000 lb. of grain per acre. Six local varieties were compared at Samalkota but the results were vitiated by overmanuring which caused the crops to lodge badly. A start was made with testing two single plant selections from the local konamani paddy. At Palur twelve short duration foreign varieties from the Central Provinces have been tested since 1910, with a view to finding one which would be suitable for lands with a precarious water-supply. It has been found that these imported varieties tend to become of longer and longer duration, and many now take a month longer than the local varieties to come to maturity. This experiment will therefore be discontinued. Thirteen second crop varieties have also been under comparative observation since 1909. Sufficient having been learnt about their duration and yield the experiment will be discontinued and the most suitable varieties grown as farm crops to supply seed for distribution to ryots.

(c) Cotton.

16. The aim of the department is to improve the yield and quality of local cottons by selecting pure strains bred from single plants picked out from the local mixed crops. These strains are multiplied and tested *inter se* on the farms and the best finally picked out for growing on a large enough scale, some 20 acres, to allow of sufficient cotton being obtained for spinning tests. It is only when these tests are favourable that a strain is finally selected for being multiplied on seed farms for distribution to ryots. On our three cotton farms, Hagari, Nandyal and Koilpatti, this work of selecting, testing and multiplying new strains is always going on; details are given in the farm reports. At Hagari four selections were grown on 4 cent plots for comparison and eleven other selections are coming on for trial. At Nandyal eight selections were similarly tested. At Koilpatti six types were tested on the field scale for yield on 1 acre plots. Of these No. A/1 gave the high yield of 171 lb. of lint per acre as against an average for local cotton of about 100 lb. This cotton has also given good spinning tests and it will be distributed in future under the name of Co. No. 3A. Six later selections were tested on 5 cents plots and some of them are very promising. Thirty-five single plant selections made last year were grown for further testing next year. One of the dangers of cultivating a pure strain bred from a single plant over a large tract is that if the season is unfavourable to the strain the whole crop is adversely affected, whereas a mixed crop will be only partially affected by the vagaries of the season. An experiment is in progress to test whether a mixture of our best types will not give a better yield in the long run than the best pure type. This must obviously be continued over a long series of years before any conclusions can be drawn. Selection work on Cambodia was continued at Coimbatore. Mr. Steel of Messrs. Harvey & Co. kindly assisted the Principal to select the best four strains out of the twelve that were under trial. A small quantity of West African cotton from Nyassaland is also being tried. A separate farm for work on Cambodia cotton has long been contemplated and it is hoped to make a start in the current year. The work on crosses between Cambodia and Spence cotton is referred to in paragraph 30 below.

(d) Dry grains.

17. *Methods of cultivation, rotation, etc.*—Good crops of dry cholam were obtained at Coimbatore, one field giving 1,318 lb. of grain and 6,800 lb. of straw per acre. A new experiment was made in cultivating cholam in lines 3 feet and 4 feet apart in order to enable weeds to be thoroughly eradicated by continued working of hoes between the lines. Five hoeings were given at a cost of 6 annas per acre and excellent yields of over 1,000 lb. per acre obtained. This method will be thoroughly tried, as it shows how it is possible to eradicate weeds without sacrificing anything of the yield. Similar wide spacing and hoeing of red gram was tried and is recommended for keeping down weeds. Measurements of the water needed by irrigated cholam grown in the hot weather showed that some 18 inches were required. Similar measurements were made for ragi. Many other dry crops were grown, including a small area of soya beans received from Madanapalle. This did well and will be tried more extensively together with a further consignment of seed which has been obtained from China. The rotation experiments with cereals and Bengal gram which have been in progress at Hagari since 1906 will be discontinued and experiments with groundnut as the leguminous member of the rotation substituted, since groundnut is now becoming an important crop on the black soils of this area. The experiment on the relative merits of planting irrigated ragi in beds or on ridges again gave inconclusive results, the slightly increased yield of the bed method being counterbalanced by the increased cost. This experiment will therefore be discontinued. The rotation experiments at Nandyal were continued. As at Hagari groundnut will be substituted for Bengal gram in future. An experiment on spacing cholam at Nandyal showed that rows 14 inches apart gave better yields than the local practice of drilling rows 9 inches apart. It is possible that wider spacing still will give even better yields and this point will be tested.

18. *Manurial.*—The permanent manurial experiments on dry crops at Coimbatore were continued, three more crops being taken. The results up to date, which indicate phosphorus starvation in all the plots which have not received this ingredient, were summarized in the Year Book. The experiments on the application of cattle and sheep manures at Hagari and Nandyal were continued. The use of oil-cake on these black soils does not appear to give results sufficient to cover the cost of application even when the cake is previously rotted before application so as to make it available quickly.

19. *Seed selection and varieties—Sorghum (cholam).*—At Hagari five single plant selections were tried again, and their yield compared with that of ordinary bazaar seed. The yields were better all round than in last year so that differences were not so well marked. Some of the selections were distinctly promising. Six selected strains were similarly tried at Nandyal. At Hagari a number of varieties from different parts of the Presidency are being grown to provide material for further selection.

20. *Ragi, cumbu, etc.*—Five selected strains of ragi were grown at Hagari for comparison with each other. The Belgian congo cumbu when tried at Coimbatore grew well, but ripened very unevenly and displayed great variations. Seed selection work on this is being carried out by the senior students. This is also being grown at Koilpatti where it did well, as also a strain of cholam from the same locality which yielded very well and gave a good ratoon crop. Strain No. 9 of Italian millet gave good results at Coimbatore, over 1,100 lb. to the acre. There is room for much more work on selecting improved strains of these dry grain crops, but it is difficult for our limited staff of agricultural officers to find time for it.

(e) Fodder crops and grasses.

21. The comparison between fodder cholam and guinea grass as a fodder crop was continued at Coimbatore. The average annual yield of fodder per acre from guinea grass up to date works out at 26,700 lb. as against 31,000 lb. from fodder cholam. The cost of production is however in favour of cholam as 830 lb. were produced per rupee of expenditure as against 600 lb. of guinea-grass. The latter is however a particularly valuable fodder for milch cattle and the results can only be properly compared on a basis of feeding value. Lucerne was also compared this year on a small scale and yielded 25,400 lb. of fodder per acre, costing a rupee per 230 lb. A new introduction was Rhodes grass obtained from the Military Dairy Farm at Bangalore, but originally coming from South Africa. It has thriven very well and grows rapidly and will be tried on a larger scale. Maize was found to give a very good yield of succulent fodder. The experiments on fodder cholam at Koilpatti this year were a failure owing to the season. Three varieties of lucerne were obtained from America and tried at Hagari. One of these 'Arabia' did very well, yielding at the rate of 48,300 lb. of fodder per acre per annum. Seed was also obtained from Bangalore but the resulting crop was badly attacked by rust. Silver beet was also tried and found to yield less than lucerne and to be very subject to insect attacks.

22. *Indigenous grasses.*—The plots of grasses at Hagari referred to in last year's report were found to be too small to give satisfactory results. They will therefore be discontinued here and be tried on a larger scale on the new sheep farm at Bantanahal. Our information regarding indigenous grasses is very scanty and steps are being taken to improve it as explained in paragraph 31 below, the first requirement being a detailed survey of such grasses. A note on a special survey of grasses in the Nellore district was published in the Year Book.

(f) Groundnut.

23. A series of experiments has been in progress at Palur since 1903 on the effect of rotating and mixing a cereal crop with groundnut. The results are not very conclusive for the reasons given below. An experiment on growing groundnut continuously on the same land, both as a dry and as an irrigated crop shows no very marked deleterious effect. The land at Palur is so favourable to

the growth of weeds however that these possibly have the effect of a cereal admixture and so counteract the effect of continued growth of a leguminous crop. As explained last year the tests of varieties which have been in progress since 1908 are inconsistent and in some cases show extraordinary variation. The reasons for this were investigated by me during the year and it appeared that the experiments have not always been well laid out. In particular the yields of the indigenous local Mauritius had frequently been taken from the average farm yield instead of from plots comparable with those on which the foreign varieties were grown. This stultified the experiments as their object was to compare the yields of the latter with local Mauritius in order to decide whether it was advisable to replace this by some foreign variety. Moreover, although Palur was originally selected for experiments on groundnut, the soil is not typical groundnut soil, being an alluvial stretch liable to flooding from the adjoining river, whereas groundnut is mainly grown on upland soils. Again the periodical floodings make the fields very uneven, and it was evident that some fields were much more fertile than others. To obtain comparable results we want even land typical of the great groundnut areas, and this cannot be found on the farm. The obvious remedy is to start a sub-station for these experiments, which are most important. The Deputy Director was accordingly asked to select a suitable sub-station. Sites have since been inspected by me and proposals will be submitted this year. Manurial experiments at Palur seem to show that an application of lime increases the yield of groundnut, though here again, the conclusion can only be reached by discarding the 'no manure' plot as possessing a superior permanent fertility as the yields from it have been consistently better than from the manured plots. A beginning was made this year with single plant selection of groundnut.

(g) *Pepper.*

24. The yield of pepper at Taliparamba was adversely affected by the heavy late rains in October and November which not only caused much of the crop to shed but also resulted in a severe attack of the pepper flea-beetle. The several manurial experiments which have been in progress for the last ten years have shown that general manures such as leaf mulch, leaf mould, and cattle manure have all shown a marked improvement in yield which has been maintained. The 'leaf-mould' system, by which the soil is kept covered with leaves throughout the hot weather and thus sheltered from the heat of the sun, has given the best average results. Fish manure gives good results although it contains no potash; whereas the use of wood ashes, which are rich in potash, alone, gave poor results after the first four years. These results show that the crop needs no special potash manuring in this tract. The addition of lime to the leaf mould gave steadily increasing yields for the first 7 years after which they rapidly declined. Of the three main varieties tested Kalluvalli continued to give best yields.

(h) *Miscellaneous crops.*

25. As already mentioned Hoogli Jute and gogu (*Hibiscus cannabinus*) were grown for fibre at Anakapalle. The experiment on potatoes at Hagari was continued. The seed potatoes saved from last year's crop did not survive the hot weather. Fresh seed was therefore obtained and the crop was doing well when the unexpected rain in February practically drowned it out. At Palur the tapioca was damaged by the cyclone so that the profit on this crop worked out at only Rs. 41 per acre as against Rs. 129 last year. Some $5\frac{1}{2}$ acres of indigo were grown at Palur and the dye manufactured in local vats. The net profit per acre worked out at Rs. 106, valuing the dye at Rs. 90 per maund of 25 lb. The average yield is 45 lb. of dye per acre, but analysis of this by the Government Agricultural Chemist showed that it was of poor quality. Tobacco, turmeric, ginger and henbane were tried for the first time at Palur. The two former did well but the two latter were a failure. Henbane did very well at Koilpatti, the crop being transplanted 15 inches apart when about two months old. Samples of the stems and leaves were valued by the Imperial Institute and by firms of manufacturing chemists in India and pronounced to be of fair quality though inferior to Egyptian Henbane. The plot

yielded at the rate of 1,040 lb. of dried leaf per acre. Experiments on manuring coconuts and castor were continued at Coimbatore.

(i) *Livestock.*

26. *Cattle.*—The Coimbatore Dairy herd was increased and at the end of the year consisted of 39 cows, 5 heifers, 5 buffaloes and 72 calves. A number of half-bred cows have since been purchased in order to increase the milk supply. The year was unfortunate in that the herd suffered from two attacks of foot and mouth disease which upset farm, dairy and stock work seriously. It is difficult to prevent infection coming in from surrounding villages as a public road runs right through the estate and close past the cattle yard. In consultation with the Deputy Director of Agriculture for Livestock, cotton seed cake from Bombay was tried in place of cotton seed and found to be more economical in spite of the distance from which it was obtained. The dairy continued to work most successfully, and dealt with 131,335 lb. of milk as against 108,077 lb. last year. Of this, 51,891 lb. was sold on the estate as fresh milk at cost price and the rest as cream, butter, ghee, buttermilk, etc. The sales of butter went up to 5,608 lb. as against 3,939 lb. last year and this without any expenditure on advertising. The demand for our butter often exceeds the supply. The difficulty in securing tins for packing the butter was surmounted by the use of red cedar wood boxes made at one of the Trichinopoly cheroot factories. The accounts show a net profit of Rs. 326 on an expenditure of Rs. 9,302, after allowing for depreciation of building and machinery and cost of establishment. But if the sale of fresh milk at cost price be eliminated, and the skim milk, which is at present mostly fed to calves, is valued at 2 pies per pound which is only half the price at which about one-third of it is sold to the public, then the profits would be about Rs. 880 on an expenditure of Rs. 6,019 or $14\frac{1}{2}$ per cent.

27. *Sheep.*—The flock at Hagari was affected by the unusually wet season and as a consequence four breeding ewes and nine out of the 30 lambs born died of pneumonia. The yield of wool was however better, the best ram giving $3\frac{1}{2}$ lb. and the best hogg $2\frac{1}{2}$ lb. The breeding experiments confirmed last year's results as to the existence of four main types—black, black faced, white faced and piebald. Of these black and white faced appear to be pure types, so far as colouring is concerned, while the black faced type is a heterozygote formed by crossing the two former. These conclusions will be tested on a larger scale on the new sheep farm and an attempt made to breed out pure types.

28. *Poultry.*—The stock at Coimbatore is gradually being improved. Fresh cocks of the White Leghorn 'utility' strain were obtained this year and the flock numbered 153 at the close of the year as against 88 at the beginning. The number of laying hens increased somewhat too slowly however owing to mortality among the chickens. It is clear that we have many difficulties before us in evolving a strain which will be an improvement on the mongrel country fowl in quality but which at the same time will prove as hardy and as able to pick up a living in the conditions of the ordinary village. Over 2,600 eggs were obtained, and as these now show a gratifying increase in size, they are graded into three sizes and sold at rates varying from four pies to eight pies apiece. The turkeys are doing well and are increasing.

B.—CHEMISTRY.

29. The preliminaries for the Kistna delta soil survey were completed and out of 133 soil samples taken 80 have been analysed. The report will be published this year. Nearly 5,000 analyses were made, mainly of sugarcane for the Government Sugarcane Expert. Dr. Harrison's investigations on paddy soils continued, being mainly directed to the tracing of the history of the carbon dioxide and hydrogen gases which are produced by the anaerobic fermentation of organic matter in the soil. It was found that these gases, although formed in large quantities, do not persist but are rapidly recombined to form organic matter through the agency of bacteria which are of importance in connexion with the conservation of lime in wet land. Work is being continued in the direction

of clearing up the bacteriological relationships involved. The results of last year's work were published as a Memoir of the Imperial Agricultural Department, entitled "The Gases of Swamp Rice Soils, Part IV." The Senior Assistant in Chemistry M.R.Ry. M. R. Ramaswami Sivan Avargal continued his researches on the availability of mineral phosphates in paddy soil. This research has not yet reached the stage of publication. A commencement was made with the microscopic examination of oil cakes with a view to detect adulteration by admixture with inferior cakes. A study of the effect of varying manurial treatment upon the composition of grain was also commenced. Several chemical papers were contributed to the "Year Book", and Assistant M.R.Ry. B. Viswanath prepared and read a paper on some Enzymes of Germinating Red Gram (*Cajanus indicus*) before the Indian Science Congress at Bangalore.

C.—ECONOMIC BOTANY.

30. The Government Economic Botanist and his staff continued their work on paddy at the Paddy Breeding Station. An area of $2\frac{1}{2}$ acres was added to the station, thus completing the compact block of 16 acres originally selected. The whole area was brought into order by straightening bunds and channels and levelling. Quarters were built for the Sub-Assistant in charge. An oil engine and pump were obtained for being erected at the large well in order to enable a second crop to be grown with surety, and seed beds for the first crop to be started earlier. This will enable more work to be accomplished each season. Work on the interaction of characters in paddy was continued and the more definite results obtained so far were submitted for publication as a Memoir of the Imperial Department of Agriculture. The more definite economic characters proved to be complicated and difficult of analysis. The most promising single plant strains were again compared for yield and the same two head the list as last year. These will be compared once more before deciding to put them out. Several pure types of varying duration obtained from a cross between the local six months' variety and a strong growing four months' variety are showing good promise.

The selection work at Manganallur was seriously interfered with by the crabs which destroyed so many seedlings as to make the comparison of the results useless. The Government Entomologist has not yet succeeded in finding a remedy for this pest. A paddy survey of the Presidency has been in progress, the varieties being sent in by the district staff and grown at the Paddy Breeding Station. Some 65 varieties were so grown this year, but many of them proved to be mixtures. The pure types are gradually being sorted out, and each described and pure line cultures started. The selections made from the cross between Cambodia and Spence cotton mentioned in last year's report were again raised in the Botanical Garden. The material shows great variation but among the several types are some which show considerable promise for growing as a dry crop, being heavy yielders with long staple. Messrs. Hilson and Thomas examined these cottons and selected some for trial in the Ceded districts and Tinnevely.

D.—GENERAL BOTANY.

31. The Government Lecturing Botanist is responsible for the teaching in botany and much of the time of himself and of his staff was devoted to this. The sending of specimens to Mr. Gamble at Kew for the completion of his Flora of the Madras Presidency has been stopped until the sea route is safer. Five new species from the collections previously sent were named and described in Kew bulletins. As the result of fresh collections 1,020 new sheets were incorporated in the herbarium collection at Coimbatore and 5,300 sheets were mounted. The study of the common grasses of the plains continued and 30 were described and drawings for plates prepared. These will first be circulated to the Agricultural Officers for the collection of information as to vernacular names, occurrences and use as fodder, and the whole will then be published as a bulletin.

E.—ENTOMOLOGY.

32. Mr. E. Ballard, the permanent Government Entomologist, remained on military duty throughout the year and his First Assistant was in charge. Spraying

against the mango hopper was carried out in the Chittoor district and a number of pests were investigated. A serious pest in the shape of a climbing caterpillar, *Cirphis albistigma*, appeared on paddy crops in the Chingleput, North Arcot and South Arcot districts in January and was studied in the field. Some work was also done on the fresh water crab pest of Manganallur, but no certain remedy has yet been discovered, nor has the life history of the crab been worked out. The cotton stem weevil which is so destructive a pest on Cambodia cotton in the Coimbatore district also remains an unsolved problem.

33. The district work on sericulture is dealt with in paragraph 48 below. Broods of French univoltine silk worms were for the first time raised successfully at Coimbatore and at Kollegal. As an experiment a quantity of eggs obtained from this strain was placed in cold storage at the King Institute, Guindy, for trial next year.

F.—MYCOLOGY.

34. The district work on palmyra and areca palms is dealt with in paragraphs 36-38 below. A considerable amount of work was done on the fungus causing secondary leaf fall in hevea rubber. Experiments are being carried out on four blocks of 100 acres each in the rubber area aiming at reducing the disease by removing all dead branches and fruits. A root disease of coffee on the Nilgiris was investigated and successful preventive measures devised. Cultural and spraying operations against brown-blight on tea were most successful. One nursery which was about to be destroyed as being hopelessly diseased was saved and 77,000 seedlings planted out from it. Diseases of grape vines in Krishnagiri were investigated, four small vineyards being taken over for spraying experiments. Forty-two specimens of diseased plants were received from the public for advice.

G.—THE SUGARCANE-BREEDING STATION.

35. Dr. Barber's report is published in Appendix IX. The work continued on the same lines as in previous years, but with increasing success. The number of cane varieties which flowered were 96 as against 71 last year. From these some 4,000 crosses were obtained and 99,000 seedlings raised as against 300 and 30,000 respectively last year. These crosses are between thick and thin canes made with a view to obtaining canes combining the hardiness of the thin North Indian cane with something of the high sugar yielding qualities of the thick South Indian cane. The number of canes selected as being probably suited to Northern India was 97 as against 11 last year. Over 4,000 seedlings were grown to maturity for chemical testing of their sugar content and 5,847 analyses were made.

Work was done during the year on the classification of Indian canes, thirty-three varieties of local canes growing on the farm being exhaustively studied. A continuous study has been made from the start of the wild grass—*Saccharum spontaneum*—which is generally regarded as the form from which the cultivated sugarcane has been derived. Seedlings have been raised from varieties of this grass and used for crossing with thin and thick canes. A study of the root system of different classes of cane was also made.

The cultivation of the station has been standardized and it is now completely laid out and utilized to the fullest extent. Some 1,400 different plots are now cultivated annually.

IV.—DEMONSTRATION, AID TO THE PUBLIC, SHOWS, AGRICULTURAL ASSOCIATIONS AND GENERAL PROGRESS.

A.—OPERATIONS AGAINST DISEASE.

36. *Palmyra disease in Gōdāvari and Kistna.*—The system of examining all trees within a radius of 50 yards from outwardly infected and dead trees for the purpose of detecting cases of concealed infection was continued. Infected tracts were gone over for the third time in Kistna and for the second time in Gōdāvari. By the middle of June 1917, the work of general examination had been finished

in Kistna and in the Central delta of Gōdāvari. In the Eastern delta and uplands of Gōdāvari, the work was completed in 172 villages by May 1917, leaving 21 villages for completion in June.

37. The total number of trees examined was 879,134 in the two districts; of these 14,236 were dead and 11,813 showed external signs of infection, while 29,032 trees were discovered to be infected internally. In addition to these, 1,725 externally affected trees and 9,888 dead trees were treated by village officers in the usual course. The south-west monsoon in both the districts was the heaviest on record during recent years and was thus highly favourable to the growth and spread of the disease; yet the total number of externally infected and dead trees cut during the half-year ending 31st December 1916 was the lowest on record although the second-half of the year is the period most favourable to the disease. Again, the percentage of the total number of diseased trees to trees examined during the course of the general examination this season was 6.6 in Gōdāvari and 5.5 in Kistna while the percentage of latent infection in both the districts works out only to 2.8. These are the lowest figures on record. It is clear that the system is working successfully and the incidence of the disease is being steadily reduced.

One noteworthy feature in the operation was that the ryots have borne the entire cost of cutting and burning the trees since July 1916. This reflects great credit on the special Tahsildars and their staff who, in the face of many difficulties, have enlisted the co-operation of the villagers who, while recognizing the benefit of the operations, prefer to postpone the work. The proposed Pest Act which provides for the necessary amount of compulsion will render the work of the staff much easier. As over 95 per cent of infected trees recover when operated on it is in the direct interests of tree-owners to compel them to take the necessary steps in time.

38. *Mahali Disease on areca nuts.*—The work of spraying against the disease was transferred from the Government Mycologist to the district staff. Nearly 43,000 palms belonging to 101 garden owners were treated, approximately one-third being sprayed for the first time. The operations were a thorough success and requests were received even from the adjoining Cochin territory for assistance in spraying. The disease is now very slight in many places where it was formerly virulent.

As usual the department lent the sprayers free and we charged only about 82 per cent of the cost of chemicals as this had doubled since the previous year. The tree owners supplied the labour. The entire cost of the operations including the pay and allowance of the staff works out to 3.47 pies per tree towards which the tree-owner paid only 1.4 pies. Even so, many persons held back. They are slow to realize that spraying is not a cure for the disease but merely a prophylactic against an attack and so they are not willing to pay anything until their trees are actually attacked when it is too late. All active persuasion has therefore been stopped for the next year, except in villages taken up for the first time. The work has been limited to canvassing in the villages before the monsoon, selling chemicals to those who want to spray, helping them with the loan of sprayers and supervising their work. If, as is likely to be the case, the disease breaks out again in places where the trees are not sprayed, the tree owners will learn to appreciate the value of spraying and to pay for it.

39. *Work against smut.*—The steeping of seed in a solution of copper sulphate as a preventive against smut was preached in the districts of Bellary and Kurnool. The treatment was found effective in the case of Italian millet and cumbu as well as cholam. In spite of the high price of copper sulphate, 21,790 acres were sown with treated seed this year as against 17,000 last year. The increase is in Bellary, the work in Kurnool having suffered from lack of staff for district work.

40. *District work against insect pests.*—The Government Entomologist and his staff toured in many parts of the Presidency to investigate insect pests reported by ryots, and gave advice and assistance as to the best method of combating the attacks. Poisoned baits were used against the climbing caterpillar on paddy in the South Arcot district, but it appears that the best results are likely to be

obtained by catching the moths before they lay by means of the Andres Maire moth trap which was successful in this respect at Manganallur. A regular campaign with these traps will be carried out in the worst affected areas this year. The Deccan grasshopper which was formerly so serious a pest in Bellary has almost disappeared.

B.—CROPS.

41. *Sugarcane.*—The demonstration of planting canes in lines and thus reducing the seed-rate was continued in the I Circle. Over 79,000 setts were sold for seed from the Samalkota and Anakapalle farms. Cane was introduced for the first time into the Bimlipatam and Srungavarapukota taluks of Vizagapatam district. Some improved furnaces were constructed for ryots. Exotic canes are spreading rapidly round Anakapalle under the stimulus of Messrs. Parry & Co. who have now opened a factory there. In the IV Circle over 107,000 setts were sold in the districts of South Arcot, North Arcot and Chittoor and a commencement was made in improving the local methods of cane cultivation near Madanapalle and Pakala in the Chittoor district by inducing the cultivators to plant the rows wider apart, thus saving considerable expense in seed. Three improved sugarcane furnaces were constructed for ryots. There has been a considerable development of sugarcane cultivation in the Palghat taluk of the Malabar district where Messrs. Parry & Co. have put up a milling and jaggery making plant. The introduction of the hard Red Mauritius cane has greatly widened the scope of cane cultivation in the Uppinangadi taluk of South Kanara as this cane is comparatively immune from the attacks of wild animals. There has been a similar increase in the cultivation of this cane in the north of South Kanara, but here the growers are all yearly tenants who are too poor to invest in jaggery making plants and so sell their crops to professional jaggery makers who reap the greater part of the profit. It is hoped to introduce jaggery making by the actual growers with the help of the Co-operative Credit Department.

42. *Cotton.*—As in previous year the work was confined to the III Circle, the 'Northern' and 'Western' area, and the VI Circle—the 'Tinnevelly' tract. In the III Circle 934 acres were sown in 1915 in the Bellary district and 980 acres in the Kurnool district with our selected strains—Sircar Nos. 1 and 2 respectively, on seed farm conditions. The average outturn of lint on these seed farms was poor, being about 40 lb. per acre, as against a normal outturn of 50 lb. for local cotton. This was due to the season which was poor, but at the same time it is becoming obvious that we must pay more attention in future to yield of lint per acre, when making our selections. So far our strains have been selected mainly for good staple, colour and strength, the qualities desired by the cotton trade. But to the ryot the yield of lint per acre is the important matter because the difference in price between long and short staple cotton is not sufficient to compensate him for the poorer yield of the former. In the Northern and Western tract we have not been able to find a strain combining long staple with high yield, the qualities appear to be mutually exclusive. We have therefore nothing to offer the ryot in preference to a high yielding short stapled cotton, such for instance as the Roseum cotton of the Central Provinces. This cotton appeared this year near Adōni and yielded remarkably well. The season was however exceptional, the rainfall having been some three times the average. It remains to be seen how it will do in a normal year. However it is evident that we may have to reconsider our policy in this tract in the near future.

From the seed farms mentioned above 176,568 lb. of seed were obtained in 1916 and of this 123,589 lb. of seed were sold to ryots at a premium or used for the next year's seed farms.

In Kurnool an experiment was made to see if it would be profitable for a ryot to clean his kappas before selling. The kappas were carefully picked over and all stained and damaged kappas separated. We could obtain no more than the current market rate, i.e., Rs. 172 per candy for the cleaned kappas while the pickings sold for only Rs. 157 a candy. The cost of picking came to Rs. 3 per candy and the total loss on the operation came to Rs. 323 assuming, as is

undoubtedly true, that we could have sold the whole lot uncleaned at Rs. 172 a candy. At Bellary we sold uncleaned cotton at Rs. 174-11-0 per candy. Unless the buying firms will give a premium for clean cotton it is obviously a waste of money to clean it. The ryot's practice of selling the good and bad together just as it comes from the field is obviously the correct one.

In the VI Circle, 552 acres were cultivated as seed farms in 1915 to supply seed for the 1916 sowing season. This area mostly consisted of Company No. 2 and Company No. 3, but 20 acres each of four special selections were also grown in order to obtain spinning tests. The average yield of lint per acre worked out at 96 lb. for Company No. 2 and 139 lb. for Company No. 3 for the 'season' picking. We do not take the second or 'summer' picking from these seed farms as the seed then obtained is not of so good quality. The average outturn of unselected Tinnies is about 90 lb. per acre for both pickings. It will thus be seen that our selections in this tract combine both good yield per acre and good staple. This is especially true of Company No. 3 and this fact is of importance in connection with the fight against 'pulichai' which is dealt with below. I calculate that the ryot who grew our Company No. 3 cotton last year made a profit of some Rs. 28 per acre over those who grew ordinary Tinnies. This profit is mainly due to the higher acre yield although the premium of Rs. 16 per candy given by the firms for the superior lint accounts for some Rs. 4-8-0 of it.

From the 552 acres of seed farms sown in 1915 supplemented by the surplus stock of farm seed 135,028 lb. of seed were obtained in the 1916 season. Of this 87,086 lb. was sold to ryots at a premium for sowing in October-November 1916 and 26,840 lb. issued to seed farms, the balance, i.e., 21,102 being classed as inferior and sold as cattle food. From last year's report it will be seen that we sold 87,096 lb. of seed in the 1915 season, sufficient to sow some 8,700 acres. About 40 per cent of the resulting crop from this seed was sold by ryots on co-operative lines as explained below. We know that these obtained 703,002 lb. of good seed for sowing in the 1916 sowing season. Assuming as in last year that only two-thirds of this was actually sown, which is a very conservative estimate seeing that the seed sells at a premium, we may safely say that 87,086 plus two-thirds of 703,002 or 555,754 lb. of our seed was sown in October-November 1916, which would be sufficient for some 56,000 acres.

The system of joint sales and ginning was expanded, and 362 ryots in 71 villages combined for this purpose this year. In six of these villages regular seed unions working under rules were formed during the year. Our aim is to form a network of these seed unions over the Tinny cotton tract, so that the bulk of the seed annually sown in the 600,000 acres of cotton may be supplied by these unions. A union consists of five or six ryots who undertake to sow the whole of their cotton area with our selected cotton, to gin and sell the lint jointly under our supervision, and to keep the seed for sale for sowing in the next season. To enable them to finance this latter item they borrow if necessary from the local co-operative credit society, of which they are members. We supply them with fresh seed of our selected strains annually sufficient to sow one-twentieth of the total area annually grown with cotton by the union. This seed is sown by one member on his land, as a union seed farm, and the resulting seed is used in the second year for the whole union. If we can get such a system widely organized throughout the tract we shall be able to put out any new strain in a few years, the programme being as follows, as soon as we have raised about 100 acres of the new strain departmentally:—

1st year 1,500 acres of union 'seed farms.'

2nd year 30,000 acres of union lands.

3rd year 600,000 acres or the whole tract, sown with union seed.

Pulichai.—This intruder into the Tinny tract was fought on two lines,

(a) by a combination of the buying firms to refuse to buy it,

(b) by distribution of seed of Company No. 3, which yields the ryot a

better return per acre than pulichai does. Either method alone would have failed. There can be little doubt that pulichai gives a better return per acre than ordinary Tinny, even when properly valued on its merits as a short-stapled cotton

and not mixed surreptitiously with good Tinny. Had we not had in company No. 3 a cotton which can beat pulichai at its own game, i.e., high yield per acre, nothing could have prevented its spread and the agreement of the firms not to buy it must inevitably have broken down eventually. We may legitimately object to a ryot palming off pulichai as Tinny and so obtaining a price to which he is not entitled and incidentally ruining the reputation of Tinny cotton. But, we have no more right to object to a ryot growing a crop of pure pulichai and selling it as such, if it pays him to do so, than we have to object to his deciding to grow groundnut instead of cotton for the same reason. Luckily for the spinners and exporters interested in long-stapled cotton it pays the ryot better to grow our company No. 3 cotton than to grow pulichai. The one great danger in the situation was that we had not a large stock of the seed of company No. 3 ready last year. As soon as the position was realized, steps were taken to increase the supply of company No. 3 seed by largely increasing the area of seed farms and we may look forward to the future with confidence. The period of danger has been bridged by the action of the firms seconded by strenuous work on the part of the staff of the Agricultural and Revenue Departments. At a meeting held at Tuticorin in September 1916 the firms decided to renew their legal agreement and to make it even more stringent in that no cotton containing more than 3 per cent of pulichai was to be ginned or bought by them. Cotton containing less than 3 per cent can be bought only after a deduction has been made for the quantity of pulichai contained. Luckily this quantity can be detected by a count of a sample of seed obtained from the gins. Each of the seven firms has deposited Rs. 5,000 as a guarantee in the name of the Director of Agriculture as Trustee under the Agreement, and Mr. Thomas, the Deputy Director of Agriculture, VI Circle, inspects yards and books of the firms to see that the conditions are fulfilled. I am glad to say that the agreement has been loyally adhered to by the firms, such few breaches of it as have been detected having been due to accident or the unauthorized action of subordinates. The attitude of the firms had a great moral effect and assisted greatly the action of the officers of the Agricultural and Revenue Departments whose activities took the form of persuading the ryots to pull up every pulichai plant in their fields. This was successfully accomplished throughout the Ramnad and Madura districts and my sincere thanks are due to the two Collectors Messrs. Paddison and Loftus-Tottenham for the whole-hearted aid which they gave me. The efforts of the Deputy Director of Agriculture Mr. Thomas in the Tinnevely district were not quite so successful but much useful work was done. In this tract we found some 90 acres of almost pure pulichai the owners of which naturally declined to uproot it. We decided to buy the crop if possible in order to control the seed and Mr. Thomas eventually succeeded in persuading the owners to sell it at 25 per cent below Tinny price which represented its market value on its merits. For the sake of the moral effect the seed from this cotton was subsequently publicly burnt at the Koilpatti farm before a large gathering of ryots.

Pulichai has thus been largely stamped out but it still exists as an impurity in the general crop over a wide area. It will be a matter of years to root it out completely not because it will be grown deliberately but because many ryots are careless about their seed.

43. *Drill cultivation in the Tinnevely tract.*—As explained in previous years' report this line of work takes the form of demonstrating on ryots' lands the use of the practice, universally followed in the Ceded Districts, of sowing crops in rows with the seed drill and intercultivating them with the bullock hoe instead of by hand.

In the year under report the area so drilled was 15,351 acres as against 17,060 last year. The falling off is in the area of cumbu drilled, that of cotton having increased. This falling off is partly real and due to the fact that the staff were compelled to devote their energies to the campaign against pulichai and is partly due to more stringent checking of the areas reported as drilled, it having been found that one subordinate at least had attempted to obtain departmental credit by exaggerating the areas drilled in past years. Moreover the rules were made more stringent in order to prevent the system of demonstration degenerating

into a system of cultivating ryots' fields for nothing, a system which could of course be expanded indefinitely. After the preliminary free demonstration we now insist on the ryot either hiring or buying a set of implements. Progress is slow, there is much prejudice to overcome and many unexpected difficulties to smooth over. For instance, the village carpenters who have been keeping a certain number of implements in order in return for their yearly fees naturally object to being expected to deal with a much larger number of new fangled implements unless their remuneration is increased.

However 111 sets of implements were sold by the department as against 83 last year, and 15 sets are known to have been made by ryots for themselves, which is a new departure.

44. *Paddy—seed and seed-rate.*—The demand for the surplus seed of the farms continued and altogether 68,251 lb. of seed paddy were sold. There was a great demand for the strains of seed paddy which have been obtained by selection at the Manganallur Agricultural station and a promising feature was that increased orders were received this year from those who had tried small quantities of the seed last year. In order to secure wider distribution of the seed and to encourage ryots to grow their own seed in future, a maximum limit was fixed for supply to any one applicant and larger orders were refused. The demonstrations of economical planting were continued in the I Circle and formed one of the main activities of the district work in the IV Circle, mainly in the Chingleput and South Arcot districts. In the Coimbatore district work was concentrated on the main wet tracts along the river valleys. Economic planting has proved signally successful in the fertile and well-drained lands along the Bhavani valley and has shown such a marked increase of yield that it is being rapidly adopted by the ryots. The rate at which this improvement is spreading in this district is shown by the following figures which give the area on which it is actually known to have been adopted: 1914-15, 450 acres, 1915-16, 1,950 acres and 1916-17, 4,600 acres. These are the minimum figures as the practice spreads so fast that one cannot keep track of it after the first year or two. In Malabar special stress has been laid on the importance of manuring seed beds and economic rather than single planting is advocated, as the paddy plant does not tiller so freely in this district of heavy rainfall. A considerable reduction of seed rate for transplanted crops has already been effected in many places in Malabar. Economic planting was also advocated in the Periyar tract in Madura district along with the green manuring work. The practice is rapidly spreading and once adopted is adhered to. It must naturally take time to become universal throughout the very large area that is annually transplanted. The small district staff of this department have long ago lost touch with the spread of this improvement, which they started, but which has now acquired an impetus of its own. As an instance of how it spreads from a ryot living in a village in a part of Salem district which has never been touched by the department. He wrote to express his thanks to the Agricultural department for having introduced this improvement and explained that the Village Munsif of the village had seen the practice while visiting a village in South Arcot and on his return had tried it on one of his fields. His neighbours mocked at the innovator saying 'Why are you leaving the field uncultivated this year?' but when they saw how the crop tillered, and the increased yield that it gave, they hastened to do likewise.

45. *Manures.*—The use of superphosphate as a manure for paddy is becoming popular in the south. This was specially the case in the Musiri taluk of the Trichinopoly district where it is used in conjunction with daincha as a green manure. There is much scope for its use in the Tanjore delta but the ryots are slow to appreciate its merits because although it gives a return of at least 100 per cent on the money invested yet this is very little in comparison with the return on money invested in cattle or sheep manures. The point which the ryot takes time to realize is that there is not enough of the latter manures to go round and that it is better to get a small but certain increase in return by using purchased manures than to get none at all by failing to manure altogether. In Madura 21

demonstrations were conducted on ryots' lands to show the value of superphosphate manuring and orders for 73 cwt. of superphosphate were received as the result of the demonstration work done in previous years. Fish manure was cheaper this year owing to good catches on the West Coast and this is becoming popular in Tanjore. Two or three large landowners are known to have obtained large consignments while the Tanjore District Co-operative Manure Society is distributing several tons of fish guano. Nineteen tons of fish manure were obtained by the Deputy Director of Agriculture, VI Circle, at the close of the and 13 tons of this have already been sold.

46. *Green Manure.*—Altogether 166,457 lb. of seed of green manure crops were sold as compared with 170,515 lb. last year. The decrease was due to the failure of the supply of daincha (*Sesbania aculeata*) seed from Bengal, the crop there having been destroyed by a cyclone. A certain amount of seed was obtained from Assam at a high price, but this was received too late for distribution in Tanjore and Madura and moreover about a third of the seed received was old seed which had lost its power of germination and so could not be distributed. We hope soon to be independent of the supply of seed from Bengal, however, as every effort has been made in recent years to get ryots to grow daincha for seed. These efforts are now being crowned with success. In parts of Trichinopoly and Salem districts the ryots are already growing enough for their own requirements, while in Kurnool ryots are growing the crop on dry lands for the purpose of supplying the seed to the department. The supply in Kurnool was small this year on account of the exceptionally heavy rains. We may hope for a greatly increased supply next year. And every ryot who grows enough for his own supplies reduces the demand for fresh seed from the department.

In Tanjore the use of kolinji (*Tephrosia purpurea*) continued to spread especially in the Shiyali taluk. This crop has the advantage that it becomes self-sown in a few years so that a permanent supply of green manure is secured by the ryots. In Salem district the continued work of the Agricultural Demonstrator has resulted in an increasing use of daincha and kolinji in the Attur taluk. In the Musiri taluk of Trichinopoly district daincha has taken a fair hold and the ryots are growing their own supplies and are beginning to sell seed to adjoining wet tracts. A gratifying feature about this is that the use of daincha in this area appears to be the result of the distribution of the Agricultural Calendars and leaflets, as it arose before we were able to do any district propaganda work there. The use of kolinji has taken a firm hold in the Gobichettipalaiyam taluk of the Coimbatore district so that the demand this year was considerably greater than the supply available with the department.

In Madura an attempt to get daincha grown for seed in the Cumbum valley was unsuccessful owing to local drought at the critical period. The experiment will be repeated this year. Arrangements were made with contractors for the supply of 1,475 bags of kolinji seed, but only 1,043 bags were actually supplied. This seed had been collected in the past from tank beds in Tinnevely where the plant grows wild, the earth under the plant being collected and sifted to obtain the seed. The continued exploitation of these tank beds in the past has led to a diminution in the growth of wild kolinji so that it is becoming difficult to obtain our requirements. The plant is common in many places however and it is only a matter of price and organization to obtain supplies. The kolinji seed was mostly distributed in the Periyar area. Much of this area is now self-sown, and private dealers have been taking up the trade of supplying kolinji seed in the last few years. The supply of daincha seed in this area was not equal to the demand this year for the reasons given above; the local ryots have however taken to collecting their own seed. Use was made of Agricultural Associations and Co-operative Societies in distributing departmental seed. Owing to the enhancement of the fees for leaf-collecting from the local forests there was an increased demand for green manure seeds from the Tambaraparni tract in Tinnevely. It was not possible to exploit this tract this year however owing to lack of staff.

In the IV Circle large quantities of kolinji, sunnhemp, and daincha seeds were sold, mainly in the South Arcot and Chingleput districts where Agricultural

Demonstrators are working. A little was sold in the North Arcot and Chittoor districts as the result of special tours by the Deputy Director and an Agriculture Demonstrator. A large stock of kolinji seed was left unsold at the end of the year, which the Deputy Director attributes to the difficulties of transit by rail.

In the northern districts this work is not so important as explained last year. The practice of growing green manure crops is well understood in the Circars. The total sales increased slightly to 9,316 lb. this year. The extension of the growing of daincha for seed in Kurnool has already been noticed.

47. *Indigo*.—As explained in last year's report, there was no necessity for the department to stock large quantities of indigo seed this year as the ryots were able to obtain their own supplies from the previous year's crops. Some 5,460 lb. of Cawnpore indigo seed were purchased and supplied to ryots in South Arcot. As mentioned in paragraph 5 above the Special Indigo Research Chemist at Pusa, Mr. W. A. Davis, visited Madras in January and I toured with him in some of the indigo tracts in Chingleput, South Arcot and Vizagapatam. As the result of his observations Mr. Davis was able to provide me with a valuable note on the possibility of improvements in indigo manufacture in Madras and the substance of this has been embodied in a leaflet which has been distributed to manufacturers in time for the current cultivation season. The question of improving the quality of Madras indigo was also discussed with a number of the exporting firms interested in the trade and my thanks are due to them for the advice and information which they have given me. Dr. Marsden is now studying the local methods of manufacture in detail and it is hoped that we shall be in a position to give better and more detailed advice to manufacturers. A small quantity of Java-Natal indigo seed was obtained last year and is being tried on our farms. This variety is reported to give a very heavy yield of dye and there is a great demand for its seed in Bihar where it is difficult to raise seed from it locally.

48. *Sericulture*.—Work was continued in Kollegal on the same lines as in previous years. The new Silk Sub-Assistant raised six broods of silk worms and sold 28,000 disease-free seed cocoons as against 13,000 last year.

The work that has been done so far is certainly useful in that a small amount of disease-free seed has been supplied to the rearers. These have shown their appreciation of the work by readily buying the seed at special prices. But if we are to make any real impression on the silk industry in Kollegal it is evident that the work must be greatly expanded. The total requirements of the taluk in seed cocoons are probably somewhere near 40 million per annum. Three broods are raised and we ought to aim at supplying pure seed for at least one brood per annum for each rearer, say 12 million seed cocoons altogether. It is obvious that this could only be done indirectly, i.e., by supplying pure seed from a central institution in the first instance to trained rearers who could specialize in raising pure seed for sale.

Mr. Maxwell Lefroy, the Imperial Silk Specialist, visited Madras during the year and I had the benefit of discussing the matter with him and also with Signor Mari, the Director of Sericulture in Mysore. Kollegal is merely an off-shoot of Mysore where the bulk of the silk industry lies and it is evident that any scheme for Kollegal should be closely correlated with work in Mysore. I am awaiting Mr. Lefroy's report before attempting to formulate any scheme for large expansion of the work. In the meantime the work will be continued on present lines, but gradually expanded as far as possible.

49. *Implements*.—The demand for the light 'Monsoon' iron plough continues in spite of the fact that its cost has risen considerably owing to the war. It is becoming increasingly popular with black soil ryots in Tinnevely. Altogether some 50 of these ploughs were sold and others let out on hire in order to popularize these. This plough, although the simplest, and therefore the best, available is by no means ideal in all respects and it is hoped that we shall be able to evolve a better plough still with the help of the Government Agricultural Engineer who is now taking up the problem. The Avalnattam Agricultural Association purchased outright the two-furrow disc plough which they had formerly hired from us, and also hired the similar plough from the Koilpatti Farm

whenever it could be spared. There is evidently a good prospect of these ploughs being widely used on the black soils in Tinnevely. Demonstrations of ploughing with iron ploughs were held at various places in the districts and also on our farms. A special demonstration at the Tiruppur Cattle show in June 1916 attracted considerable attention from the ryots present. The sale of drill cultivation implements in Tinnevely has been mentioned in paragraph 43 above. In Vizagapatam the use of the cattle mhote for raising water is practically unknown, picottahs worked by man power being universally used. A start has been made to demonstrate the advantages of the mhote, using iron buckets.

50. *Live Stock*.—The Deputy Director of Agriculture for Live Stock made a thorough enquiry into the conditions of the Madras Town Milk trade during the year and his report will be published as a bulletin. Regular breeding work with cattle will commence only when the cattle farm in the Ongole tract is opened, and as explained in paragraph 6 above a suitable site for this has not yet been found. The Deputy Director of Agriculture for Live Stock has toured over most of the Guntur and Nellore districts in this connection and studied the local cattle and breeding practices. He also visited the District Agricultural Stations at Samal-kotta, Anakapalle, Nandyal, Hagari and Koilpatti and the Military Dairy Farm at Bangalore. The number of cows brought for service at Coimbatore was 504 which is somewhat less than in the last two years; the decrease is attributable to the attacks of foot and mouth disease. A start has been made with keeping breeding bulls on our Agricultural Stations and these have now been supplied to Anakapalle, Hagari, Palur and Koilpatti. Ryots are beginning to bring in their cows for service everywhere except at Hagari. It would appear that the ryots, in this part of the Ceded Districts at least, are so ignorant of the first elements of cattle breeding as to be entirely unaware of the necessity of choosing the proper time for bringing in their cows. A similar ignorance has been noticed in other places also, for instance the breeding bull which had been bought by the Palghat Agricultural Association from the Coimbatore herd was, without good cause, reported to be 'useless' and so brought to the Tiruppur Show for sale,—where he demonstrated the contrary, and was taken back and is now found to be most useful. This ignorance is perhaps not surprising in non-breeding tracts, seeing that the ryots have never exercised any sort of supervision over the promiscuous breeding of their village herds; but the fact may account for some of the failures of the Veterinary Department in the matter of breeding-bulls. During the year a scheme for encouraging Agricultural Associations, Co-operative Societies and individuals to maintain good breeding bulls by paying them Rs. 100 per annum towards the maintenance of the bull on condition that certain conditions were observed, was sanctioned by Government and advertised in the districts. So far eight applications have been received but the scheme cannot be said to be in working order. Most of the applicants desire help and advice in purchasing a suitable bull and naturally want the bull passed by the department before they buy it. It is difficult to arrange for this when the applications come from all over the Presidency. It will be simpler when we are in a position to supply bulls bred by us on Government Cattle Stations.

Certain rules for the grant of waste lands for Cattle and Dairy Farms were approved by Government during the year—vide G.O. No. 1820, Revenue, dated 13th August 1916. Two cases of application under these rules were brought to my notice and in both cases they were from speculators whose main idea was to get the land and who obviously had no real intention of using it for cattle and dairy farming. The applications were refused. It is always the danger of such concessions that they appeal to the wrong class of people.

51. *Cattle Shows, Agricultural Lectures, etc.*—No cattle show was held at Ongole this year, the Show Committee having decided to hold the show biennially in future. This decision is the result of an agitation against the show based on the feeling 'that the country is being depleted of its best type of animals owing to the wide advertisement that is being given to the breed by the shows.' I quote from the circular of the Committee announcing the decision. That this feeling is based on insufficient evidence is sufficiently obvious from the fact that the average

number of Ongole cattle exported out of the country,—mostly to Java for breeding purposes,—is only about 500 which is a very small fraction of the total number exported from the Ongole tract to other parts of the Presidency, in the ordinary course of trade. About 5,000 cows per annum were sent to Madras Town alone for the milk trade. The cattle trade is based on economic causes which the show does not affect, and it would be more correct to regard the show as an effect of the trade than vice versa. The usual cattle fair, of which the show is merely an adjunct, was held at Ongole and as a matter of fact some 400 animals were exported to Java this year.

The usual cattle and pony show was held at Tiruppur and agricultural lectures and demonstrations were given there as well as at the Mailam Cattle fair in South Arcot, the Lalgudi Educational Exhibition at Trichinopoly and at the Andhra Conference at Cocanada. Government granted Rs. 200 towards the expenses of the annual poultry, fruit and vegetable show at Ootacamund in May 1916. A new feature this year was a ploughing competition at the Central Farm, Coimbatore, the first prize, a 'Monsoon' plough, being won by a farm coolie. A large number of demonstrations were carried out on ryots' own lands in connection with single planting of paddy, green-manure crops, drill cultivation, artificial manures, jaggery making, iron ploughs, etc., most of which have been mentioned in the preceding paragraphs. A start was made with demonstrating the use of the mhote in the Vizagapatam district where it is almost unknown, only picottahs being used. The Agricultural Demonstrators on district work take full advantage of every improvement carried out by a ryot by collecting the neighbours and urging them to do likewise. The Deputy and Assistant Directors of Agriculture conducted the more important demonstrations in the villages before larger gatherings of ryots.

The maistries and coolies who are employed on our District Agricultural Stations form a means by which knowledge of new methods might penetrate into the village. Landowners are slowly beginning to appreciate the benefits of employing maistries who have been trained by us, and occasionally take our men into their employ. In 1913, a leaflet was issued inviting landowners to send their own men for regular training on the Agricultural Stations, but the response to this has been small. Three men from the West Coast were trained in jaggery making and economical transplanting of paddy at Coimbatore and three coolies from a mission station underwent a six weeks' training at Palur. A man was trained for a year at Coimbatore for the American Mission in Nellore. A regular system of training coolies and small ryots in drill cultivation is working in Tinnevely and Ramnad districts. The regular coolies attached to the Koilpatti Farm are sent out as maistries in the sowing season and train the coolies in the village. In recent years these have proved insufficient and selected village cultivators who have been trained in previous years have also been employed as maistries. The total number of individuals who have been so trained since 1913-14 is 817, of whom 393 were trained last year.

52. *Agricultural Associations and Co-operative Societies.*—The Vizagapatam District Agricultural Association held one meeting at the Anakapalle Farm but seems to have done no other agricultural work. A Taluk Association has been started at Sringavarapukota which promises better. The Ganjam District Agricultural Association gave prizes for improvements and some of its members are reported to have gone as far as to try improvements on their own lands. The Gōdāvari District Association has done good work both educative and demonstrational. In the South Arcot district the Agricultural Co-operative Society in Rettanai village continued to do useful work. A District Agricultural Association with limited membership was formed in North Arcot district, the members being pledged to carry out one definite improvement each on their own lands.

The Kumbakonam Agricultural Association and the Kumbakonam Agricultural Co-operative Society (Limited), which appear to be practically identical, acted as a green manure seed depot for the department, but did not fulfil our sale conditions. The former still publish a monthly leaflet. The latter did practically no Co-operative work. The Tanjore District Co-operative Manure Society

manufactured bone meal for its members. They also purchased large quantities of fish guano through the Fisheries Department.

In Malabar the village associations continued to do useful work but unavoidable changes in the district staff of the Agricultural Department made it impossible to inspect them as often as was desirable. The Coimbatore District Agricultural Association conducted the Tiruppur Show but did little else. The Madura and Ramnad District Agricultural Associations did useful work in supplying kolinji seed and fish manure to its members. Use is being made of this association to test the suitability of new strains of paddy selected by the Government Economic Botanist. The Uttangudi Agricultural Co-operative Society purchased a large quantity of superphosphate at wholesale price for manuring paddy. Agricultural Co-operative Societies were newly formed at Tamaraipatti and Kudakulam in the Madura and Ramnad districts and an Agricultural Association at Sholavandan in the Madura district. At Tinnevely an Agricultural Improvement Society was started which is already showing signs of useful activity.

Seed Unions for the Co-operative sale of cotton were formed for the first time in the Tinnevely tract as explained in paragraph 42 above. These are not registered societies, but work in conjunction with village Co-operative Credit Societies, the members of the Union being members of the Credit Society and so obtaining the necessary financial assistance.

Lack of adequate staff in the district makes it difficult for the department to keep in close touch with all these societies and associations, but real progress is being made. The useless district associations have mostly been eliminated and the tendency is to form village associations or Agricultural Co-operative Societies which take up definite lines of work with the advice of the department.

53. *Miscellaneous.*—The Assistant Director of Agriculture, I Circle, and myself inspected the Allur swamp lands in Nellore district in connection with the criminal settlement of Yerukulas at Kāvali. The Salvation Army settlements at Kammapuram and Kappiampuliyur (Stuartpet) in the South Arcot district and at Bommanigudda in the Chittoor district were visited by the Deputy Director of Agriculture, IV Circle. He also inspected sites proposed for such settlements in the North Arcot district. The Bommanigudda settlement was also inspected by the Deputy Director of Agriculture for Live-stock and advice given regarding cattle-breeding and preparation of silage.

General correspondence with literate ryots increases. In the head office at Madras 1,399 applications for advice were received direct from ryots as against 1,271 in 1915-16 and 1,119 in 1914-15.

Twelve gentlemen were nominated by the Collector of Gōdāvari as honorary visitors to the Samalkota Agricultural Station in accordance with the G.O. Mis. No. 2478, Revenue, dated 8th December 1915. Of these only four visited the station during the year, on one occasion each.

Syllabuses for teaching Nature Study in elementary and training schools were prepared by the officers of the Educational Department who were trained at Coimbatore last year. These syllabuses were sent to me for criticism and in my opinion they were much too bookish and technical and altogether prepared from the wrong standpoint. It is clear to me that the preparation of a syllabus for training teachers in 'Nature Study' should be undertaken by the best officers whom the Educational Department can find if any good is to come out of it.

At the request of the Assistant Inspector of Schools, Vizagapatam, a number of teachers of elementary schools were sent for training at the Anakapalle Farm for a fortnight to receive simple lessons on local agriculture and its possible improvements. The experiment was successful and will be continued.

Boys from the surrounding elementary and secondary schools were brought by their teachers on excursion to the Palūr Farm.

54. *General progress.*—The year under report has again seen steady progress all round. There have been minor set backs,—the failure in the supply of daincha seed and the trouble with cattle disease at Coimbatore for instance, but in all the important work progress is continuous. The chief difficulty is still the lack of staff and this will be the case for a long time yet. In fact even when we have

recruited the full cadre contemplated in the scheme of reorganization sanctioned last year I am convinced that we shall find it utterly inadequate for the work that will then be in sight, and will have to embark on a still larger scheme. We are recruiting new men rapidly—17 were entertained last year and another 10 since then, but this does not at once increase our number of experienced hands. These tend to diminish as the senior men are promoted to gazetted posts or retire. On the other hand such experienced men are essential for new farms or new lines of district work. At present such new work can only be taken up by moving our experienced men from a farm or district with which they are thoroughly acquainted and replacing them by less experienced hands who have to learn the particular work from the beginning. This naturally interrupts the continuity of work but cannot be helped if we are to expand our activities over a wider area. This state of things will of course be remedied as the new hands who have been recruited in recent years become fully trained, but I wish to emphasise the fact that it is not possible to take up new work as soon as new hands are recruited, but that these must first be properly assimilated into our staff by training under the older hands, who are all too few for this business. Much of the time of the senior men has actually been taken up with this training in the year under report.

V.—AGRICULTURAL ENGINEERING.

55. As explained in paragraph 4, the new Agricultural Engineering section of the department was organized on 1st August 1916 when the Pumping and Boring establishment of the Department of Industries was taken over under the control of a newly-appointed Agricultural Engineer with an Assistant. It had been originally intended that the new Agricultural Engineer, Mr. F. T. T. Newland, should work for some time under Mr. K. T. B. Tressler, the then Director of Industries, in order to acquire experience of the current work, but this was rendered impossible by the fact that Mr. Tressler left Madras for Military work on the day after Mr. Newland took charge. It must be remembered that the Pumping and Boring section of the Department of Industries attended also to the erection and inspection of minor industrial plants in the districts, such as rice hullers, cotton ginneries, etc. In order to avoid disturbance of current work this branch of activity was also taken over temporarily. It is somewhat difficult to define the boundaries of the respective spheres of the Agricultural and Industrial departments with respect to minor industries dealing with agricultural products. The matter formed the subject of correspondence during the year and a redistribution of work and staff has since been carried out, so that the Agricultural Engineering section may confine their attention to agricultural implements, pumping and boring work, and such minor industries as are carried out by agriculturists. All industries carried out by capitalists will be attended to by the Department of Industries in future. A full report on the working of the section during the year will be found in Appendix X. The main lines of work are summarized below.

56. *Pumping (including minor industrial plants).*—During the year six pumping and twenty minor industrial plants were erected for private parties, and twenty-three in all were in progress at the end of the year. The fee charged for such work is 2½ per cent on cost. A feature of the year was a falling off in the number of new installations erected. Most of the work consisted in the erection of second hand plants bought by new owners or the re-erection of plants originally set up by private contractors. The latter item is gratifying because it shows that machinery owners are realizing that it is better to pay for sound advice and supervision than to entrust the erection of their plants to an unqualified 'fitter' who offers to do it cheaply. The general use of second hand plants is due to the difficulty in getting new machinery during the war. The high price of liquid fuel, which is more than double that of three years ago, militated against any large expansion of this branch of work. These factors account for a falling off in applications for investigation and advice which totalled 125 as against 136 last year. The department undertakes the periodical inspection and adjustment of installations for a fixed fee of Rs. 15 per mensem. The number of installations

paying this fee was 234 which is only 2 less than in last year. Of these 111 were pumping plants and the rest industrial. Every installation is inspected three times a year and also at other times if special requisitions are received from the parties.

Test Pumping sets.—Twelve pumping sets owned by the department were let on hire to ryots during the year. Some of these are high speed sets using kerosine oil, which are used for emptying wells to enable them to be deepened by boring in their beds, and for testing the supply from boreholes or wells; while the others are driven by oil-engines using crude oil and are hired to ryots for six months or so at a time to enable them to make a thorough trial of power pumping before they go in for installations of their own. Fifty-four out of the 57 applications for these sets received during the year were complied with. The demand is increasing and the purchase of four more sets has been sanctioned.

57. *Boring.*—During the year 32 hand boring sets and two power drills were in use. The total depth bored came to 22,323 feet as against 24,750 feet last year, the number of boreholes being 379 as against 495 in the previous year. The average depth of the borings was thus greater this year and this alone accounts for the diminution in the total depth bored, as the rate of progress falls off rapidly as the depth of a borehole increases. Considerable difficulty was experienced in getting lining pipes and materials for constructing boring tools, which have all risen very much in price. Seven borings of over 200 feet were put down by hand sets, and the deepest went to 252 feet 6 inches. The deepest boring made by a power drill was 332 feet. Out of the 379 borings made during the year, 248 were successful in finding water or in increasing existing supplies. Thirty-nine of the borings were supplied with permanent lining pipes, the total length of pipes so put down being 3,124 feet. Sixty-nine applications for boring were pending at the beginning of the year and 232 fresh applications were received during the year. Of these 221 were complied with, leaving 73 pending at the end of the year. Arrangements are being made to increase the number of boring sets in order to keep pace with this demand. A strong sub-artesian spring was tapped in the Gudivada taluk of Kistna district giving a supply of 500 gallons per minute at 7½ feet below the ground level. An artesian supply was found in three boreholes in the Pattukkottai taluk of Tanjore district, the static level of the water being from 10 to 32 feet above ground level.

Mapping of underground water-supplies.—Two surveyors were employed during the year in taking levels of the various boreholes which have been put down in the past in the coastal districts. This work has been completed in Chingleput and Tanjore and is now in progress in South Arcot and Vizagapatam. The results will be published in the form of maps giving the contours of the sub-soil water levels, and these maps will be of great use in giving advice to ryots in these tracts in the future as it should be possible to prophecy the depth and nature of the sub-soil water-supply with considerable accuracy.

58. *Other experiments—Sugarcane crushing and jaggery making plants.*—Two such plants each consisting of a 12 horse-power oil-engine driving an 18-inch three roller mill, with a battery of jaggery pans heated by improved furnaces, were in use during the year, one in the Coimbatore district and the other near Hospet in Bellary district. The first set was hired to a contractor for Rs. 333 per mensem but worked under the supervision of the department. In 164 working days of 12 hours each some 1,550 tons of cane were crushed and 1,662 pothis (of 250 lb. each) of jaggery obtained. The contractor charged the ryots Rs. 3 per pothi of jaggery and made a profit of 10 annas per pothi. The rent paid covered interest, depreciation and repairs to the machinery and left a balance of Rs. 425 to the department, which is equal to 4 annas per pothi of jaggery made. The net cost of making a pothi of jaggery therefore works out at Rs. 2-2-0. The weight of cane crushed is based on an estimate as actual weighings were not made, and further the volume of juice obtained was not measured. It is not therefore possible to gauge the efficiency of the crushing. More detailed records will be kept this year. As the result of this demonstration two similar sets have been erected for private parties in the Coimbatore district and one in the South Arcot district. There is no doubt that these plants are an economic success, provided that sufficient cane

can be obtained within a small distance. Cane cultivation, however, is usually scattered and the fields are often distant from a cart-track. Further expansion may be possible by laying down light tramways to bring in the cane, but this must wait until after the war.

The factory near Hospet was started very late in the season as the sheds and furnace were damaged by heavy rain in December and plague and cholera made labour difficult to obtain. Detailed records of the work done were kept however and these show that the average production was 71.5 per cent of juice or 11.9 per cent of jaggery reckoned on weight of cane. The cost for labour and materials was Rs. 2-5-0 per ton of cane or Rs. 19-8-0 per ton of jaggery produced. The total amount of cane crushed was less than 50 tons and this is too small to allow of any satisfactory estimate being made of the cost of depreciation and interest on the value of the plant.

Motor ploughing.—Two motor tractors were taken over from the Department of Industries, of 45 and 22 b.h.p. respectively. The larger was tried at drawing a 5 furrow disc plough in Tinnevely, but broke down completely. The latter was tried by the Rev. Bawden on his criminal settlement at Kavali and did some useful work, but frequently went out of order. The design of these two tractors is not suitable for the rough work of ploughing and further trials will be made with other designs when these can be obtained.

Workshops.—Work to the value of Rs. 13,666 was carried out at the workshops attached to the Agricultural Engineering section. The greater part of this was in connection with the departmental pumping and boring plants. Some work was also done for the Department of Industries and work to the value of Rs. 131 done for private parties. A rotary power drill was newly constructed and an apparatus made for measuring the discharge of pumps under various heads. Four lathes and a drilling machine were lent to the Public Works Department workshop for war work.

Miscellaneous.—The Government Agricultural Engineer designed and constructed an elevator for stacking straw, working on the picottah principle, which was found to be of use at Coimbatore. He is working at winnowers, seed drills, spraying machines, etc., and also at improved light iron ploughs, in consultation with the Agricultural officers of the department. He also experimented with the Mansfield Water Finder which was obtained from the makers under the orders of Government, the instrument having been reported by the Bombay Department of Agriculture as giving useful indications of underground water supplies in Bombay. In spite of a number of trials no definite indications could be observed and the instrument must be written down as a failure in Madras. It is possible that it is only of use where water occurs in very definite cracks or fissures in rock sub-soil, as appears to be the case in the Deccan trap areas in Bombay.

59. A trial was given to the special loan rules under the Land Improvement Loans Act sanctioned by Government in G.O. No. 2743, dated 14th December 1916, under which the Director of Agriculture was empowered to grant loans for the erection of pumping installations. A Special Tahsildar was provided from December 1916 to deal with applications for these loans. The rules were advertised in the district gazettes and through the departmental subordinates in the districts, but very few applications were received. Up to March 31 these totalled twelve, and of these four were pending at the end of the year, one had been sanctioned and seven had been rejected or withdrawn owing to the parties refusing to accept the conditions of the special rules. As the work on hand was not sufficient to keep the Special Tahsildar fully occupied, he was asked to inspect the existing pumping installations with a view to study the economic conditions under which they were working and generally to study the economics of the subject. During the year ending 31st March 1917 he visited 58 installations in the Chingleput district and submitted reports to me from time to time. As a result of this study it was found that the special loan rules sanctioned in G.O. No. 653, Revenue, dated 21st March 1916, were unworkable, being too stringent, and proposals were accordingly submitted for a drastic modification of the rules. It is unlikely, however, that there will be any great demand for loans for the installation of pumping machinery until prices of machinery and fuel fall again after the war.

VI.—PUBLICATIONS AND SUPPLY OF INFORMATION.

60. A new departure was the publication of the first 'Year Book'. This is intended to be a means of placing on permanent record short notes on unfinished work or other miscellaneous information which at present is apt to get buried in official files. In the interests of economy a small edition of only 320 copies was printed this year. The key for the identification of insectivorous birds protected under the Wild Birds and Animals Protection Act, mention of which was made in last year's report, was printed and distributed to all Magistrates. Mr. Wood's lecture notes on Irrigation were printed in the form of a bulletin. A note entitled "Madras Agriculture—A brief survey" which had been prepared by Mr. Chadwick for incorporation in the Book of the Madras Exhibition, 1916, was printed separately for distribution. This contains a general account of the agriculture and chief crops of the Presidency with detailed statistical information concerning all products of commercial importance. This latter information was incorporated in the Handbook of Commercial Information published during the year by the Department of Industries.

61. The following leaflets have been issued during the year:—

Number.	Subject.	Prepared by	Language.	Number of copies printed.
IV of 1916	Pulichai, Madam or Jari cotton in Tinnevely and Kamnad districts.	Mr. G. A. D. Stuart	English	2,000
V of 1916	Pulichai, Madam or Jari cotton	Do.	Tamil	12,000
I of 1917	Guinea grass	Mr. R. C. Wood	Tamil	12,000
			English	10,000
			Tamil	20,000
			Telugu	20,000
			Malayalam	5,000
			Canarese	5,000
			Uriya	1,000
II of 1917	Lucerne	Do.	Uriya	1,000
III of 1917	The Mango Hopper Pest and its control.	Mr. T. V. Ramakrishna Ayyar.	English	5,000
			Tamil	10,000
			Telugu	10,000
IV of 1917	Possible improvements in the manufacture of Indigo in the Madras Presidency.	Mr. G. A. D. Stuart	English	3,000
			Tamil	5,000
			Telugu	5,000
V of 1917	A few home-made remedies against some common plant pests.	Mr. T. V. Ramakrishna Ayyar.	English	1,000
			Tamil	20,000
			Telugu	20,000
			Malayalam	5,000
			Canarese	5,000
			Uriya	1,000

Very large numbers of these leaflets were sent to Collectors and agricultural officers for distribution. The leaflet on cotton and indigo were also distributed through the commercial firms interested. Over 73,500 copies of the Agricultural Calendar published in English, Tamil, Telugu, Malayalam and Canarese were distributed through Tahsildars, Presidents of Taluk Boards and Assistant Inspectors of Schools.

VII.—STATISTICS.

62. Nineteen crop forecasts dealing with the sowings and outturns of paddy, cotton, groundnut, sugarcane, gingelly, castor and indigo were issued. The usual weekly statements of cotton pressed at the various presses, used by the different mills in the Presidency, and exported by sea, were compiled and issued. Fifty-eight crop cutting experiments were made on ryots' lands by officers of the department. Much attention was given this year to the improvement of crop statistics and returns, in consultation with the Board of Revenue and the Director of Land Records.

VIII.—MISCELLANEOUS.

63. *Special reports, etc.*—A number of special enquiries and reports were made at the instance of the military authorities regarding the supply of draught bullocks, pure ghee, tinned provisions, etc. Special reports on the effect of the

lack of freight on the groundnut trade were submitted to Government. Six head of breeding cattle were purchased on behalf of the Mauritius Government and shipped during the year. The Cinchona factory was inspected in company with the Surgeon-General and the Deputy Director of Agriculture for Cinchona. The possibility of increasing the supply of medicinal drugs by growing the plants in this Presidency was under investigation.

64. *Personal.*—I regret to have to report the first case in which a subordinate of the department has failed in honesty. A probationary Agricultural Demonstrator engaged in cotton work in Tinnevely came under suspicion of having attempted to obtain departmental credit by exaggerating the areas of crops drilled by ryots at his instance, and also of the more serious offence of having misappropriated cotton which was the property of Government. A detailed enquiry was held by the Deputy Director of Agriculture, VI Circle, and by myself and as the result, the Agricultural Demonstrator was allowed to resign under Board's Standing Orders 133—5 (1), the case against him being one of strong suspicion but not definite proof. There was no actual loss to Government as the cotton suspected of having been misappropriated was within the small percentage of excess weight which is usually obtained on reweighing large stocks bought in small quantities at a time. No defect was found in the system of accounts.

Except for this incident I have nothing but praise for the work of all officers of the department. Where all have worked so zealously it is difficult to select names for special mention. The scientific officers at Coimbatore were untiring in that work of research which must form the basis of all agricultural improvements. The excellent condition of the Central Farm and the enthusiasm and keenness shown by the students both at their work and their play are a monument to the skilled experience and ungrudging labour of Mr. R. C. Wood, the Principal. Among District Officers, I must make special mention of the good work done by Mr. R. Thomas in eliminating pulichai cotton, and by Messrs. D. Balakrishnamurti and M. Govinda Kidavu in spreading agricultural improvements in their respective charges. The work in my office is growing steadily heavier as the activities of the department expand and I have been most ably assisted by my Personal Assistant M.R.Ry. V. S. Aswatha Ayyar Avargal.

65. Final accounts for March 1917 have not yet been received from the Accountant-General. Subject to any correction thereby entailed the expenditure and receipts during 1916-17 are as follows:—

Expenditure	...	...	...	...	...	...	...	Rs.
Receipts	...	...	...	...	...	...	...	7,15,518
								1,35,903
Net expenditure	...	...	...	...	...	...	...	5,79,615

This includes the cost of the pumping and boring sections of the Department of Industries taken over in August 1916.

The budget allotment for the year including reappropriation and additional funds sanctioned comes to Rs. 7,97,824. A sum of Rs. 57,889 out of this was surrendered before the close of the year and Rs. 25,417 lapsed. The failure to spend the full allotment was mainly due to the fact that Mr. Ballard remained absent throughout the year and that two Deputy Directors for whom provision was made could not be recruited, and partly to the exceptional season in the Ceded districts which threw back the cotton crop and made it impossible to spend the whole of the allotment for cotton improvement before the close of the financial year.

I have the honour to remain,
Sir,
Your most obedient servant,
G. A. D. STUART,
Acting Director of Agriculture.

APPENDIX I.

ADMINISTRATION REPORT OF THE AGRICULTURAL COLLEGE, RESEARCH INSTITUTE AND CENTRAL FARM, COIMBATORE, FOR THE YEAR 1916-17.

I. COLLEGE.

Teaching.—Fresh ground is still being broken in this direction, as the first year's teaching of the second course was given for the first time. The teaching of the short course remained practically the same; it is hoped shortly to embody the few changes which experience has found desirable in a revised syllabus. In view of the general restriction in travelling, the tour which it had been intended to make in the Ceded districts and the Circars was cut out, and a tour in the south of Coimbatore, which was rather interfered with on account of plague, was substituted. The first tour was to Kollengode, where we were the guests of the Raja of Kollengode; the second was to Tanjore, South Arcot and Chingleput, where the class was lucky to escape, at Madurantakam, the storm which did so much damage on the 22nd November. The Deputy Director for Livestock delivered the Dairy Lectures to class II in June.

2. *Examinations.*—There was no examination for the Diploma in the year under report. In future this examination will be held annually in December; the Certificate examination at the usual time in March. For the latter, this year, thirty-two students appeared, and twenty-three passed and were awarded Certificates. The Clogstoun Medal went to M. Anantan. The examinations were conducted with the help of officers of the Department.

3. *Students.*—The numbers were as follows at the opening of the year: class I 42, class II 37, and class III 8,—total 87. In class I, one student died during the year and four left; in class II five left; the balance at the close of the year was thus 77.

4. *Hostel.*—M.R.Ry. C. Tadulinga Mudaliyar handed over the Wardenship on the 1st of September to M.R.Ry. C. Narayana Ayyar who has held the post since. The thanks of all concerned are due to the retiring Warden whose popularity was undoubted. Thanks are also due to the honorary auditors of the hostel accounts Messrs. K. S. Subrahmanya Ayyar and B. V. Nath. The year has been one of financial stringency, and it was found necessary towards the close of the year to levy a surtax of Rs. 1 a month to wipe off a loss of Rs. 400 which had been allowed to accumulate. It will be necessary in all probability to continue this in view of the general rise in prices of all foodstuffs.

The foundation stone of the new Games Pavilion was kindly laid by His Excellency on the 23rd November 1916, and good progress has been made, though owing to contractors' delays, it could not be finished by the close of the year. It will be ready for occupation at the opening of the next term. Much of the work has been carried out by the students themselves. Prizes kindly offered by the late Warden did a great deal to stimulate a taste for gardening, and improve the appearance of the Hostel surroundings. The college dress was made compulsory for students joining the College from the present year. It has proved satisfactory and is popular. A few students preferred to buy cheap khaki in the town, but regretted their mistake when their clothes began to shrink and turn colour.

The Students' Club enjoyed a successful year. The annual dramatic entertainment produced over Rs. 300 which was paid into the Madras War Fund. A new college prize for the best all round athlete was presented by the Raja of Parlakimedi.

5. *Building.*—The electric light installation was completed during the year, and works satisfactorily, though without some kind of storage, it will never be possible to utilize it to the full. The suction and pressure systems are still approaching completion, while the loss of the motor has held up the electric pumping plant indefinitely.

6. *The Library.*—Mr. McRae was Librarian throughout the year. The library clerk K. S. Subrahmanya Ayyar was transferred to the Principal's office on 18th November 1916 and the Mycologist's head clerk M. R. Venkatarama Ayyar took his place.

Eighty-one new books were received, of which 61 were bought and 17 presented. There were 3,592 issues on loan and 1,859 parts of periodicals were circulated to officers of the department and others. The more important agricultural periodicals were also circulated to the Farm Managers and Assistant Farm Managers. One-hundred and twenty-five volumes were bound and 149 are at the Press being bound. A shelf catalogue of all books and periodicals was made and an author and subject catalogue up to December 1916 was prepared and sent to Press. All books and periodicals have been numbered and arranged.

7. *Staff*.—The posts of Chief Assistant, Engineering Assistant and Second Assistant changed hands during the year. The office also lost the Head clerk who was transferred on promotion to Madras. These changes were unavoidable, but it is hoped that more permanency, at any rate in the teaching staff, will be the rule in future.

8. *Publications*.—The lectures given in the short course on "Irrigation and drainage" were written up and are being printed for private circulation. This procedure will be adopted, as time permits, with other sections, which it is hoped ultimately to combine into a text-book. Notes were written for the Year Book and for the Calendar. An *Estate Manual* was compiled and published during the year.

II. ESTATE.

9. *Estate*.—The unsightly drain in front of the college has been filled up and the ground levelled. Tree planting continues steadily. Four isolation sheds are being erected to deal with cases of infectious disease.

10. *Quarters*.—A great improvement took place during the year. The quarters mentioned in last year's report as being under construction were completed and handed over. The Lecturing Botanist's quarters (G.O. No. 185 W., dated 28th January 1915), and a number of new B and C types (some of those sanctioned in G.O. No. 2164, dated 11th November 1914), were also handed over towards the close of the year, and have had the effect of relieving the congestion.

11. *Sanitation*.—The year's record is satisfactory. It is a matter of congratulation that plague was kept out of the Estate. Simple preventive measures were promulgated and with the help of public opinion were fairly well enforced. Among other measures a Co-operative Fuel Depot was opened on the Estate, the connection between firewood and plague being that the stores of firewood usually kept by every householder served admirably to harbour rats. Much good and thorough work was done in connection with this depot by a voluntary committee to whom the thanks of all are due. The usual measures were taken against mosquitoes and flies. The drain on the south of the Estate was completed and has not only removed what has long been a grave nuisance, but has enabled the water to be utilized for crop production. There were twenty-five births and ten deaths during the year.

III. FARM.

12. *Farm*.—The harvests on the whole were good. The season was favourable and the lands are beginning to show the effect of the improved treatment they are getting.

13. *Livestock*.—There were two attacks of foot-and-mouth disease during the year; the first light, the second two months later, very severe. This disease will have to be guarded against more carefully in the future in view of the more valuable cross-bred animal which we are now keeping, and the fact that they tend to suffer more severely. The Hospital and the stud bulls continue popular; a few cross-bred buffalo bull calves by our Delhi bulls have been bought in for work or for service elsewhere.

The poultry increase, but slowly; the number of eggs produced during the year was 2,600.

14. *Dairy*.—The dairy has been conspicuously successful under the management of the Assistant Principal. The sales of butter for the last four years are 1,075, 1,886, 3,939 and 5,608 lb., a striking proof that even without advertisement, good butter will find a market. The assistance of the Deputy Director of Agriculture for Livestock in preparing cultures is gratefully acknowledged. A brief profit and loss statement is appended.

Receipts.				Expenditure.			
	RS.	A.	P.		RS.	A.	P.
Sales	...	...	...	Stock in hand, April 1916	...	32	8 6
Stock in hand, April 1917	...	40	8 0	Purchase of milk	...	8,208	7 0
				Depreciation	...	329	6 0
				Wages	...	246	0 0
				Miscellaneous expenses	...	195	3 7
				Ice	...	171	1 6
				Transport, etc.	...	120	0 0
				Balance being profit	...	325	14 9
Total	...	9,628	9 4	Total	...	9,628	9 4

15. *Staff*.—M.R.Ry. S. Subrahmanya Ayyar continued as Farm Manager and worked well. Mention may also be made of the increasing work of the Farm Office Manager M.R.Ry. T. V. Narayana Rao, which is invariably performed accurately and ungrudgingly. The Sanitary Inspector P. Ramaswami Ayyar was largely responsible for the carrying out of the Plague precautionary measures, and was most diligent.

STATEMENT of seed sold (presumably for sowing) at the Central Agricultural Station for the year 1916-17.

	LB.
1. Cambodia cotton seed	3,841
2. Uppam cotton seed	1,347
3. Periya manjal cholam	95
4. Other cholams	203
5. Ragi	108
6. Sugarcane setts	400
7. Wheat	72
8. American maize seed and cobs	175
9. Red gram	9
10. Bengal gram	200
11. Lab-lab	6
12. Iron cowpea	3
13. Guntur chillies seed	1
14. Bengal daincha seed	5
15. Indigo seed	15
16. Sunnhemp seed	2
17. Cambodia kappas	55
18. Banku paddy	79
Anaikomban	20
Anna samba	9
19. Castor seed	16,286
20. Guinea grass slips	

APPENDIX II.

ADMINISTRATION REPORT OF THE AGRICULTURAL STATIONS DURING THE YEAR 1916-17.

ADMINISTRATION REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, I TO III CIRCLES, FOR THE YEAR 1916-17.

I have the honour to submit the Administration Report of the circles under my jurisdiction for the year 1916-17.

(1) *Staff*.—I remained in charge throughout the year except for one month in April-May 1916, part of which was spent on leave and part on duty at Coimbatore, helping with examinations. During this month M.R.Ry. D. Balakrishnamurti Garu, Assistant Director of Agriculture, I Circle, was in charge of the duties of my office, in addition to the duties of his own circle of which he remained in charge throughout the year.

(2) *District work*.—I remained in direct charge of this work until the 22nd January 1917, on which date M.R.Ry. K. Ramasastrulu Nayudu Garu joined duty as Assistant Director of Agriculture, II and III Circles, with headquarters at Nandyal. In order to leave me as free as possible to conduct plant breeding work and experimental work on the farms, the charge of the district work was handed over to him. The details of this work will therefore be found in his report which has already been forwarded to you.

The work now directly under my charge consists of the running of the three farms, Hagari, Nandyal and Sirvel, in which is included experimental work and plant breeding work with sorghum, cotton, Italian millet and ragi. A small area of six acres under the tank at Nandyal has been leased out for experimental work in connection with the manuring of paddy and a sheep and seed farm is being started at Bantanahal in Bellary district.

Hagari Agricultural Station.

Season.—As in last year the rainfall was in excess of the average. Its distribution was however favourable to the early crops, though distinctly adverse to the late crops more particularly cotton, which has done badly this year both as regards yield and quality of produce. The sorghum crop was saved by unusual rains which were received in February of this year.

2. *Crops—Cotton*.—The crop was sown at the right time, but was checked in growth by late rains. As a mixed crop with Italian millet it was grown over an area of 41.07 acres and gave an average yield of 73 lb. per acre of kappas, the best yield being 207 lb. from a plot of 72 cents. As a pure crop the average acre yield was 106 lb. of kappas over an area of 21.07 acres and the best return was 365 lb. per acre from a small plot of five cents.

Sorghum.—This crop was grown as a main crop for grain, pure and mixed with Bengal gram, as a second crop after Italian millet for grain and as a main crop for fodder. The respective areas of these crops were 16.8, 1.8, 10.4 and 25.9 acres. The yields were as follows:—

(1) Average acre yield—776/1,291 lb. grain/straw, maximum yield 1,332/2,727 lb. grain/straw from a plot of 75 cents.

(2) Average acre yield—680/1,975 lb. grain/straw.

(3) Average acre yield—163/349 lb. grain/straw, maximum 514/1,442 lb. of grain/straw from a plot of 36 cents.

(4) Average acre yield—2,124 lb. of dry fodder, maximum 4,735.

The low yield is mainly due to the fact that the crop was caught at harvest time by heavy rains. Most of this crop was cut with a McCormick New Four reaper which did very satisfactory work especially where the crops were very thick.

Italian millet.—As a pure crop this crop occupied a total area of 16.7 acres and as a mixed crop 41.7 acres. The average acre yield was in the first case 387/415 lb. grain/straw and in the second 449/460 lb. grain/straw. The maximum yields were respectively 817/947 and 650/663 lb. grain/straw per acre. The lower average yield for the pure crop is mainly due to the fact that as this crop came to harvest earlier than the mixed crop it was caught by rain at that time and a good percentage of the grain was shed.

Bengal gram.—As a main crop this crop was grown over an area of 10.7 acres and gave a poor return of 105 lb. per acre. As a second crop after Italian millet it occupied only a small area and gave a yield of 116 lb. per acre. Both yields are very low.

Groundnut.—This crop was grown on an area of 2.7 acres and gave a poor yield of 500 lb. of nuts per acre. Rains here also interfered with the harvest and much of the crop had to be left in the ground.

Garden crops.—The crops raised in the garden this year were as follows: ragi, groundnut, onions, mondi korra (a variety of millet obtained from Vizagapatam), brinjals, sugarcane, potatoes, chillies, turmeric, tobacco, silver beet, lucerne, berseem and Guinea grass.

None of these calls for very much comment. Mondi korra required no irrigation and gave a yield of 2,717/3,000 lb. of grain/straw per acre from a plot of 60 cents. Brinjals did well and gave a yield of 5,981 lb. per acre and a profit of Rs. 150. Potatoes were spoiled by the February rains and failed. Lucerne grew well but became attacked by rust and the whole crop had to be uprooted and burnt.

Sheep.—The season was again too wet to be altogether satisfactory. Of thirty lambs born alive nine died and four of the breeding ewes died. The cause of death was in most cases pneumonia. It is satisfactory to be able to report that the neighbouring shepherds are showing signs of taking to the practice of having their ram lambs castrated. Twenty lambs were brought this year for this purpose.

New works.—During the year the ginnyery was completed and is now in use.

Staff.—Farm Manager M.R.Ry. T. V. Rajagopala Acharya remained in charge throughout the year with the exception of one month in September-October when Assistant Farm Manager G. R. Venkatachalapati was in charge. This latter officer remained in charge of the garden and pastures throughout the year. Assistant Farm Manager V. S. Subrahmanya Sastri remained at the farm during the year. Assistant Agricultural Demonstrator R. Swami Rao and Assistant Farm Manager A. Venkoba Acharya joined duty at this farm on the 1st and 22nd of June, respectively. The former remained till the end of the year and the latter took leave from the 19th February 1917, for 1 month and 3 days, and was then transferred to Anakapalle.

Nandyal Agricultural Station.

Season.—The rainfall this year was abnormally heavy, 73.8" instead of the normal 30". Without exception all the crops were adversely affected.

Crops—Cotton.—Both quality and yield were poor. Over an area of 24 acres a yield of only 150 lb. of kappas per acre was obtained. The best yield 400 lb. per acre was given by Company No. 2 from a small plot of 5 cents.

Sorghum.—This crop was grown over an area of 13.5 acres and gave an average acre yield of 315/566 lb. of grain straw. The best yield was double of this and was given by a small plot of local sorghum.

Bengal gram.—The return from this crop was worse than last year. The average acre yield was only 48 lb. and the maximum 276.

Indigo.—This crop was grown over an area of 14.6 acres and gave the poor return of 74 lb. of seed per acre.

Staff.—Assistant Farm Manager V. G. Dhanakoti Raju remained in charge of the farm until the 24th November 1916 when he was relieved by Farm Manager M.R.Ry. A. V. Tirumuruganatham Pillai and put in charge of district work. The latter officer remained until the 21st April 1917 when he was relieved by Assistant Farm Manager V. S. Ramaswami Ayyar and

went on leave. Assistant Farm Manager V. Ratnaji Rao remained attached to the farm until the 17th February 1917 when he was transferred to district work. Assistant Farm Manager E. K. Nambiyar joined duty at this farm on the 22nd February 1917 and remained till the end of the year.

Sirvel Agricultural Station.

Season.—The season here was worse than at Nandyal. The rainfall amounted to 83", three times the average for the locality.

In consequence the crops were miserable in the extreme and some fields absolutely failed. As has happened each of the three seasons that this farm has been in existence the canal breached and there was a failure of water at the time the grain ought to have been filling. No paddy could be drilled and recourse had to be taken to sowing broadcast instead. The average acre yields were as follows: Broadcast, Block II, 205/804 lb. of grain/straw, Block III 378/909 lb. of grain/straw. Transplanted paddy, Block II, 523/1071 lb. of grain/straw. The best yield was obtained from a plot of 15 cents of transplanted paddy, manure with green manure and supers, which gave an acre yield of 1,413/2,273 lb. of grain/straw. There seems some likelihood that this method of manuring will prove profitable as in all cases where the crop was so manured the yield was better than when manured with green manure alone.

The succeeding crop of daincha sown after the paddy was fairly satisfactory though uneven in growth.

New works.—An implement shed and a cart shed were partially built during the year.

Staff.—Assistant Farm Manager V. S. Ramaswami Ayyar remained in charge of the farm until the 20th June 1916 when he was transferred to Coimbatore and his place was taken by Assistant Farm Manager T. R. Venkaswami Rao.

Assistant Farm Manager G. Sitarama Sastri joined duty at this farm on the 4th July 1916 and remained till the end of the year.

BELLARY,
18th June 1917.

G. R. HILSON,
Deputy Director of Agriculture, I, II and III Circles.

ADMINISTRATION REPORT OF THE ASSISTANT DIRECTOR OF AGRICULTURE, I CIRCLE, FOR THE YEAR 1916-17.

I have the honour to submit the administration report of the first circle for the year 1916-17.

2. I remained in charge of the circle throughout the year; I was also in charge of the office of the Deputy Director of Agriculture, I, II and III Circles, Bellary, for a month (14th April to 14th May 1916) during the absence of Deputy Director on privilege leave and was on special duty for over two months (from 1st August to 16th October 1916) in connection with the preliminary inspection of the Nellore and Guntur districts for the selection of suitable sites for a cattle breeding station.

3. I spent 300 days in camp when I visited Samalkota Farm seventeen times, Home Farm, Parlākimedi, five times, and Nandyal, Sirvel and Hagari Farms once in addition to the frequent inspection of Anakāpalle Farm during my stay at headquarters.

4. In the course of my tours in addition to the usual routine district work, the following special inspections were made and separate reports submitted:—

(a) Inspection of Andhrajaateya Kalasala, Masulipatam, to advise the authorities regarding the opening of an agricultural course in the institution.

(b) Inspection of Allur swamps in Nellore district in connection with the Criminal Settlement of Yerukulas at Kavali.

(c) Inspection of sites for starting a cattle-breeding station in Kallikota and Attagada Estates, Ganjam district.

(d) Inspection of swampy lands along the sea-board in Gōdāvari district with a view to find out a suitable paddy crop that can withstand submersion and the evil effects of brackish water.

(e) Inspection of an orchard at Ellore struggling on alkaline land.

I also attended the Agricultural Conference at Coimbatore in connection with the College Day and the Indian Science Congress at Bangalore.

5. The annual report of the Home Farm, Parlākimedi, for the last fasli year with the review of the Raja was separately submitted.

6. I have continued the work detailed in paragraph 8 of my last year's report but it could not be pushed through further to a satisfactory degree owing to the paucity of hands. But it is satisfactory to note that the work set on foot in previous years has been steadily and satisfactorily multiplying and I am striving my utmost to meet this end. It is hoped that with the availability of hands, the district work will be definitely outlined and centres of activity definitely fixed.

Samalkota Agricultural Station.

Season.—The rainfall during the south-west monsoon was slightly higher than the average and almost equal to the fall of last year but was very evenly distributed. The outbreak of the monsoon was very timely and the sowings in the rainfed area were, therefore, very early. Subsequent regular rains were most beneficial to all dry crops but the rains of north-east monsoon were very heavy as in last year just at the harvest time damaging the paddy crop to a very great extent and spoiling the pulses and sunnhemp for fodder sown in the standing paddy crop before harvest. The season, most favourable and encouraging as it was in the beginning, was very disappointing towards its close.

2. **Crops.**—(a) *Sugarcane.*—This year the crop was fair and would have been better had it not been for the poor germination at start and for the heavy rains of October. There was comparatively little disease; out of 24,470 clumps only 233 were diseased. Most of the area was cut down for seed purposes both for distribution and for planting on the farm, and the average yield of jaggery was 9,784 lb. As B 3412 has again headed the list in the outturn of jaggery and is liked by the ryots, this variety was distributed on a larger scale.

(b) *Paddy.*—(i) *Rainfed.*—This was grown both as a pure and as a mixed crop. The average acre yield was 1,591 lb. grain and 3,469 lb. straw when grown pure and 1,258 lb. grain and 1,996 lb. straw when grown mixed with cambodia cotton and red-gram. Once again black and white budama gave the highest outturn. The former, 2,181 lb. grain and 3,620 lb. straw and the latter 1,931 lb. grain and 3,831 lb. straw.

(ii) *Irrigated.*—Second crop paddies were a thorough failure owing to late planting and to scarcity of water after planting as the canal failed completely owing to shortage of water in the river.

Main crop.—The season for this was very unfavourable throughout. South-west monsoon was very early and water was received in the canals unexpectedly earlier than was ever usual. Continuous wet weather seriously interfered with the proper growth of seed-beds and in October there was a continuous heavy downpour of rain when the longer varieties were in flower. Late plantings suffered from Kodu (Silver shoot disease). The yields were, therefore, very low. Rasangi gave an average acre yield of 3,080 lb. and Konamani 1,771 lb. of grain.

(c) *Green manure crops.*—Late north-east monsoon rains spoiled the sunnhemp sown in the standing crop of paddy but teegapesalu (a variety of green gram) grown with the help of canal irrigation was very satisfactory.

(d) *Cambodia cotton.*—This was sown mixed with budama and by itself. In both cases the crop suffered much from the attack of leaf roller and from the heavy north-east monsoon rains. The flushing was therefore not very satisfactory.

3. As a result of experimental work that has been done at this station, the following conclusions have been arrived at with regard to sugarcane and paddy.

Sugarcane varieties.—J 247 distributed last year to the delta ryots is gradually appealing to them as one best suited for delta conditions, though the delta ryots were very reluctant in the beginning, its superior growth, best tillering capacity and the wonderful quality to withstand both drought and water logging convinced them of the superiority of this variety and it is now being multiplied wherever distributed. B 3412 and 6450 were again distributed and B 147 to a limited extent.

4. **Irrigated paddy.**—(a) *Seed selection.*—Experiments with plantwar selections are being continued and better strains multiplied for distribution.

(b) *Manuring.*—An experiment with cyanamide was newly started and it is too early to draw conclusions. The testing of the residual effects of manures applied previously to paddy and sugarcane crops was continued.

(c) "Time of planting" experiments started at the request of the District Collector, Kistna, were also continued.

5. **Seed distribution.**—The following quantities of seed have been distributed during the year:—

Paddy—					
Konamani	...	...	...	...	LB.
Rasangi	...	...	...	...	2,588½
Garikasannavari	...	...	...	...	3,852
Other varieties	...	...	...	...	747
					2,146½

Green manure seeds—

Daincha	...	...	...	...	...	1,252½
Teegapesalu	...	...	...	...	...	133
Sunn hemp	...	...	...	...	...	320
Groundnut	...	...	...	...	...	1,885
Sugarcane—						SETTS.
Canes	...	...	...	...	...	6,903 = 48,321

6. **District work.**—(a) Owing to the scarcity of hands demonstration work with thin sowing of paddy seed-beds and single planting of paddy on ryots' lands could not be done on an experimental scale but the only available hand spared no pains in continuing the work started in previous years.

(b) At the instance of the District Collector, Gōdāvari, groundnut propagandist work was proposed but as the Assistant Agricultural Demonstrator arrived very late in the season the progress was rather limited. 1,385 lb. of seed-nuts were distributed to 53 ryots in nine villages. The sowings were rather late and the season not very favourable. The work will be continued and early arrangements will be made for the next season to induce the ryots to give a fair trial to the crop. A leaflet was drawn on the subject and the same was printed in the District Gazette in diglott.

(c) Demonstration of planting canes in lines and thus reducing the seed-rate was continued.

(d) The work of crop-cutting experiments, the usual crop-cutting experiments, were done as far as the staff and time permitted.

7. **Staff.**—Farm Manager M. K. Nambiyar was in charge of the farm throughout the year except for two months when he was on privilege leave when Assistant Agricultural Demonstrator N. Sitaramaswami Nayudu was in charge. Assistant Farm Manager D. Panakala Rao was transferred to Palur and Assistant Farm Manager S. Pranatariharan joined duty in his place in the last week of April and underwent clerk's training during the year. The newly appointed Assistant Farm Manager, A. Gopalakrishnayya, joined duty on 3rd July 1916. Assistant Agricultural Demonstrator B. Siva Rao was transferred from Hagari in June for groundnut propagandist work. He had a month's privilege leave in October-November and at the expiry of his leave he was transferred to Anakāpalle. Assistant Farm Manager K. M. Jacob was transferred to this farm from Malabar in December. M.R.Ry. N. Sitaramaswami Nayudu was the only hand available for district work when he was not required on the farm. The other hands being new to the language and place could not be sent out for district work.

8. **Agricultural associations and co-operative societies.**—The Gōdāvari District Agricultural Association with its energetic and enthusiastic Secretary has been doing very useful educational work not only in agriculture but also in the improvement of rural tracts. The appointment of honorary visitors to the farm had its inception from this. But the honorary visitors have not yet taken the interest expected of them. Some of the members have been demonstrating on their own lands, the economic planting of paddy and green manuring making them small demonstration farms for the benefit of the neighbouring ryots. To make a special mention M.R.Ry. Diwan Bahadur D. Seshagiri Rao Pantulu Garu, B.A., B.L., has arranged to cultivate about fifty acres of his trust lands under the supervision and advice of the Agricultural Department and a start has already been made by planting cane on an area of seven acres on farm lines.

There are 55 co-operative societies for credit but none of them have any agricultural significance. It is very regrettable to note that the benefit is monopolized by those who are not much in need as the loans are shared mostly by well-to-do members on the score that they are able to get loans on cheaper rates of interest. There are few or no societies that are started on the liberal principle of relieving indebtedness of the poorer classes. In times of need the poorer agricultural classes are forced as usual to go to the usurers as the societies are not giving any relief to the poorer classes that are most needed.

Anakāpalle Agricultural Station.

As detailed in the opening paragraph of last year's report, the laying out and cropping of the farm has been definitely settled and the remaining new work, a masonry thrashing floor, was completed.

2. **Season.**—The total rainfall for the year was 42.36 inches, slightly below the average for the past four years. The hot weather showers were very poor, but the south-west monsoon rains were sufficient though the outbreak was rather late and this delayed the sowings a little bit. The north-east monsoon rains were rather heavy and very harmful and most unevenly distributed resulting in the failure of pulses. The season was on the whole normal.

3. **Crops.**—(a) *Sugarcane.*—This crop suffered from red-rot probably due to the short interval the field has had in having sugarcane. The total area planted was 2.77 acres which yielded 18,063 lb. jaggery excluding 35,066 setts and 221 canes.

(b) *Paddy*.—In two fields F. Nos. 18 and 12 paddy followed jute and gogu and was therefore planted very late in September ending in a complete failure. The other fields under paddy totalling 12.56 acres gave an acre yield of 2,407 lb. grain against 2,524 lb. the average for the previous year which was due partly to intensive cultivation and partly due to the damage caused by north-east monsoon rains.

(c) *Puru or cold weather Chodi (Ragi) and Gingelly* harvested in April 1916 from an area of 5.90 acres and 10.39 acres, respectively, gave an acre yield of 2,083 lb. and 410 lb., respectively.

(d) *Ganti (Cumbu)* was grown on 7.61 acres and yielded 950 lb. per acre.

(e) *Punasa or early Chodi (Ragi)*.—In two fields F. Nos. 20 and 24 the crop failed as they were flooded immediately after planting. The crop in the other fields in an area of 4.20 acres was fair and gave an acre yield of 1,320 lb. of grain against 1,086 lb. the previous year.

A further trial was made with Coimbatore Ragi, but the yield 873 lb. per acre did not compare favourably with that of the local variety grown alongside and yielded 1,792 lb. grain per acre.

(f) *Maize* sown in the punasa (early) season suffered from wet weather and fetched only Rs. 78 for an area of 2.20 acres. But that grown in the Paira season was very good and gave Rs. 100 an acre.

(g) *Daincha* grown for seed both as a mixed and pure crop on an area of 2.46 acres yielded 459 lb. of seed per acre as the crop was caught in rains at the time of harvest.

(h) *Red-gram* sown pure and mixed was rather poor owing to wet weather.

(i) *Cambodia cotton* failed owing to heavy rains immediately after sowing and was therefore ploughed up.

(j) *Hot weather jonna* from Coimbatore was also a failure owing to unfavourable weather and had to be cut for fodder.

(k) Small plots are raised with Lucerne and Guinea grass for the benefit of the visitors.

(l) Comparative trials were made with two varieties of Bimlipatam jute local and Pusa and the latter gave a higher yield. A trial was also made with Bengal jute but was not very successful.

Experimental work—(a) *Manuring*.—Superphosphate at 2 cwt. an acre was tried on paddy and the results are not conclusive.

Manurial experiments with canes to compare castor cake with the local manuring with Vempali and cattle manure was not of any value as the canes suffered from disease.

(b) A number of paddy varieties were tried side by side for comparison and it is too early to draw any conclusions as this is the first year of the trial.

Of the cane varieties J 247 alone was free from disease. B 3412 and 6450 suffered to a slight extent and the worst were B 208 and 1529 and the two local varieties, Bontha and Keli.

4. Seed distribution—

	LB.
Green manure seeds...	...
Paddy ...	3,844
Cambodia cotton ...	4,032
Other seeds ...	30
Groundnuts ...	27
Sugarcanes ...	930
	7,683 canes = 30,732 setts

5. *Live stock*.—One more Ongole breeding bull was obtained from the Veterinary College, Madras. The buffalo-bull is still young for service. The number of cows brought for service since 9th January 1916 was 46 of which 11 were reported to have been successful, 13 were not served and information about 22 doubtful.

6. *District work—Implements*.—(a) Twenty-seven monsoon ploughs were sold since 20th January 1916 excluding four sold to the farms. The sales are rather slow in the understood by the ryots.

(b) A start has been made to demonstrate the use of mhoote a thing almost unknown in the district. A dozen iron buckets were obtained from Madras late in the year out of which nine have already been sold. The Vizianagram Estate Agricultural Department has been very useful in advertising the use of the iron ploughs and mhoote by purchasing and demonstrating them on its own farms for the benefit of the ryots.

Scarcity of hands is the only obstacle for the extension of district work outlined in paragraph 5 of last year's report as all the ryots have realized the value of the reduced seed rate in seed beds and the subsequent economic planting of paddy. In spite of the little we were able to do for want of hands, the work already started in previous years has been spreading very rapidly and it goes without saying that there is a very great scope for any amount of district work and improvement in Vizagapatam and Ganjam districts, commensurate with the availability of hands. In the neighbourhood of the farm almost all

the ryots have already reduced their paddy seed rate and the effect of the demonstration plots in Revidi, Kottam and other places on the neighbouring ryots was most satisfactory.

Cane cultivation on farm lines with seed supplied from the farm was introduced in two villages in Bimlipatam and Srungavarapukota taluks where canes were not cultivated before. Better methods of jaggery making were demonstrated and improved furnaces constructed.

Messrs. Parry & Co.'s cane cultivation at Anakapalle and in the neighbouring villages, is a big piece of demonstration work whereby the exotic varieties are replacing the local ones very rapidly.

Home Farm, Parlākimedi, is also doing its educative work slowly and steadily. The graft mango garden started there has been inducing several ryots to plant grafts on hill slopes not very useful for cultivation.

No crop cutting experiments were done for want of hands.

Visitors.—Four thousand six hundred and nine visitors visited the farm during the year. A selection class was held by the Principal, Agricultural College and Research Institute, Coimbatore, for selection of students for admission into the college. The Vizagapatam District Agricultural Association held one of its meetings on the farm for the benefit of its members.

Through the kind exertions of the Assistant Inspector of Schools, Vizagapatam, a number of teachers of elementary schools were sent for training on the farm for a fortnight to receive simple lessons on local agriculture and the possible improvements. They were taught the importance of reduction of seed rate in seed-beds, green manuring paddy fields, single planting of paddy and management of cattle and preservation of manure so that they might sow the seeds of improved agriculture, in the heads of the sons of the bona fide ryots in rural schools. This experiment has been very successful and the Assistant Inspector of Schools has again been requested to continue the policy.

The Agricultural teacher of Andhrateeya Kalasala, Masulipatam, was sent for training towards the close of the year. Students seeking admission into the Agricultural College are coming to the farm to learn something about local agriculture.

7. *Staff*.—Farm Manager V. Muttuswami Ayyar relieved Farm Manager K. Narayana Ayyangar on 25th April 1916 and remained in charge of the farm throughout the year. Assistant Farm Manager S. Sitarama Patrudu remained on the farm throughout the year and he had a fortnight's privilege leave in December. He underwent clerical training for three months during the year. Assistant Farm Manager M. Viraraghava Rao remained on the farm until 6th November 1916 when he was transferred. He had a month's clerical training before he left the farm. Assistant Farm Manager B. Siva Rao joined duty here on 24th November 1916. These three Assistant Farm Managers have earned their well-merited promotions by their industrious and willing work.

8. *Agricultural Associations and Co-operative Credit Societies*.—The District Agricultural Association, composed mostly of officials and residents of Vizagapatam, is a dead letter and does little or no agricultural work of any kind. A Taluk Agricultural Association was started in Srungavarapukota taluk with bona fide ryots only as members and village associations are springing up and their work will have to be seen hereafter as they are very recently born.

The Ganjam District Agricultural Association appears to do some better work by awarding prizes for improvements in Agriculture and some members take real interest and cultivate their own fields on better lines. A number of private individuals have been doing very useful work. A special mention must be made here of M.R. Ry. B. V. V. Narasimha Raju Garu of Revidi, Bimlipatam taluk, who has been cultivating about 150 acres of his wet lands on the lines suggested by the department and he has been working all his dry lands with four monsoon ploughs and one R.T. Turnwrest plough. His example is being followed by most of the neighbouring ryots. He may therefore be considered as the pioneer in agricultural improvements in Vizagapatam district.

There are 51 co-operative societies in Vizagapatam and 34 in Ganjam district and the remarks noted under this head above hold good here also.

ANAKAPALLE,
3rd May 1917.

D. BALAKRISHNAMURTI,
Assistant Director of Agriculture, I Circle.

G. R. HILSON,
Deputy Director of Agriculture, I—III Circles.

ADMINISTRATION REPORT OF THE ASSISTANT DIRECTOR OF AGRICULTURE, II & III CIRCLES,
NANDYAL, FOR THE YEAR 1916-17.

I have the honour to submit the Administration Report of the district work section of the II and III Circles for the year 1916-17.

The district work section of the two circles, consisting mainly of the cotton improvement work, sorghum smut work, pattimannu work and green manure work, was supervised by the Deputy Director of Agriculture, I-III Circles, till 22nd January 1917, when, it was taken over by the Assistant Director of Agriculture, II and III Circles, who was specially appointed for the purpose. The latter officer, while in charge of the work, toured 33 days in all, in introducing himself to the work that is being done on the Hagari, Nandyal and Sirvel farms and in inspecting the district work of the circles.

Staff.—The district work of II and III Circles was managed during the year by two Agricultural Demonstrators stationed at Nandyal and Bellary, one at each station. These two officers were also helped by the staff on the farms at Sirvel, Hagari and Nandyal whenever the latter could spare time. As a matter of fact, the Assistant Farm Manager V. Ratnaji Rao of the Nandyal farm conducted the pattimannu work in the Guntur district entirely by himself. At Nandyal, the Assistant Agricultural Demonstrator Raghavulu Nayudu was in charge of the district work till 3rd October 1916, when, he was relieved by M.R.Ry. V. G. Dhanakoti Raju who was granted two and a half months' privilege leave and was consequently relieved in turn on 16th February 1917 by V. Ratnaji Rao who remained in his post till the end of the year under report. During their periods of charge, Messrs. Raghavulu Nayudu, Dhanakoti Raju and Ratnaji Rao toured 85, 49 and 126 days, respectively. At Bellary, Agricultural Demonstrator M.R.Ry. S. Ramaswami Pillai was himself in charge of the district work throughout the year. He spent about 171 days on tour in connection with his work.

District work.

Cotton improvement work.—Arranging seed farms economically for producing improved strains of cotton seed and distributing this amongst ryots formed the chief features of this work for the year under report. Round about Hagari, seed farms to the extent of about 934 acres were arranged and 95,947 lb. of good seed of Hagari No. 1 was obtained for distribution. Of this seed, 48,400 lb. were distributed in the district for sowing purposes. This seed was sufficient to sow 4,840 acres. 10,316 lb. were distributed free to the seed farms of 1916-17. Round about Nandyal, seed farms to an extent of about 940-50 acres were arranged in 1915-16. All the seed obtained from the seed farm kappas was distributed for sowing purposes. The demand for this Nandyal cotton No. 2 strain was so keen that nothing was left on the farm. 62,458 lb. sufficient to sow about 6,245 acres was distributed amongst 46 villages of Nandyal, Sirvel and Koilkuntla taluks. Ryots appreciate cotton No. 2 of Nandyal because it gives about 30 per cent of lint whereas their local seed gives about 26 per cent.

Side by side with the distribution of improved strains of local cotton, Cambodia cotton seed was to some extent stored for distribution purposes. Nandyal farm distributed about 356 lb. amongst 13 ryots of the Nandyal and Sirvel taluks. At Bellary the Agricultural Demonstrator distributed about 689 lb. amongst 15 ryots in Bellary district. The demand for this seed was not very great owing to its availability almost anywhere in the Presidency.

Sorghum smut work.—The campaign against sorghum smut in Kurnool district was not attended with considerable success. During the year 1915-16, 55 villages were tackled and 6,035 acres were treated against smut. In 1916-17, only 25 villages could be approached and about 1,170 acres treated. The reason for the fall in figures was due to the want of hands for doing more work. At Bellary the Agricultural Demonstrator succeeded in treating about 20,620 acres of cereals against smut. Details are shown below :—

8,768	acres of Mungari Sorghum.
9,312	„ Korra Italian millet.
2,380	„ Sazza Cumbu.
160	„ White Sorghum.

Pattimannu work.—Under the name of pattimannu substitute plots, experiments on paddy in Mulapalem, Kuchipudi, Doppalapudi and Vetapalem, Guntur district, were conducted. In each place manured and no-manured plots were maintained at departmental expense to test the effects of superphosphate on some of the poor soils of the Guntur district. In the manured plots superphosphate at the rate of two cwts. per acre was applied and results were observed and compared with no-manure plots arranged for the purpose. Out of the four plots, only two showed successful results. The other two failed.

Green manure work.—During the year under report the work in connection with the green manure seeds was merely collection of seeds from within the circles and distributing them amongst applicants both from within and without. Indigo, wild and cultivated, and sunhemp were purchased and stored in required quantities. But in the case of daincha the process adopted in getting supplies for distribution was different. The department distributed 236 lb. of seed amongst ryots of Sirvel and Nandyal taluks who sowed this mixed

with dry crops of red soils and brought the crop for sale. Much of the crop was reported to have been spoilt by the heavy rains during November. However, 5,534 lb. of seed was brought to the department by the ryots for sale and this was bought at the rate of 21 lb. per rupee.

Distribution of green manure seeds.—The following is the list of green manure seeds distributed according to districts :—

SEED DISTRIBUTION STATEMENT.

Name of seed.	Kistna.	Guntur.	Nellore.	Oddapah.	Kurnool.	Anantapur and Bellary.	Mysore.	Total.
	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.
Bengal daincha	1,440	...	500	84	310½	8	...	3,146½
Wild indigo	...	150	30	...	243	12	...	435
Sunn hemp	...	...	...	...	69½	...	...	69½
Local daincha	...	...	...	...	...	62	...	62
Indigo	...	...	...	...	...	31	...	31
Total	1,440	150	530	84	631½	108	800	3,743½

During the year under report sixteen crop cutting experiments were conducted.

NANDYAL,
11th May 1917.

K. RAMASASTRULU,
Assistant Director of Agriculture.
G. R. HILSON,
Deputy Director of Agriculture,
I-III Circles, Bellary.

ADMINISTRATION REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE,
FOURTH CIRCLE, FOR 1916-17.

1. **Staff.**—I continued to be in charge of this circle till 15th August 1916 as Assistant Director of Agriculture and subsequently as Acting Deputy Director of Agriculture. I spent 236 days on tour and visited Palur Farm nine times.

2. M.R.Ry. A. V. Tirumuruganatham Pillai remained as Farm Manager, Palur, till 14th November 1916 when he was transferred to Nandyal. He spent 47 days on tour and took the Assistant Farm Managers of Palur in tour for being trained on district work. Assistant Farm Manager N. V. Viswanatha Ayyar was in charge of the farm from 24th October to 2nd November 1916 while the Farm Manager was on casual leave. He relieved M.R.Ry. A. V. Tirumuruganatham Pillai and remained in charge from 15th November to 5th December 1916. M.R.Ry. K. Ummikrishna Menon assumed charge of the Palur Farm from 6th December 1916 and continued to be so till the end of the year. He spent 29 days on tour and trained also Assistant Managers in turn on district work.

Assistant Farm Manager N. V. Viswanatha Ayyar was in charge of the wet block till 31st May 1916 when he proceeded on privilege leave for 1½ months. On his return from leave he was given office training for three months which lasted till 15th October 1916. He was then in charge of the wet block till 23rd October 1916. During his stay at Palur he spent seventeen days on tour. He relieved M.R.Ry. K. Ramanatha Ayyar who was on district work at Tindivanam during his privilege leave (24th October 1916 to 2nd January 1917). He was doing district work from 6th December 1916 to 31st March 1917 having his headquarters at Tindivanam and spent 62 days on tour.

Assistant Farm Manager Pranatartiharan, who was in charge of the dry and garden blocks, was transferred to Samalkota on 13th April 1916.

Assistant Farm Manager Panakala Rao, who was transferred from Samalkota, joined Palur on the 19th April 1916 and was in charge of dry and garden blocks till 1st June 1916, and then in charge of wet block till 6th September 1916. He proceeded on sick leave from 7th September 1916 and did not return till 2nd January. While he was on leave he was transferred to Coimbatore.

Assistant Farm Manager V. Ramanatha Ayyar joined the farm as a probationer on the 24th May 1916 and remained in charge of the dry block till 16th January 1917. From 17th to 31st January 1917 he was doing miscellaneous works. From 1st February 1917 he is undergoing office training. He spent sixteen days on tour along with the Farm Manager.

Assistant Farm Manager L. Narasimha Acharya, who joined on 22nd June 1916 on probation, was in charge of the garden block till 23rd October 1916 and subsequently of the wet block till 31st March 1917. He spent twelve days on tour with the Farm Manager.

Assistant Farm Manager C. Arulanandam Pillai, who joined on 16th October 1916 as a probationer, underwent office training till 16th January 1917 and was subsequently in charge of the dry block. He spent 29 days with the Farm Manager on tour.

M.R.Ry. C. V. Sessa Acharya was on district work round Palur and Tindivanam till 15th May 1916 and spent 45 days on tour. He was on leave from 16th May 1916 and was eventually transferred to Coimbatore before he rejoined from his leave.

M.R.Ry. K. Ramanatha Ayyar, who was on district work in Madura, was transferred to this circle in place of M.R.Ry. C. V. Sessa Acharya to Tindivanam. He joined on 25th May 1916 and remained on district work till 24th October 1916 when he proceeded on privilege leave. On his return from privilege leave on 2nd January 1917 he was exploiting the Kolinji areas in Tiruvannamalai and Tiruppattur taluks of the North Arcot district till the close of the official year. He spent 172 days on tour.

M.R.Ry. S. Subba Ayyar continued to be in charge of district work in Chingleput district and spent 220 days on tour.

There were also some changes in the ministerial staff of this office. The head clerk was transferred to the Director's office and second clerk was promoted as head clerk and another was sent from Coimbatore as second clerk of this office, who was also transferred temporarily at the close of the year to Sixth Circle. This place was filled up by one of the clerks of the Director's office.

3. *District work.*—The district work done by the officers this year consisted mainly in inducing the ryots to sow a lesser seedrate of paddy in a larger extent of nurseries, and in the adoption of economic transplanting of paddy. Growing of green manure crops and ploughing them in before transplanting paddy was also recommended. It may be safely said that there has been a great increase in the area under economic planting and in the sowing of lesser seedrate in larger extent of nursery. The following statement furnishes the total quantity of green manure seeds distributed in the circle during this year:—

District.	Number of villages in which seed was distributed.	Kind of seed.			Total.
		Daincha.	Sunn hemp.	Kolinji.	
		LB.	LB.	LB.	LB.
Chingleput	107	1,540	2,159	15,036	18,735
South Arcot	94	7,657	7,863	14,555	30,075
North Arcot	95	2,087	1,062	1,783	4,932
Chittoor	7	49	778	107	934
Miscellaneous	...	2,679	50	42	2,771
Grand total	303	13,412	11,912	31,523	56,847

More seeds could have been sold this year had it not been for the dislocation caused in booking goods in all the railways just in the season when there were opportunities for selling.

The statement furnished above does not include the quantity of indigo seeds purchased by applicants at the instance of this department. Owing to the rise in the price of indigo seeds during the sowing season a merchant who was dealing in Cawnpore indigo seeds was referred to whenever orders were received, and the total quantity disposed of was 35 bags of 48 Madras measures per bag or about 5,460 lb.

4. Demonstrations on the work of monsoon ploughs were given at Palur, Singaperumalkoil, Chandathur, Walajunagar, Rettanai, Mailam, etc. Eighteen monsoon ploughs were sold of which fifteen were from head office and three from Palur. The high war cost of the plough stands as a block to its more extended purchase. Forty-nine sharepoints were also sold during the year.

5. The Rettanai Co-operative Society has been lending these ploughs on a small hire. About 100 acres of land were ploughed near Rettanai with this and about 100 acres near Kilacheri.

6. As usual the triangular harrows and monsoon ploughs were taken on hire from Palur farm by the poor ryots in the vicinity. The hire for plough was 2 annas per day and that of harrow was 1 anna and the amount realized was Rs. 3-8-0 and Rs. 1-6-0, respectively.

7. Three improved sugarcane furnaces were constructed, one at Chandathur, one at Manur near Vellore and another near Jalarpet.

8. Several applications were received from sugarcane growers in South Arcot district to obtain the services of trained coolies to manufacture jaggery and with the kind help of the Principal of the Agricultural College two coolies were lent from the Coimbatore Farm. These two together with another obtained from Chittoor district were showing the method of manufacturing jaggery in parts of South Arcot and North Arcot districts. These were also useful in showing the improved methods of planting canes in various places particularly in North and South Arcot districts.

9. The Agricultural Co-operative Society at Rettanai was visited twice by me and twice by the officers on district work and assistance was rendered in the way of drawing up cropping schemes for the lands belonging to members. The society tried the West African groundnut side by side with the Local Mauritius and having found its advantage has arranged to try it again in the lands belonging to all the members this year. They have also purchased fish manure for distribution to the members for being used as manure for paddy.

10. Demonstrations of the crops grown successfully by adopting the improvements recommended by the department were held at Singaperumalkoil (Chingleput taluk), Rettanai (Tindivanam taluk), Chandathur (Gudiyattam taluk), Manur (Vellore taluk) and in some villages in Wandiwash and Cheyyar taluks. Revenue officers cordially co-operated in all these places.

11. A District Agricultural Association was formed in the North Arcot district and about a dozen members paying an assessment of Rs. 500 and above were admitted as members. Each member undertook to adopt one definite improvement recommended by the department and the lands belonging to the majority of the members were visited and advice given. It is noteworthy to record here that the places in which improvements were effected have already become popular and the ryots in the vicinity have already shown signs of appreciating the departmental activities. If more hands are available, these centres could be tackled very easily.

12. The prominence given to the extension of profitable varieties of sugarcane, first by the farm and then with the hearty co-operation of the East Indian distilleries, has borne fruit in increasing the area of the crop in the vicinity of Nellikuppam from about 200 to 2,000 acres during the past decade. The total number of setts distributed by the department in Cuddalore taluk in spite of the heavy distribution by the factory is a matter of extreme importance from various points of view. More than anything else it proves the inevitable necessity for opening some sugarcane seed farms to supplement the supply from the farms belonging to the East India Distilleries. Further it proclaims the confidence and the desire which the ryots evince in procuring a pure seed supply from the department. Arrangements have therefore been made to meet the situation by opening two sugarcane seed farms in this circle, one near Palur and another near Madanapalle.

The following statement will show the number of setts distributed this year in this circle:—

	SETTS.
Cuddalore taluk	37,500
North Arcot district and Chittoor	54,200
Outside the Circle	15,250

13. A start has been made in the improvement of the methods of cultivation of sugarcane in the immediate vicinity of Madanapalle and Pakala (Chittoor district). Furrow planting 2½ to 3 ft. apart instead of planting at a distance of 1 ft. to 1½ ft. has been adopted. The reduction in the number of setts planted, viz., 28,000 to 12,000 has reduced the cost of cultivation by Rs. 78 per acre.

Other work done during the year.

1. Vernacular lectures were delivered at various centres by district officers and myself.
2. Each of the Salvation Army Criminal Settlements at Kappimbaliyur (Stuartpet), South Arcot, and Rhumminigadda, Chittoor district were visited twice. The Kammapuram Settlement was visited by me once and by the Farm Manager, Palur twice and the Farm attached to the Melrosapuram Mission School was visited thrice. Budhamangalam Mission Settlement was visited by the officers on district work once.
3. Inspections were made to select sites for Criminal Settlements at Vembakkampet and Vanganur and darkhast applications for lands at Elavur and Dhuli.
4. During the Mailam cattle fair a stall was erected to display the green manure seeds and the useful agricultural implements and the departmental activities were advertised. Leaflets and calendars were distributed to literate ryots.
5. Twelve crop cutting experiments were conducted—seven by the Assistant Agricultural Demonstrator, Chingleput and five by the Farm staff of Palur.
6. Seeds were supplied to officers outside the Presidency including Native States as well as to foreign places like Federated Malay States and Ceylon.
7. The cyclone-affected tracts in this circle were visited by the district officers and myself and agricultural advice was given to those who were in need of it.
8. The introduction of new crops like guinea grass was grown in larger extents this year.
9. The Principal of the Agricultural College and the students of Class II who accompanied him on agricultural excursion were shown round the crops in the vicinity of Palur farm, Nellikuppam and Madurantakam.

10. In most of the cyclone-affected tracts of this circle an insect attack on paddy (Army worm—*Cirphis albistigma*) caused a good deal of damage and the assistance of the Government Entomologist, Coimbatore, was procured to such of those ryots who applied for departmental help.

11. Correspondence in my office has shown a considerable increase besides the usual routine correspondence during the calendar year under report. One thousand three hundred and sixty-nine letters were received from private individuals for advice. The following statement will show the comparison of the same with the previous years:—

1914	...	...	...	...	...	...	766
1915	...	...	...	...	...	...	924
1916	...	...	...	...	...	...	1,869

The above will show that the activities of the department are being appreciated and that the work is increasing gradually and to keep pace with this increase more hands are necessary both in the office as well as in district work. With the establishment of only three clerks it would have been impossible to cope with this work by working within office hours only.

In conclusion I wish to express my appreciation for the work done by my subordinates (including office staff). Some have had more arduous duties to perform than others. But on the whole each has done his best and has shown an increasing interest and enthusiasm in the work allotted to each and if any credit is due to the work done by me it is due to the co-operation which I have received from my subordinates.

Palur Agricultural Station.

1. *Season.*—Although the total rainfall recorded during the year was 49.72 inches which is very nearly the average of the past ten years, yet the season was an unsatisfactory one as the rains were ill-distributed. A cyclone unprecedented in virulence and dangerous in its effects swept over the district in November and a good deal of damage was caused to the then standing crops. The rainless months of April, May and June and first-half of July affected the irrigated groundnuts and early planted crops a good deal. During December-January the sowing of the usual crops, viz., indigo, gingelly, ragi had to be deferred on account of the excessive moisture of the soil.

2. *Rainfed dry area.*—In the cereal groundnut rotation experiments, tenai has yielded low this year; cumbu has yielded better than tenai. In the 'B' series where a cereal groundnut rotation is spread over two years the plots were under groundnuts this year and the yields indicate that the year was favourable for groundnuts. In the varietal test so far as the yields of nuts are concerned Madagascar, Barbados Ceylon, Senegal, Mauritius, Ceylon and West African have given better yields than Local Mauritius. The majority of them have also yielded better oil yields per acre. Of the other crops grown Panicholam seems to have succeeded well. Daincha sown late has yielded 238 lb. per acre and at the current market rate at annas 8 per Madras measure a net profit of Rs. 17-1-8 per acre has been obtained.

3. *Dry area well irrigated.*—The "no manure" plot has given the highest yield of groundnut this year. The continuous groundnut experiment both the irrigated and rainfed have yielded better than last year. Of the new crops tried tapioca has given lesser revenue than last year as it has been damaged by the cyclone. Indigo and Cambodia cotton have given good yields. Turmeric has succeeded well and tobacco gives every hope about the possibility it can have in this locality. Of the sugarcane tried in irrigated dry land B. 1529 has come to maturity earlier than the rest. Red Mauritius has given nearly 36 tons per acre in dry land.

4. *Wet lands.*—Garudansamba has yielded 2,712 lb. per acre and has improved considerably this year. Of the short duration varieties tried, Sambalpur has yielded 3,250 lb. per acre and Swarnawari ranks second yielding 2,704 lb. per acre. As sufficient trial has been given to these varieties and as enough information has already been obtained regarding them all varieties except Chitrakali, Rascadam and Swarnawari will be discarded from next year. Of the second crop varieties Vellai Sirumani heads the list. Local garudansamba has come next. Poombalai comes next to all samba paddies. In this connection it should not however be forgotten that the varieties that happened to obtain a place next to the water channel have come to the fore front in yield, but local Sadaisamba in spite of its remoteness from direct flow from the channel has yielded well. Of the several district varieties tried with exception of Garudansamba, Red Sirumani, Molagusamba, Local Sadaisamba, Vellai Sirumani, Poombalai and Jeeragasamba others will be discarded next year.

The green manure crops tried during the year should be considered as partial success only. Demonstrations were held from time to time to show the growth to the ryots in the vicinity. In the continuous daincha manuring field the yield of paddy is much better than in previous years and a steady improvement is seen every year. The yields of paddy in green manure varietal tests are higher than those of last year and this should be attributed only to the right season in which the crop was planted. In the paddy experiments with local manures

tree leaves have given the best yield. In the series where paddy is manured with green-manure plus artificials, the result in single crop land shows that the green manure plot has yielded the least. In the double crop land, where green manure was applied to first crop the results show that the increase in the yield of second crop continues from 1914-15 and that in the plot where no artificials were applied the lowest yield has been obtained, and the plot that received bonemeal plus green manure yielded greatest return this year.

5. *Sugarcane.*—Sixteen varieties were tried this year in wet land. This was planted late and the fields in which these were grown had not good facilities for drainage. B. 3412 and Tana Blanche have successfully resisted against stagnation. J. 247 and Fiji B. were the worst affected. On the whole the yield was not so good as that of last year.

6. Distribution of seeds—

	LB.	LB.
(a) Greenmanure seeds, farm seed	109	7,802
Bengal Daincha, purchased seed	7,693	
Sunn hemp, farm seed	937	
Do. purchased seed	8,584	
Wild Indigo (Kolingi)	...	6,719½
Indigo seeds (Cawnpore)	...	91
(b) Ordinary farm seeds—		6,017
Ramagarudansamba	...	472
Molagusamba	...	816
Sadaisamba	...	1,618
Poombalai	...	1,929
Swarnawari	...	570
Rascadam	...	180
Vellai sirumani	...	264
Other varieties	...	2,657
Other seeds—		586
Groundnut	...	...
Cambodia cotton	...	...
Sugarcane	...	...
Locally purchased from outside	...	...
Implements—		No. 4
Scind ploughs	...	14
Triangular harrows	...	3
Monsoon ploughs	...	...

The bifurcation dam still continues to give trouble. There were 7½ pairs of animals in the beginning of the year under report in the farm. One animal died on account of snake bite. 2½ pairs that have grown old were discarded and sold and 2½ pairs of animals were recently purchased at the Mailam fair and added to the farm livestock, thus making the total strength 7 pairs.

Building and repairs.—The extension of Farm Manager's quarters as well as repairs in the seedstore, Indian visitors' quarters and Assistant Farm Manager's quarters were attended to. The new threshing floor that was under construction was completed. An implement shed and bull shed are under construction.

Visitors.—During the year under report the number of persons who visited the Farm was 818 as against 634 of the previous year.

Excursions of elementary and secondary school boys from the neighbourhood visited the farm more often than before. This shows a healthy sign of the attempts made by the Educational authorities to infuse agricultural ideas in the minds of the growing school-going generation.

St. Thomas' Mount,
18th May 1917.

J. CHELVARANGA RAJU,
Acting Deputy Director of Agriculture, IV Circle.

ADMINISTRATION REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, V AND VII CIRCLES, FOR THE YEAR 1916-17.

I have the honour to submit my Administration Report for 1916-17.

2. I took over charge of the Southern Division (Tanjore, Madura, Rāmnād and Tinnevely) from Mr. Thomas on 30th October 1916 on my return from leave as well as the subdivision (South Kanara, Malabar, Coimbatore, Salem and Trichinopoly) from Mr. Rama Sastrulu on 6th November 1916 and remained in charge until the receipt of G.O. No. 2536, Revenue, dated 11th November 1916, in accordance with which this division was divided into three circles, viz., V Circle comprising the districts of Tanjore, Trichinopoly and Salem, VI Circle comprising

the districts of Rāmnād, Madura and Tinnevely, and the VII Circle comprising the districts of Malabar, South Kanara and Coimbatore, and presumably the Nilgiris though this was not mentioned in the Government Order. I handed over the charge of the VI Circle to Mr. Thomas on 20th November 1916. Since then I have been in charge of the V and VII Circles.

3. *Subordinate staff*.—There have been many and frequent changes in the staff during the year under report and only one officer has been continuously employed in the same work throughout the year. This has partly been due to the transfer of officers to work in other circles, partly to the organization of district work, partly to the formation of new stations and partly to the conduct of work where leave vacancies could not be filled on account of lack of staff.

(a) *West Coast staff*.—At the commencement of the year, the whole staff of four officers on the West Coast were stationed at the Taliparamba Agricultural Station. Six officers were posted to the West Coast during the year, of whom two were newly appointed as Assistant Farm Managers and one newly appointed officer was posted directly to district work. Nine officers received orders of transfer, while one was placed under suspension. Of these nine, four were posted to district work on the West Coast, three were transferred to the newly opened coconut stations and two were transferred to other charges. The staff at the end of the year were as follows:—

Taliparamba Agricultural Station.—Assistant Farm Manager, M. Raman.
Coconut Station No. I.—Assistant Farm Manager, K. Govindan Nambiyar, sub. *pro tem.*, newly appointed.
Do. No. II } Assistant Farm Manager, A. Gopal Nayar, newly appointed on
Do. No. III } probation.
Do. No. IV—Assistant Farm Manager, C. S. Madiah.

District work.—

Tellicherry (South Kanara and Malabar)—II Grade Agricultural Demonstrator, M. R. Ry. M. Govinda Kidavu.

Mangalore (South Kanara)—Assistant Agricultural Demonstrator, K. T. Bhandari.

Ottapalam (South Malabar)—Assistant Agricultural Demonstrator, M. U. Vellodi.

(b) *Coimbatore district staff*.—Assistant Agricultural Demonstrator, M. R. Ry. W. Raghava Acharya, was in charge during the whole period under report, except from 23rd December 1916 to 7th March 1917 when he was temporarily in charge of the district work in Tanjore district.

(c) *Salem and Trichinopoly districts*.—Agricultural Demonstrator, M. R. Ry. S. Narayana Ayyar, was in charge till 15th August 1916 when he was transferred to Rāmnād district. His place was taken by Agricultural Demonstrator M. R. Ry. C. V. Sessa Acharya, who continued in charge for the rest of the year, except from 22nd January till 16th March 1917 when he was temporarily posted to the Manganallur Agricultural Station.

(d) *Tanjore district*.—Assistant Agricultural Demonstrator M. R. Ry. T. R. Venkaswami Rao was in charge till 1st May 1916 when he was transferred to Kurnool district, his place being taken by Agricultural Demonstrator M. R. Ry. K. Narayana Ayyangar, who remained in charge till 12th October 1916, when he went on long leave. No substitute was posted till the end of the year, but urgent work in connection with green manure seed distribution was done by the Assistant Agricultural Demonstrator from Coimbatore who was, as stated above, temporarily transferred to here.

(e) *Manganallur Agricultural Station*.—M. R. Ry. Rao Sahib A. Rama Rao was in charge and was the only officer subordinate to me whose work was not interrupted during the year. He was assisted by Assistant Farm Manager T. A. Krishna Ayyar until 9th November 1916 when the latter was transferred to Madura district, and by two sub. *pro tem.* Assistant Farm Managers newly appointed, viz., Viravaradha Raju and M. A. Balakrishna Ayyar, who were posted here on 20th June 1916 and 24th October 1916 respectively. He was further assisted during the Samba harvest by the Agricultural Demonstrator from Trichinopoly, who was sent here temporarily as the work was too heavy for the inexperienced staff.

From the above statement, it will be seen that very little continuity of work was possible and that the work was further handicapped by new and inexperienced officers in many cases taking the place of those who had gained local knowledge and experience.

4. *District work*.—(a) Protective measures against Mahali disease (Phytophthora omnivora). This work, which until this year was in charge of the Government Mycologist, was handed over to the district staff. The disease is known to occur in two separate tracts, viz., South Malabar and the adjoining territory of Cochin State, and also in the village of Hanur which lies right to the north of South Kanara in a small tract of country isolated from the rest of the district by Mysore State territory. Work at the latter centre was given up, partly because it was impossible with the available staff to supervise the work in this inaccessible spot, partly because labour at the spraying season is very difficult to obtain at the gardens belonging to non-cultivating owners, and partly because the neighbourhood is so malarial that any staff sent there usually go down with malaria of a virulent type, which in more than one case has necessitated long leave. The department cannot in its present state

of development afford to lose even temporarily the services of officers in this way. Two Assistant Agricultural Demonstrators K. M. Jacob and M. U. Vellodi were posted temporarily to South Malabar to be in charge of spraying operations against this disease with headquarters at Anakara and Mulaseri respectively. Each was in charge of a separate circle including several amsoms and nearly 43,000 trees were sprayed in 101 different gardens. Of these, approximately one-third were sprayed for the first time. The department supplied the supervision of the work and lent the spraying machines. The tree owner paid for the chemicals, but as the cost of these was nearly double that of last year, this was sold at a cost of Re. 1 for chemicals sufficient to spray 100 trees against the cost price of Rs. 1-3-6. Even at this reduced price, many persons were unwilling to purchase chemicals. The cost of the operation including the pay and allowance of the staff amounted to 3-47 pies per tree, of which the tree owner paid 1-4 pies in addition to providing the labour to climb the trees and do the spraying. The operations were very successful and only on an occasional tree in the gardens sprayed was the disease seen and in such cases, it was usually due to the garden owner's delay in spraying till the disease actually appeared. The treatment is not a cure, but merely a prophylactic.

(b) *Sugarcane*.—Work in connection with this crop was confined to the West Coast, but unfortunately owing to the frequent changes in the staff very little inspections could be given to the growing crops. Cultural instructions are very necessary where this crop is newly introduced. There has been a considerable development of this crop in the Palghat taluk of the Malabar district and in the Uppanangadi taluk of the South Kanara district. In the latter taluk, the introduction of the hard Red Mauritius cane has greatly widened the scope of cane cultivation on account of its comparative immunity from the attacks of wild animals, and farmers of all castes are now taking to this, while formerly its cultivation was practically confined to the Sudra Christians.

In the north of the South Kanara district cane cultivation continues to spread and now the Red Mauritius is the predominant variety. The majority of the growers are, however, merely petty tenants and from want of capital are forced to sell their standing crops to professional jaggery makers, with the result that the grower of the crop fails to reap the full benefit of his labours. It is hoped that with the aid of co-operative societies this difficulty will, in time, be overcome. The Registrar of Co-operative Societies has recently visited this part of the district, and his Inspector has toured in these villages with an officer of the department with a view to seeing whether the starting of such societies is possible. It is unfortunate that the prices of cane crushing and jaggery making plants are now very high on account of the scarcity of materials.

(c) *Paddy*.—Demonstration work connected with the crop includes (1) economic planting, which includes (a) the sowing of thin seed beds, (b) adequate manuring of seed beds; (2) green manuring; (3) other manuring; and (4) seed distribution and trial of new varieties.

(1) *Economic planting*.—This practice is advocated in all districts though its application has to be modified to suit different conditions. In Malabar, for example, great stress has to be laid on the importance of manuring seed beds, especially those reserved for the second crop. Here also economic rather than single planting has to be advocated as this crop does not tiller nearly so freely on the West Coast as in districts of lower rainfall. In many places here, a considerable reduction of seed rate for transplanted crops has been effected. In the Coimbatore district work has been confined to the valley tracts where the bulk of the wet cultivation exists. Economic planting has been signally successful in the fertile and well drained lands along the Bhavani, which readily respond to this method and show such a marked increased yield that there is no question in the mind of the cultivator as to which is the better practice, and also to a lesser degree in the other valley tracts. Throughout these tracts, as a result of these demonstrations there has been a considerable reduction in the seed rate and the dry method of preparing the seed bed is becoming increasingly popular. The following are approximate figures showing the spread of economic planting in this district:—

1914-15.	1915-16.	1916-17.
ACS.	ACS.	ACS.
460	1,950	4,600

(2) *Green manuring*.—The development of this practice has been seriously checked by the difficulty in providing an adequate supply of seed and very much more could have been sold if it had been available in the proper season and if the staff had been adequate to see to the demands for this. 10,089 Madras measures (33,630 lb.) of Kolinji seed were sold chiefly in the Shiyali and Gobichettipalaiyam taluks, in both of which places the demand was considerably greater than the supply at the disposal of the department. There is no doubt that there is a great scope for the development of this as a green manure crop on loamy soils especially on single crop lands, and there is also no doubt as to its value as a manure. It has the further advantage that it is not relished by cattle, which are not therefore attracted to a field where this is grown and they thus usually leave it alone. Efforts have been made to exploit further sources of the supply of this seed and there is no doubt that much more seed could be obtained if arrangements could be made to collect it. These enquiries also elicited

the fact that the increasing demand for Kolinji leaves is in many places menacing the supply. The competition to get such plants is so great that the plants are often pulled up before they have matured seed which naturally leads to a decreased supply in succeeding years. The demand in Shiyali taluk is likely to greatly increase. Though a few persons have grown this for some years, yet its general use has only developed since the department has been able to take up systematic district work. There are fairly large areas where this is now self-sown and the crop establishes itself after the paddy harvest without having to sow the seed afresh.

The supply of daincha seed this season was most unsatisfactory. It was very expensive as well as difficult to obtain and that obtained was by no means of good quality. The supply arrived too late to be of any use in the Cauvery delta, South Kanara and parts of Coimbatore. Arrangements are being made this coming season to have as much of our requirements as possible grown locally so that the department will, it is hoped, be independent of outside sources of supply. This green manure crop continues to give satisfaction on heavy soils, especially so on any land which is badly drained or inclined to be alkaline, and 2,498 Madras measures or 8,742 lb. have been sold during the year under report.

(3) *Other manuring.*—In many places the use of superphosphate is becoming popular. This is especially the case in the Musiri taluk where this manure is used in conjunction with daincha as a green manure, and there is probably a considerable scope for the use of this in the Tanjore delta, especially when used in conjunction with a green manure crop. Its introduction is, however, up-hill work for although it is estimated that its use brings in approximately 100 per cent on the money invested this is very little compared to the return of money invested in cattle manure and sheep penning. The farmer, however, seems to forget that the supply of these latter manures is strictly limited and that it is better to get some increased and profitable return from the use of purchased manures than none at all by neglecting to manure. This point of view one would imagine would appeal to the educated farmer and mirasidar of whom there are many in the district and in a few cases it has, but in very few. Fish manure seems to be more popular than superphosphate and it certainly has proved itself to be a valuable manure. Two or three large land-owners have obtained large consignments of this while its use may become more popular through the distribution which is being done by the Tanjore District Co-operative Manure Supply Society, Limited, who have ordered several tons of fish guano.

5. *Seed distribution.*—The sale of strains of seed paddy obtained by selection at the Manganallur Agricultural Station amount to nearly 40,000 lb.: (This figure is very largely the sales of March 1917. Those of April 1917 are almost as high, but are not given as this belong to the next administration year) and a gratifying feature of these sales is that many persons who have purchased last year have again come forward with increased orders for seed. It would have been possible to sell considerably more as several orders were received for 100 and 200 kalamas. (1 kalam=60 lb.) It was felt, however, that such wholesale distribution should be discouraged and a maximum amount which could be supplied to any one applicant was fixed in order that (1) the distribution should be as wide as possible and (2) persons should be encouraged to reserve their own seed when once they had obtained the strain.

It was unfortunate that no officer was available for district work to inspect the crops grown with this seed. Such inspection is necessary in order to see how the yield of these strains compared with local seed and how each strain suits the soil of different localities. This was only possible in a few cases and there the people were enthusiastic over this seed. A small quantity of seed of the Government Economic Botanist's unit strains has this year been distributed in places where they are likely to be useful.

Seed distribution—General.—A statement of seeds distributed at different centres in 1916-17 is given hereunder:—

Name of centre of distribution.	Kolinji	Sunn-hemp.	Bengal daincha.	Local daincha.	Indigo.	Paddy.	Cotton.	Ginger.	Chilli seedlings.	Sugarcane setts.	Pepper cuttings.
	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	Nos.	Nos.	Nos.
Head office	4,636	1,498	1,507	21	169	...	...	...	...	...	...
Manganallur farm	3,307	...	971	...	10	39,615	...	...	...	...	...
Taliparamba farm	167	...	460	...	...	3,250	...	101	10,975	15,450	6,300
Kambakonam	2,147	338	...	...	...	...	...	...	...	...	...
Shiyali	10,833	...	1,225	...	...	...	...	...	...	...	...
Mayavaram	500	...	18	...	...	...	...	...	...	...	...
Atur	233	...	2,321	...	...	...	...	...	...	...	...
Ettaper	...	...	248	...	...	...	...	...	...	...	...
Narasinsapuram	...	...	334	...	...	...	...	...	...	...	...
Gobichettipalayam	10,997	...	165	...	...	...	...	...	...	...	...
Coimbatore	580	772	926	...	...	...	...	...	...	...	...
Dharapuram	230	212	628	...	...	...	...	...	...	...	...
Central farm	...	...	...	...	...	...	4,830	...	...	...	...
Total	33,630	2,820	8,743	21	179	42,865	4,680*	101	10,975	15,450	6,300

* 3,342 Cambodia and 1,347 Uppam.

West Coast Coconut Stations.

6. These consist of four sub-stations and represent the different classes of soil on which coconuts, apart from those grown on backwaters are cultivated. No. I station is situated in the village of Pilicode, 1 mile from Charvathur railway station and the soil here is lateritic. No. II station is in the village of Nileshtar, about three-quarters of a mile from the railway station and the soil here is a red sandy loam. No. III station is also situated in Nileshtar village and is about 1 mile from the railway station. The soil here is sandy. With the exception of a small portion of No. II station, these lands were Government waste and were handed over in the month of June 1916 to this department. All three stations were enclosed, laid out and the construction of buildings and wells has commenced. No agricultural work has yet been started on any of these. No. IV station is situated in the village of Kudlu some 2½ miles to the north of Kasaragod town. The soil here is a red sandy loam and carries existing coconut trees of from 20 to 40 years of age. This had to be acquired and was handed over to this department in the beginning of December. A considerable amount of preliminary work has been done. The boundary fence had to be built up, existing houses had to be put into temporary repair, wells had to be cleaned out, useless trees had to be felled, the garden had to be laid out in suitable blocks, trees had to be numbered, classified and registered and cleaned and work was also commenced on the necessary buildings and wells. It is hoped that all buildings under construction on the four stations will be completed before the monsoon breaks. Arrangements have also been made to procure seed nuts for raising nurseries for the new stations and seedlings for filling up vacancies in No. IV station.

Taliparamba Agricultural Station.

7. The work here as already mentioned has been generally hampered by the lack of continuity of management. The season has been favourable to all crops except pepper. Rains commenced early and continued late and the result of the latter was to cause heavy shedding of pepper as well as to favour a severe attack of the pepper flea beetle. The total rainfall was 160.27 inches against an average of 138.15 inches.

(a) *Wet lands.*—Good rains in May greatly helped the cane crop as well as the green manure crops. The paddy nurseries, however, suffered as the monsoon burst on the 1st of June before the seedlings were ready and continued steadily from then onwards; which gave little opportunity for their further development before planting. The season, however, continued to be favourable and the yields of paddy were better than last year. The cane crops this year were good, but they were late in maturing. Three varieties new to this coast were under trial this year including the 'Vellai' cane of Coimbatore. This gave a remarkably good jaggery, but it is uncertain in germination and so far has not shown very vigorous tillering powers.

(b) *Pepper gardens.*—These have, on account of prolonged late rains, given very poor yields. Many plots which gave promise of a very heavy crop gave practically nothing at harvest time. This was mainly due to a severe attack of the pepper flea beetle whose larva feeds inside the berry. The prices for the produce, however, were exceptionally high and this made up for the low yield.

(c) *Dry land crops.*—With the exception of chillies all these have done well. Ginger gave high yields and the trials with concentrated manures show that these can replace cattle manure as a manure for this crop. The chilli crop suffered severely from a fungus disease known as 'fruit spot' which was favoured by the moist weather conditions which prevailed when the crop was ripening. As this disease appears to be carried by the seed from one season to the next, fresh seed has been obtained for next year's sowings.

Manganallur Agricultural Station.

8. The season was on the whole very favourable to crop production. No heavy rain was recorded till after water was received in the channels, so no difficulty was experienced in obtaining a deep puddle, which is essential on these heavy delta soils for satisfactory crop production. September was a period of some anxiety, but the water-supply never actually failed and the showery but not too heavy weather of October-November greatly helped the Samba crops which gave very heavy yields. The Ottadam crops, i.e., the long duration crop of the mixture known as 'Udu' was the only one which did not give very satisfactory yields and this is attributed to the lack of rain at the time this crop was cut back for the Kuruvai harvest (i.e., the harvest of the short duration crop of the mixture known as Udu). Unexpected heavy and continuous rain fell at the time the main Samba nurseries were sown which caused much damage and loss of seed and season. These weather conditions also were apparently favourable to the activities of the fresh water crab which played serious havoc with the young seedlings. Many of the small seed-beds of selected strains were completely destroyed despite every care and attention bestowed on them. These causes made it necessary to resow considerable areas of seed-bed which in its turn made the planting season later than usual. These crabs also did serious damage in many newly planted fields before the crops had become established.

(a) *The paddy crop.*—The yields this year have been on the whole very good though how much better than in previous years it is impossible to estimate as such a large area of the station is now under experimental cultivation.

The increased yields are specially marked where soluble phosphatic manures have been applied and more especially where these have been applied in conjunction with either green manure or ammonium salts. One of the greatest difficulties met with in this wet cultivation on delta soils is the impossibility of obtaining uniform condition for experiment. This applies especially to mechanical conditions and drainage which are easily affected locally by rainfall and underground seepage. It appears evident that low yields in certain plots do not necessarily point to permanent infertility but rather to temporary infertility due to causes beyond control. In several cases the yields in plots which last year were exceptionally low are this year exceptionally high, which seems to indicate that last year there were causes present, which prevented the crop utilizing fully the plant food in the soil and which were not present this year. A reference to last year's report will show that the probable cause of this was the heavy rains in June which prevented the formation of a deep puddle and it is more than probable that, as this water found its way through the soil, it would tend to collect more in certain places than in others and thus emphasize the shallow puddle in certain spots. This season eliminated this factor with the apparent result that those portions which yielded poorly last year were enabled not only to give up the plant food made available this year, but a portion at any rate of that which was available but inaccessible to the plant last year. It is thus clear that the results obtained from experimental plots must be based on a number of experiments as well as a number of seasons under the same experiment.

Several unit strains supplied by the Government Economic Botanist were under trial on a field scale and though the yields of some of them are promising they are of too short a duration for the season in which they were planted. Seed of the more promising varieties has, however, been distributed to places, where the season would probably suit them, for further trial. Numerous other strains were planted out by the Government Economic Botanist, but the damage to these crops by crabs was so serious that no comparison between these was possible.

The bulk selection Red and White Sirumani varieties of the farm continues to give great satisfaction in the district, both on account of the purity of the sample and the better yielding qualities of these strains.

(b) *Pests.*—As has already been mentioned the fresh water crab has seriously interfered with the experimental work on the station and the Government Entomologist has been investigating the life history of this pest as well as means for its destruction. It is too soon, however, to say how far the means adopted for its destruction will prove satisfactory in lessening the pest as it is yet unknown to what extent these crabs can travel down the irrigation channels from land not under control.

The disease known locally as 'Surai' (*Pseudococcus Sacchari* O'Kl.), and which is reported to be caused by a 'mite' has done considerable damage this season and has appreciably affected some of the yields from experimental plots.

Paddy smut was also very severe, especially on the White Sirumani variety. This disease, however, as it is only prevalent in good seasons is not looked upon as a serious pest.

The agricultural public are taking a greater interest in this station though not as much as one could wish considering the important and valuable work which is being done here.

TRICHINOPOLY,
14th May 1917.

H. C. SAMPSON,
Deputy Director of Agriculture.

ADMINISTRATION REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, SIXTH CIRCLE, FOR THE YEAR 1916-17.

I have the honour to submit the Administration Report of the Sixth Circle for the year 1916-17.

1. STAFF.

(1) The Sixth Circle, which comprises the districts of Madura, Rāmnād and Tinnevely was first placed in separate charge of a Deputy Director of Agriculture on 20th November 1916. Previous to that date these three districts formed part of the Southern Division. Mr. Sampson, on return from leave in November, resumed charge of the Southern Division excluding the newly formed Sixth Circle. The headquarters of this circle were located at Madura and a new office was formed with the necessary staff. From the time I handed over charge of the remainder of the Southern Division (that is, Fifth and Seventh Circles) I have retained charge of the Sixth Circle.

(2) *Koilpatti farm.*—Mr. N. S. Kulandaiswami Pillai remained in charge of the farm throughout the year. At various times he has been assisted on the farm by Assistant Farm Managers Messrs. K. Gopalakrishna Raju, C. S. Madiiah, R. G. Mal, C. R. Srinivasa Ayyangar, K. S. Sankaram Pillai and A. K. Ganesa Ayyar. There have been numerous and unavoidable

transfers of subordinate executive staff on the farm as well as of clerical staff. These frequent transfers prove a considerable handicap to the Manager, more especially in his supervision of the district work which centres on the farm, and also in the conduct of experimental work which has largely to be entrusted to inexperienced Assistant Managers. Owing to the rapid extension of the district work and to the attendant clerical work sanction was accorded for the temporary entertainment of a second farm clerk.

(3) *Subordinate officers on cotton improvement work.*—The cotton tract of this circle which stretches from near the Periyār tract on the north to Tuticorin has been divided into five sections each in charge of an Agricultural Demonstrator. Mr. A. Chinnaatambi Pillai remained in charge of the Pudiamputtur section. Mr. T. S. Venkatarama Ayyar replaced Mr. K. P. Sundara Ayyar in the Kadambur section. Assistant Farm Manager Mr. R. G. Mal assisted in the Koilpatti section. Mr. K. Gopalakrishna Raju was placed in charge of the Sattur section and Mr. S. Narayana Ayyar in charge of the Virudupatti section. With this distribution it is possible to supervise improvement work throughout the cotton tract. That section north of Virudupatti has been exploited for the first time during the year under review. The Farm Manager, Koilpatti, continued to exercise general supervision of all cotton improvement work outside the farm.

(4) *Subordinate officers on green manuring work.*—Agricultural Demonstrator Mr. K. Sankara Ayyar remained in charge of work in the Madura section of the Periyār tract throughout the year. In the Sholavandan section, Mr. K. Ramanatha Ayyar was relieved by Mr. K. Unnikrishna Menon who was in turn relieved by Mr. T. A. Krishna Ayyar.

2. DISTRICT WORK.

Improvement work on ryots' lands is largely confined in this circle to the improvement of paddy cultivation in the Periyār tract of the Madura district and of cotton cultivation on the black soils of all the three districts.

A. Improvement of paddy cultivation.

(a) As in past years, the sale of green manure seeds, the economic transplanting of paddy, the diminished seed rate of paddy in the nursery, and demonstrations to prove the value of superphosphate as a manure for paddy have formed the chief items of district work connected with the improvement of paddy cultivation in the Periyār tract.

(b) The season was particularly favourable to the growth of green manure crops. Ample summer rains were received which ensured the growth of those green manure crops sown in the standing crop of paddy before harvest, and also allowed a fairly large area to be sown later in the dry. A practice which is increasing in popularity is the sowing of daincha seed in single crop wet lands with the first receipt of Periyār channel-water early in June. The crop is ploughed in when about six weeks old, by which time the growth is luxuriant. As far as the 1916 paddy crop was concerned the north-east-monsoon rains were very disappointing and disease was rife. A noticeable feature under this year's conditions was the relative immunity of the green-manured paddy crops to the prevalent diseases.

(c) *Seed distribution.*—The subjoined statement gives details of the green manure seeds distributed:—

Statement showing the distribution of green manure seeds in the VI Circle during 1916-17.

Kind of seed.	Weight of seed distributed.			
	1916-17.	1915-16.	1914-15.	1913-14.
	LB.	LB.	LB.	LB.
Daincha	8,659	16,574	47,636	29,339
Kolinji	45,130	41,449		
Sunn hemp	1,075	1,321		
Indigo	627	227		
Grand Total ...	55,491	59,571	47,636	29,339

The demand for kolinji (wild indigo) and for daincha (*Sesbania aculeata*) continues to increase, but the supply of daincha seed procurable before the harvest of paddy in February was considerably below the demand. The quantity of daincha seed indented for was 26,000 lb. but the delivery of this seed from Bengal was delayed to such an extent that this year sales are much below those of the previous year. The original indent of 55,000 lb. of kolinji seed was eventually increased by 3,333 lb. The total quantity of kolinji seed sold by the department within this circle amounted to 45,130 lb. In addition a large quantity was sold by seed merchants in the bazaar, and one dealer is reported to have disposed of 1,300 lb. of seed. Unlike other green manures kolinji becomes self-sown on single

crop paddy lands once it becomes well established. Besides, the growth in many instances was so rank in the past year that part of the vegetation was removed to manure other fields than those on which the crop was grown. For these reasons it is not possible to record the actual area manured with kolinji grown in the Periyār. Much the same applies to the area under *daincha*, for ryots now frequently collect seed from crops primarily intended for green manuring purposes. They utilize this seed for their own lands and sell the surplus to their neighbours. The area green-manured in this circle in the past year is roughly estimated at about 15,000 acres. The special feature regarding the cultivation of *daincha* which deserves to be recorded is its increasing popularity as a fodder crop. Many cases are known where goats have been specially fattened for the butcher on a *daincha* diet. The danger from cattle trespass continues to be the chief objection with many ryots against the cultivation of this useful green manure. Indigo seed does not find a ready sale because of its prohibitive price, and the demand for *sunhemp* seed is limited because the crop is not well suited to the tract.

(d) *Supply of seed.*—In the past the red soils and tank beds bordering the hills in Tinnevely and Rāmnād districts have been the chief source of supply of kolinji seed for the southern half of the Presidency. The supply here is not only precarious, being largely dependent on the timely receipt of rains, but it is being depleted in increasing proportion every year. Attempts were made during the year to exploit fresh tracts. Large areas covered with wild indigo were found bordering the seashore in the Rāmnād district, but owing to the sandy nature of the soil and the scarcity of labour the cost of collecting the seed will be considerably higher than that paid in the past in Tinnevely. This circle contracted for 245,833 lb. of kolinji seed for the various circles of which 173,833 lb. only were delivered. Owing to the uncertainty of both the quantity and the quality of *daincha* seed available on the Calcutta market an attempt was made to cultivate *daincha* on contract for seed purposes on assessed waste lands in the Cumbum valley. But as these lands were being reserved as a site for a criminal settlement, the sanction of the Revenue officers had to be sought. The seed was sown too late in the season, and the usual rains were disappointing. The experiment, though not altogether successful, deserves further trial. A few ryots grew *daincha* for seed purposes voluntarily; others collected a fair quantity of seed from their crops intended for green manuring purposes and made substantial profits. It has been realized that the only satisfactory means of fostering the cultivation of *daincha* for seed purposes is to offer the cultivators a price for the seed which will make the crop more profitable than their ordinary dry land crops. With this object the purchase price for the coming season will be increased to Rs. 6 per Madras measure; that is, 50 per cent higher than that offered last season.

(e) *Superphosphate manure.*—During the year applications were received for 73 cwt. of superphosphate manure. Ryots order their supply direct from the supplying agents. This department simply forwards indents to these agents and does not undertake the direct purchase and sale of superphosphate manure. Demonstrations were conducted on the land of 21 ryots in 18 villages scattered throughout the Periyār with 20 cwt. of superphosphate distributed gratis to prove its value as a manure for paddy.

(f) *Fish manure.*—But little fish manure is commonly applied to paddy land in the Periyār. On the West Coast, which is the only source of supply, both the price and the quantity vary widely with the season. Last season was favourable to large catches of fish and the price demanded was relatively low. In anticipation of a local demand in the coming season some 19 tons of beach dried sardines were purchased. Of this quantity 13 tons have already been sold.

(g) *Distribution of improved paddy varieties.*—This work has only just been started. Six varieties of improved strains selected by the Government Economic Botanist have been obtained for trial in the coming season. Members of the local Agricultural Association have kindly undertaken this experimental work under the supervision and advice of officers of this department.

(h) The demand for green manure seeds and for advice on agricultural matters generally from ryots in the Tamarapandi valley of the Tinnevely district, is rapidly increasing. Restrictions recently imposed regarding the supply of leaf for green manuring purposes from the Tinnevely forests have induced a number of ryots to grow their own green manures. It is unfortunate that the necessary subordinate staff is not at present available to attend to work in this tract.

B. Improvement of Cotton Cultivation.

(a) *Seed distribution and seed unions.*—An improved strain of cotton selected initially from a single plant on the Koilpatti farm was first placed on the market in an appreciable quantity in 1913. The quantity of seed obtained from the 1913 crop of selected cotton was infinitesimally small when compared with the demands of the whole of the cotton tract in this circle. Now cotton easily propagates twenty-fold; and as late as 1915 this department controlled the supply and the sales of all the improved seed available. In 1916 the quantity of this seed on the market, though still limited, had become so great as to make it impossible for this department to handle the whole of it. Provision had to be made to ensure that

none of it should be used as cattle food. With this object many of those ryots who sold their cotton co-operatively to the mills were induced to pool their seed until the coming season, then sell it co-operatively. Six special villages were selected for this work. By-laws were framed on a tentative basis until experience had been gained. Many difficulties were encountered, but with the invaluable assistance of officers of the Co-operative Societies Department these trial seed unions worked well. They sold their seed at prices varying from Rs. 12 to Rs. 15 as compared with Rs. 9 to Rs. 11 for bazaar seed. In addition, a large number of ryots sold their improved seed individually. It is estimated that altogether about 70,000 acres of cotton were sown with improved seed during the year. Though these seed unions only sold some 106 pothies (26,182 lb.) of seed, ample experience has been gained to organize them on a large scale. By this means it is hoped in the course of time to supply the demand of the whole cotton tract for improved cotton seed.

(b) *Seed Farms.*—The primary object of a seed farm is to provide seed for propagation purposes. The area under seed farms in the past has averaged about 500 acres. The Director of Agriculture in his report to Government No. R.O.C. 2231 G1., dated 14th June 1916, stated that in view of the competition which has arisen for this class of cotton, the advisability of managing from 1,000 to 1,500 acres of seed farm in 1916-17, was being considered. Were the object solely to meet the demand for Company cottons from purchasing firms, then the necessary provision for propagating them on the maximum possible scale could be conveniently and fairly easily arranged through the agency of those seed unions already established; but the villages profiting by such a distribution of seed would be confined to that part of the tract south of Sattur. A much more potent factor than the demand for this cotton from the firms arose to meet the pulichai situation. It was realized that one of the most effective means of eradicating pulichai cotton was to replace it with an improved type of cotton which suited the tract. Such a cotton was at hand in Company 3, and it was extremely unfortunate that the propagation of this cotton was not so far advanced in 1915 as to be able to supply the seed to all comers. All the seed available with the department after about seven years' continuous propagation from the single plant stage was only sufficient to sow about 3,000 acres. With the available allotment of Rs. 39,190 we could control some 500 acres of seed farm only. And owing to the stringency incidental to war conditions it was extremely doubtful if the Government would increase this allotment however strong or urgent the case made for an additional allotment. In the light of these facts, and realizing that the emergency must somehow be met, the seed farm indentures were overhauled and it was found that if this department confined itself to the purchase of seed only, as distinguished from kappas, it could then control nearly five times the area under seed farms with the same allotment. Proposals were submitted accordingly to the Director of Agriculture to purchase only cotton seed, as distinguished from kappas, from seed farms. But it was decided to retain about 225 acres under the old seed-farm conditions according to which the kappas had to be purchased, and start with about 2,100 acres under the new conditions. The major portion of the latter area was specially selected in the pulichai tract north of Sattur where cotton improvement on a comprehensive scale was not attempted previously. By instituting this new system of seed farms it was possible to distribute under seed farm conditions almost the whole of the seed of Company No. 3 available with the department in 1916. We will therefore be in a position to distribute the produce from this seed farm in the coming season that the use of the whole quantity for seed purposes will be guaranteed should the demand therefor be forthcoming. The general introduction of Company No. 3 cotton in the pulichai tract should go far towards allaying any fears or suspicions entertained by the local ryots regarding the advice given them ament the eradication of pulichai cotton.

(c) *New selections.*—Five selections of improved strains of cotton were submitted to the local spinning mills who conducted special spinning tests with them. We are indebted to Messrs. Harvey & Co. and to the Manager of the Chidambara Vinayagar Mills, Koilpatti, for kindly undertaking this work. Both these mills agree in extolling the high spinning qualities of one of the selections now called Company No. 3-A. This selection has proved to be a very heavy yielder and arrangements are being made to propagate it on the maximum scale. The remainder of the lint obtained from the seed farm kappas was sold to the local firms on a new system in such a way that the vagaries of a fluctuating cotton market need now cause no anxiety; whereas previously, with a falling market, the department stood to lose heavily on the transaction.

(d) *Co-operative sales.*—The work of inducing ryots to pool their kappas and sell the lint co-operatively to the ginners has received the attention of this department for the past four or five years. It is the common practice in this tract for the ryot to sell his kappas to a cotton dealer, or middleman, through whom the cotton firms obtain their supply of lint. One large source of profit to the middleman who deals in our improved cottons is their high lint outturn. Thus taking the average lint outturn of Tinnies at 25 per cent, then cotton ginning at 30 per cent will give an increased yield of lint amounting to five parts in 25. He thereby increases his profits in the sale of lint by 20 per cent. The lint outturn of the first improved cotton marketed on a large scale (that is, Company No. 2) is 29 per cent, and that of Company No. 3 (which is fast replacing Company No. 2) is 33 per cent. This high lint outturn

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is the chief inducement to ryots to pool their kappas and sell the cotton direct to the mills. The dealers or middlemen have not been slow to realize the value of this high lint outturn and are offering the ryots proportionate premiums for these cottons. The success that has attended our efforts in this branch of work is indicated in the accompanying statement:—

The following is indicated in the accompanying statement:—						
Year.	Number of villages concerned.	Number of ryots who pooled their kappas and sold the lint co-operatively to the mills.	Average number of ryots per village.	Amount of kappas brought for co-operative ginning.	Amount of good seed obtained.	Ample to sow about
1913	...	3	...	LB.	LB.	ACA.
1914	...	20	6	80,000	22,500	1,500
1915	...	29	63	182,750	97,500	8,500
1916	...	71	89	226,000	169,560	11,300
		362	50	1,004,292	708,002	46,900

It is calculated that the 362 ryots who sold their cotton co-operatively in 1916 as advised by this department reaped excess profits amounting to not less than Rs. 33,000, and in addition they made an excess profit of at least Rs. 5,500 by sale of their improved type seed. These are profits which are known to have been made. A large number of ryots, for various reasons, preferred to sell their improved cotton in the customary manner to dealers. They, also, reaped substantial excess profits which cannot be easily estimated with any degree of accuracy. But the estimate lies on the safe side with Rs. 50,000 as the excess profits reaped by the local ryots on our improved cottons during the year under review. It was during this year that the improved cottons originally selected and distributed from the Koilpatti farm were first marketed on a commercial scale. The year was, in consequence, perhaps the most critical in the history of cotton improvement in this tract. The cottons marketed had in previous years survived the various tests to which they were subjected on the Koilpatti farm and on ryots' lands as seed-farms. The reports received from local mills on their spinning qualities were encouraging, but it still remained to be seen if the produce suited those of the world's markets which handle Tinnies. In 1916 the quantity of selected cottons on the market was estimated at 2,000 candies of 500 lb. This fact was communicated early in the season to all the local firms who deal in cotton. Their offers of premiums in excess of the market rate for Tinnies were invited. The season opened with offers of a premium of Rs. 10 per candy of 500 lb. above the ruling market rate and closed at Rs. 16; but cases are known where as high a premium as Rs. 20 was paid towards the close of the season for this cotton. A system of certificates was instituted whereby the purity of the cotton was guaranteed to the purchasing firm. The high premium paid has served a very useful purpose in advertising departmental cottons amongst the ryots.

(e) *Drill Cultivation—1916-17 crop.*—This branch of work was thoroughly overhauled before the 1916-17 crop was sown. New rules were framed regarding the loan of drill-sowing implements to ryots. As will be seen from the accompanying statement these new conditions have affected adversely the actual area drilled. The main idea underlying the newly framed rules is that when the free use of implements is given to a ryot he should, after two years' usage, be in a position to decide as to whether cultivation by means of drill-sowing implements is a paying proposition. He is then advised to purchase a set of implements which costs him Rs. 15 new; but he is given the option of using departmental implements on payment of a nominal fee which covers their depreciated value. If he adopts neither course then departmental assistance is withdrawn. Moreover, a more rigorous check has been made, and will continue to be made, on all drill sown areas.

Year.	Total area drilled.	Area drilled with departmental assistance.	Area drilled by ryots themselves.	Sets of implements sold by the department.	Implements made by the ryots.
	ACS.	ACS.	ACS.		
1913	...	7,117	4,399	2,718	85
1914	...	11,329	6,924	4,405	32
1915	...	17,060	8,600	8,400	83
1916	...	15,351	8,450	6,901	111

* These areas are estimates and not actuals.

† This area is actual.

From the above statement it will be observed that the total area sown under drill is less than that reported the previous year. No anxiety need be felt on this score. What really matters in this branch of improvement work is the area cultivated under drill by ryots

without departmental assistance of any kind. Another sure indication of progress is the number of implements sold to or made by the ryots. Inclusive of 15 made in the villages, 111 new sets of implements made by, or purchased by the ryots, were at work as compared with 88 in 1915, 82 in 1914, 85 in 1913, and 12 in 1912. This work has suffered appreciably owing to the demands made on the time of the subordinate staff by the more urgent pulichai eradication work.

(f) *Eradication of pulichai cotton.*—The situation regarding the measures adopted to eradicate pulichai cotton up to the middle of the 1916 picking season has been given in previous reports. Though the legal agreement, whereby firms who bought cotton were liable to be penalized should they be found purchasing pulichai cotton, was drafted fairly early in the 1916 season, it was not until late in July that the agreement was duly signed by all the parties concerned. The season was then far advanced, and most of the pulichai cotton on the market had found a sale before the agreement became legally operative. The agreement, as constituted, appertains to purchased cotton which has been ginned direct by the purchasing firm either in its own or in a leased factory—it is not concerned with "cherka" (or hand-ginned) cotton. And this latter is the favourite loop-hole with cotton dealers for the disposal of pulichai cotton. The formal legal agreement entered into by the various local cotton firms became inoperative in October 1916. At a meeting held in September at Tuticorin it was decided to renew the agreement but to make the conditions more stringent in that no cotton containing above 3 per cent of pulichai should be bought by any firm. This clause has had a marked moral effect on this year's sowings and has induced many ryots to uproot pulichai plants when found mixed with the local cottons.

Pulichai cotton has been known to exist in the Tinnevely cotton tract now for the past ten years or so. It was not until 1915 that this department decided to take steps to check its propagation. In that year the area under pulichai mixtures in which the pulichai exceeded 75 per cent of the crop was, judging from the reports of my demonstrators, at least 1,000 acres; and on an area of at least ten thousand acres mixtures containing lower percentages of pulichai could be found. To dissuade the ryots from continuing its cultivation in 1916 was given precedence over all other cotton improvement work. And judging from the situation as it stands at the time of writing, we can well be proud of the success that has attended our efforts. I use the plural term *our efforts* here advisedly. For only by the active co-operation and united effort on the part of all the local firms interested in Tinny cotton, of the Revenue officials concerned, and of officers of the Agricultural Department, would it have been possible to convince the ryot that he was standing in his own light and in that of his sons by continuing to cultivate pulichai cotton. As a result we have induced him to reduce the area from thousands of acres to less than 90 acres. I have just succeeded in purchasing the produce from practically the whole of these 90 acres. This has been done to prevent the further propagation of the seed in the coming season. This work has demanded no small amount of my personal attention because of the reluctance shown by the ryots in parting with their pulichai cotton at a price 25 per cent below that of Tinnies. This price was decided upon because it represents the true marketable value of pulichai cotton as "Bengals." Each house where this cotton had been stored was visited separately, the cotton weighed in my presence, delivery taken, and payment made on the spot. The readiness with which the ryots eventually parted with their stocks at the low figure of Rs. 27 per pothie of kappas as compared with Rs. 35 for Tinnies was largely to be attributed to the strictness observed by the purchasing firms in allowancing from the opening of the season for small percentages of pulichai in mixtures, and in immediately rejecting all cotton which contained above 3 per cent of pulichai. Cotton dealers soon learned these facts and refused to purchase pulichai except at a very reduced rate.

It is especially gratifying to be able to record that in the present season the total area under pure pulichai cotton throughout the districts of Madura and Ramnad known to be the original home of pulichai did not exceed 6 acres. It was in the Tinnevely district, in villages near Kalugumalai that the crop was grown pure on the fairly extensive scale of 80 acres. There were, however, large areas in the two former districts containing small percentages of pulichai. But, almost without exception, the ryots were induced to uproot it soon after germination when its presence could first be detected. Such a degree of success as I am now able to record would have been impossible were it not for the fact that Mr. G. F. Paddison and Mr. A. R. Loftus-Tottenham, Collectors of Madura and Ramnad, respectively, have taken a personal interest in the work from the commencement and have given me their whole-hearted support.

The goal which this department made its objective in 1915 was nothing less than the complete eradication of pulichai cotton from the Tinnevely tract. That goal has not yet been reached, and I can say here without the least compunction, that from my personal knowledge of the situation, I consider that nothing short of legislation making it a penal offence both to grow pulichai cotton and also to gin it, will ever effect complete eradication. And nothing short of absolutely complete eradication will, in my opinion, ever prevent a recurrence of the situation which we had to confront in 1915. The road has now been well paved for the introduction of legislation. This would at the present stage involve no hardship whatsoever in the case of any ryot or of any dealer or firm. It would merely serve as an effective preventive against the re-introduction and propagation of this low grade cotton.

(g) *Implements*.—The number of drill sowing implements sold during the year has been referred to in paragraph (e) *supra*. The two-furrow disc plough lent to the Avalnatham Agricultural Association since 1914 was purchased outright by them. A similar plough in use on the farm at Koilpatti was let out on hire whenever it could be spared. The monsoon plough is becoming increasingly popular with blacksoil ryots and though by no means an ideal implement yet it does very efficient work. Four monsoon ploughs were sold from the farm this year.

3. KOILPATTI AGRICULTURAL STATION.

Season.—The summer rains were very disappointing and the cotton crop sown in 1915 failed to give an appreciable summer yield. It was therefore uprooted in July and August and the lands prepared for the 1916 crop. The distribution of rain during the growth of the latter crop was exceptional in many respects. The season opened well and all the cereal crops, fodder crops and cotton germinated splendidly. The sowing season was followed by a drought of four weeks. The November rains were again followed by an almost continuous severe drought of nearly six weeks. The showers of early January considerably relieved the situation as regards the cotton crop but were too late to save the cereals and fodders. The February rains were worse than useless as far as the blacksoil crops were concerned. These caught the cotton crop in full flower and within a few days of their receipt practically every flower and tender boll had dropped. Much the same applies to the March rains which caught the crop just as it was recovering from the February disasters. As a result of these untimely rains the quality of the lint this year is much below the average. The cotton was exceptionally stony and contained a large percentage of immature fibre. The sea-breeze from February to April was unsteady and the standing crops did not derive the benefit from this source that they are accustomed to.

A. Red Soil Block.

The experimental work conducted on this block is of secondary importance only. Large profits were made during the year from a small area cultivated with Senna (*Cassia angustifolia*). Owing to an abnormal increase in the market price of senna leaf (seven annas per pound as compared with the pre-war rate of one-half anna per pound), it was decided to cultivate this crop with the primary object of meeting the increased demand for seed. The yield of irrigated Cambodia cotton on these shallow soils of poor natural fertility was low, as usual, and the quality of the staple inferior. Daincha (*Sesbania aculeata*) grown experimentally for seed purposes was a partial failure owing to insect attacks. The experimental cultivation of pure crops of three varieties of cowpeas proved unprofitable owing largely to a long period of drought following germination. Onions grown from bulbs gave a higher yield but less profit than those grown from seedlings, as the latter commanded a higher price on the local market. Belgian Congo sorghum continues to do well under the local conditions; it grows luxuriantly, tillers freely, the fodder is sweet and is relished by cattle, and the crop, after harvest, ratoons freely. It seems to suit this tract and its cultivation will be fostered. At the request of a Tuticorin firm a small area was cultivated with Henbane (*Hyoscyamus muticus*). As a result of experience gained in the previous season a few modifications were made in cultivating it under irrigation. Samples of the dried stems and leaves were submitted to the Imperial Institute for analysis and report on their commercial value. It appears from these reports that the percentage of "Hyoscyamine" is less than that obtained from Egyptian henbane. Prices in London have varied from £50 to £80 per ton during the past year as compared with £20 a ton before the war. Arrangements are being made to comply with the wishes of the firms who valued the product to supply them with a larger consignment for test purposes. Reports received from America where *Muticus niger* is the variety most in demand are not so encouraging. It was found that the cultivation of maize grown on the farm becomes more profitable when the cobs are sold green in the local bazaar. Owing to the partial failure of the fodder crop on the black soil block the maximum area available on the red soil block was cultivated with fodder crops; these included sorghum, guinea grass and maize. The coconut and guava trees responded well to moderate doses of concentrated and green manures.

B. Black Soil Block.

The cereal crop cumbu (*Pennisetum typhoides*), the fodder crop (*Sorghum vulgare*) and the local cotton (*Gossypium obtusifolium*) were grown in the usual four-course rotation. Selection work with cotton continues apace and a fresh supply of seed of the improved strains was obtained for distribution purposes so as to maintain the quality of those already marketed. Some of the later selections have proved superior to their progenitors and arrangements are being made to market these on the maximum scale. A new departure was made in selecting from amongst the general crop of bazaar cotton for heavy yielding types. Some of these recent selections have proved on a small scale to yield heavily without materially affecting the quality of the lint. One selection has a remarkable staple measuring nearly one and a quarter inches in length; it is a fairly heavy yielder, and has been

favourably commented upon in small samples by some of the local firms, but it is feared that its lint outturn will not reach expectations, in which case it may yet have to be discarded. From the 1915 crops some 500 plants were selected, and the seed-cotton from the individual plants examined. Of these, all except 53 were discarded; the latter were propagated and are now under further comparative tests together with 13 selections on the field-plot scale of five cents, and ten selections on the field-crop scale of one acre.

Numerous manurial experiments were conducted on the various crops. It is the common practice in this cotton tract to manure heavily the staple food crop—cumbu. The manure is distributed broadcast and covered with a light ploughing. An experiment conducted on the farm seems to indicate that the yield of cumbu grain can be appreciably increased if part of the manure is applied in the furrow with the seed at the time of sowing. This fact will be verified in the coming season.

An experiment was started in 1903 to compare the relative values of different manures when applied to unirrigated black soil crops. It was discontinued in 1911 and from that year records have been maintained of each year's produce from the fields concerned in order to find the residual values of these manures. The interesting results obtained have been summarised in the Koilpatti Farm Report, 1916-17 (q.v.).

List of seeds used for sowing and of implements distributed from the Koilpatti Farm in 1916-17.

Farm Seeds.						Quantity.
						LB.
Onion	bulbs	...	...	...	...	104
	seeds	...	...	...	...	10½
Senna	...	...	...	...	...	234
Daincha farm seed	...	...	...	...	...	120
Periyamanjal sorghum	...	...	...	...	...	831
Irungu sorghum	...	...	...	...	...	543
Cumbu	...	...	...	...	...	19
Maize	...	...	...	...	...	151
Cambodia cotton seeds	...	...	...	...	...	563
Farm cotton seeds excluding the quantity grown under seed farm conditions.						6,793
Drill implements	...	...	...	...	...	83 sets.
Monsoon ploughs	...	...	...	...	...	4

Implements.—The two furrow disc-plough, the baghar and the bucksraper continue to do good work. The monsoon plough has proved to be fairly well adapted to the cultivation of black soils where lightness of draught coupled with moderately deep cultivation are the primary considerations. A Junior hoe was purchased for intercultivating the irrigated red-soil crops.

Cattle.—Most of the 14 bullocks maintained on the farm contracted foot-and-mouth disease as usual at the time of the Kalngumalai fair. There were fortunately no fatal cases. A stud bull was maintained from November 1916. Though the bull now at stud is not admirably suited to the local conditions he is a considerable improvement on the nondescript type of animal commonly used for stud purposes by the local ryot.

New works.—The farm office was extended during the year. A thatched mud shed was constructed for housing the animals placed at stud and an opener shed was attached to the ginnyery.

Visitors.—During the year about 830 ryots visited the farm. The fact that a large number of black soil ryots visit the farm uninvited is a sure sign that their confidence has been won. Other visitors included the Agricultural Adviser to the Government of India, the Director of Agriculture, the Collectors of Tinnevely and Ramnad and a number of local zamindars.

4. GENERAL.

(a) *Agricultural Co-operation*.—The co-operative element in the paddy tracts of this circle, though yet in its infancy, is becoming more pronounced every year. The Madura and Ramnad District Agricultural Association continues to do useful work. It distributed 7,560 lb. of kolinji seed during the year and has taken advantage of the low ruling price of fish manure to buy it wholesale and sell to its members at a small profit. Use is being made of this association to test the suitability of new paddy selections from Coimbatore. The Uthangudi Agricultural Co-operative Society purchased wholesale a fairly large quantity of superphosphate for manuring paddy. The following Societies were formed during the year: Tamaraipatti Agricultural Co-operative Society, Kudakulam Agricultural Co-operative Society, Sholavandan Agricultural Association, and the Tinnevely Agricultural Improvement Society, which latter is already showing signs of useful activity.

The co-operative sale of cotton by ryots has been commented upon in paragraph 2 (d) supra. Seed Unions were formed this year for the first time. It is found that these work smoothly only when run in conjunction with Co-operative Credit Societies. If such a society is not close at hand then the Co-operative Societies Department is invited to enquire into the possibility of opening one in the village. Two such societies were opened during the year and Credit Societies already existed in two of the remaining four seed union villages.

(b) Cotton improvement work has attained such large dimensions during the last two years that it was fast becoming impossible to administer efficiently with the small staff allotted for this work. The pulichai problem, a solution to which was first seriously attempted in 1913, demanded the special attention of all officers engaged in cotton improvement. This work has fallen most heavily on the shoulders of the Farm Manager, Koilpatti. Mr. N. S. Kulandaiswami Pillai and the two Demonstrators at Satnr and Virudupatti Messrs. K. Gopalakrishna Raju and S. Narayana Ayyar, respectively. The situation was one which demanded tact and resourcefulness of no mean order and the officers named deserve special commendation for the success which has attended their efforts.

Much of my time was taken in inspecting the yards of purchasing firms throughout the tract and checking their purchases of pulichai mixtures. As a result but little time was left for me to supervise and check personally the work of the district staff. The large increase in the area under seed farms entails a proportionate extra increase in the clerical work involved, and the sanction of Government to entertain a second farm clerk at Koilpatti was welcomed. Green manuring work in the Periyar tract has for the time being to take second place to cotton improvement work. The former continues to flourish but is strictly limited by the quantity of green manure seed available for distribution.

MADURA,
17th June 1917.

R. THOMAS,
Deputy Director of Agriculture, VI Circle.

APPENDIX III.

ADMINISTRATION REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE, LIVE-STOCK, FOR THE YEAR 1916-17.

I joined the Agricultural Department on the 24th April 1916, reporting myself at Bombay on that date, and arrived in Madras on the 28th of that month.

2. I remained in Madras until May 8th, then went to Coimbatore Agricultural College where headquarters were fixed till 24th July.

3. The period at Coimbatore was mainly taken up with dairy problems, and the more important ones which require investigation were briefly studied and classified in the hope that they may be examined in detail at some future date. Conditions vary so very much in Madras when compared with Great Britain and some other dairying countries, that practices applying in such places cannot be recommended without first being tested from first principles. Most of the Dairy literature which pretends to deal with dairying in India has been gone through, and it is quite evident that it is mainly extracts and copies from other works;—it is unfortunate that very little is based on (a) investigation, (b) observation, (c) experiment or (d) research, in the Indian districts. The live-stock literature is in much the same position.

From the preliminary investigations at Coimbatore I am of opinion that until a considerable amount of work is done under a, b, c, d, very little real advance will be made.

During the period at Coimbatore courses of lectures on live-stock and general dairying were delivered to the students and also the Tiruppur show attended.

4. After return to Madras on July 25th, the preliminary work which preceded the enquiry into the whole question of the milk supply of Madras was taken up. A number of dairymen in each district were visited, their herds inspected, evidence taken and observations made. These inspections were made in the early mornings and in the evenings when at headquarters. The interim report which deals with all the principal aspects of the question has been prepared and submitted. The final report and recommendations for the improvement of the industry are in an advanced state.

5. Several tours were made in the Guntur and Nellore districts in connection with a cattle farm site. During the year the requirements of such a farm were worked out from observations and a draft memorandum prepared.

6. In these districts also typical villages were visited with a view to obtaining first hand information regarding breeding—feeding and general management of cattle—also to study the relation of the numbers and kinds of cattle to economic agriculture. During these tours, a special study of the Ongole cattle was made as a preliminary to the purchase of breeding stock for the farm.

7. I visited the Agricultural Department's farms at Samalkot, Anakapalle, Nandyal, Hagari and Koilpatti, also the Military Dairy farms at Bangalore to get a general idea of what is being done.

8. At the end of the year I acted as examiner in dairying at the Agricultural College, Coimbatore.

9. From the date of joining until the 31st of March 1917, 127 days were spent in camp. If to this is added the days spent in connection with the enquiry into the Madras milk supply—duties which should be classed as district work, the total number of days at out-door work equals 187.

10. Staff.—Assistant Agricultural Demonstrator M. Raghavalu Nayudu joined duty on 5th January 1917 and has given general assistance in connection with the work.

11. General.—From general observations, it appears quite evident that the duties under my charge are of the pioneer character without any traces of routine, hence it follows that if the initial lines are to form a safe foundation for future progress—a condition essential to success—developments in the early years must necessarily be of somewhat slow growth.

CAMP COIMBATORE,
8th May 1917.

A. CARRUTH,
Deputy Director of Agriculture, Live-stock.

APPENDIX IV.

ADMINISTRATION REPORT OF THE GOVERNMENT AGRICULTURAL CHEMIST FOR 1916-17.

I have the honour to submit herewith my administration report for the year ending 31st March 1917.

2. I was in charge of the office for the whole of the year under review except for 25 days from 6th to 30th April 1916 when I availed myself of privilege leave. The Senior Assistant in Chemistry M.R.Ry. M. R. Ramaswami Sivan Avargal was in charge of the office during that period. I was also in charge of the office of the Principal when the latter was on privilege leave from the 4th to 23rd September 1916. The Government of India have sanctioned the grant of a personal allowance of Rs. 150 per month to the Government Agricultural Chemist from the 1st March 1917.

3. In the reorganization scheme of the department, assistant M.R.Ry. P. A. Subrahmanya Ayyar was promoted to second grade assistant on Rs. 175. Assistants Messrs. P. A. Raghunathaswami Ayyangar and B. Viswanath were placed in the fourth grade (Rs. 75—5—125) but were allowed to retain their personal scale and M.R.Ry. T. Lakshman Rao was confirmed as fourth grade assistant on Rs. 75—5—125. The Government sanctioned the entertainment of a new assistant and M.R.Ry. U. Mudlagiri Nayak was appointed as sub. *pro tem.* assistant to fill the vacant post.

4. The following members on the staff availed themselves of the privilege and sick leave for the periods noted against each:—

(1)	M.R.Ry. M. R. Ramaswami Sivan Avargal.	24 days from 11th May to 3rd June 1916.
(2)	„ B. Viswanath	15 days from 5th to 19th June 1916 and 26 days from 24th August to 18th September 1916 (leave on medical certificate).
(3)	„ T. Lakshman Rao	6 months' combined leave made up of 6 weeks and 27 days' privilege leave and sick leave for the remaining period from 1st November 1916.

5. The Senior Assistant in Chemistry continued in general charge of the teaching section and M.R.Ry. P. A. Subrahmanya Ayyar of the Physics and Meteorological section as well as acting as the personal assistant for Research work. Class III had 93 lectures of one hour duration and 64 practical classes of three hours' duration. Eleven regular lectures and two revision lectures on Agricultural Chemistry were given by the Senior Assistant in Chemistry for Class I and five lectures on feeding of animals for Class II. Three lectures on Meteorology and 13 in Physics were given by M.R.Ry. P. A. Subrahmanya Ayyar for Class I. (The lectures were given according to syllabus.) Lectures hitherto given on Dairy Chemistry were taken over by the Deputy Director of Agriculture, Live-stock, Madras.

6. The following samples have been analysed and reported upon :—

Soils	116
Manures	17
Foodstuffs and fodders	84
Dairy products	68
Water	24
Oils and oilseeds	48
Sugarcane	4,517
Miscellaneous	5
Total	4,879

Of these, only 55 were extra-departmental samples and include 30 done for ryots. The corresponding figures for the previous year were 189 and 78 respectively.

7. The preliminaries for the Kistna Delta soil survey were completed and out of the 133 samples obtained, 80 have been analysed. The work is progressing rapidly and the report will probably be ready for publication during the year 1917-18.

8. During the year investigations relating to paddy soil conditions were directed mainly to a study of the relation of carbon-dioxide and hydrogen to the soil. It has been shown that although the anaerobic fermentation of organic matter normally leads to the production of very considerable volumes of these gases yet they only form minor constituents of the soil gases. This is accounted for by the fact that they cannot persist as such in paddy soils except in small proportions. Hydrogen when alone tends to disappear in the presence of sulphates through reduction processes, whereas a mixture of carbon-dioxide and hydrogen disappears even in the absence of sulphates, through a recombination to organic matter. These changes are brought about by micro-organisms and are of importance in connection with the conservation of lime in wet land. They also offer a feasible explanation for the accumulation of marsh gas and nitrogen as the major constituents of the soil gases. Work is being continued in the direction of the clearing up the bacteriological relationships involved.

9. The Senior Assistant in Chemistry continued his experiments relating to the availability of Trichy phosphates in paddy soils. They have not reached completion, as yet, and are being continued.

10. Several other minor or preliminary investigations were carried out. A commencement was made with the microscopical examination of oil cakes with a view to the determination of adulteration by admixture with inferior cakes. It was found possible to easily recognize different cakes and also to identify the component cakes in a mixture but a considerable amount of detailed work will be necessary before the results can be made public. Refractometric examination of the juice extracted from growing canes at different periods of their growth held out a possibility that it would be feasible to make an early selection of cane seedlings for quality, but, unfortunately, field experiments on the large scale did not yield definite results and consequently they will be continued in the ensuing year. Advantage was also taken of the fact that the permanent manurial plots are now showing definite results to begin a study of the effect of varying manurial treatment upon the composition of grain.

11. The following publications have been issued from my section during the year under review :—

- (1) Copper sulphate as a stimulant for the rice crop.
- (2) Changes in physical composition caused by the conversion of dry soil into paddy soil.
- (3) Composition of South Indian Foodstuffs and Fodders.
- (4) The gases of swamp Rice Soils, Part IV—The source of the gaseous soil nitrogen.
- (5) The Enzymes of Germinated Red Gram.

The last is the work of Assistant M.R.Ry. B. Viswanath carried out on his own initiative and No. 4 is a continuation of my investigations carried out in conjunction with my assistant M.R.Ry. P. A. Subrahmanya Ayyar.

12. During the year under review, I was on tour for 14 days and members of my staff for 133 days.

AGRICULTURAL COLLEGE,
7th May 1917.

W. H. HARRISON,
Government Agricultural Chemist.

APPENDIX V.

ADMINISTRATION REPORT OF THE GOVERNMENT ECONOMIC
BOTANIST FOR 1916-17.

I have the honour to submit my annual report for the year 1916-17.

2. *Charges*.—I was in charge of the section throughout the year except for one month's privilege leave from 7th May 1916 during which period the First Assistant M.R.Ry. G. N. Rangaswami Ayyangar was in charge.

3. *Staff*.—The First Assistant went on privilege leave for six weeks from 23rd March 1917 and the Second Assistant for five weeks from 22nd May 1916. Sub-Assistant P. V. Raghavendra Rao was transferred to the Agricultural section from 15th June 1916 and his place was taken by the Assistant Farm Manager K. Ramanuja Acharya. The latter, who was put in charge of the Paddy Breeding Station, was on privilege leave for six weeks from 4th September 1916. Assistant Farm Manager C. R. Srinivasa Ayyangar, who was deputed for training in Economic Botany, joined the section on 3rd January 1917.

Two temporary clerks were employed during the busiest season for three and five months respectively. Further permanent additions to the staff will be necessary before certain desirable expansions of the work can be brought about.

4. *Tour*.—I spent fifty-two days on tour in various paddy-growing areas and the two Assistants sixty-three days. It is hoped that, as the work settles down to a more definite state, more time will be available for general touring in addition to that necessary for carrying on special work in definite areas.

5. *Paddy Breeding Station*.—An area of about 2½ acres was added to the Paddy Breeding Station thus completing the compact block of 16 acres originally selected. The whole area was brought into order by straightening bunds and channels, levelling, etc. Quarters were built for the Sub-Assistant in charge and a small well provided for the use of the occupants.

A six horse power engine and three-inch pump were obtained to be fitted at the large well. This will be a most useful installation as it will be a safeguard against shortage of channel water in the season, will admit of a second crop being grown after the channels are dry and will make it possible to start seed-beds for the earliest crops at least a month earlier than channel water can be expected. In this way, by spreading out the season, very much more work can be got through.

6. *Paddy*.—Work on the inheritance of characters was continued and considerable progress made. The most definite results so far obtained have been submitted for publication as a Memoir. Many of the varietal characters are dependent on simple factors whereas others are affected by the interaction of several factors. Interference between factors is very common and new cases are continually coming to light.

The more definite economic characters prove to be complicated and difficult of analysis. A large mass of records with regard to such characters as duration, height or plant, size and shape of grain, etc., is being accumulated and, it is hoped, will lead to definite results eventually.

The most promising strains have again been compared for yield and the same two head the list as last year. They will be compared very carefully next season before finally deciding which to put out.

In addition to these selections several pure types of varying duration, derived from a cross between the main local six months' variety and a coarse strong-growing four months' variety, are very promising and will be tested on a large scale next season.

7. *Selection work on the Mangallur Farm*.—This was very seriously hampered by the damage done by crabs. The two early sown varieties were so much destroyed after transplanting that no comparisons for yield were possible and the two main crop varieties were attacked in the seed-bed and over 90 per cent of the lots rendered useless. The Entomology section has at last undertaken to grapple with this pest. Meanwhile next season's work will be largely confined to a continuation, on a larger scale, of experiments designed to estimate the probable error of comparing for yield plots of various sizes and shapes. This year's results were rather unexpected and need confirming before they are made the basis of future work.

8. *Paddy Survey*.—A total of sixty-five varieties, received from the district staff, were grown this year. Of these a disappointingly large proportion showed considerable mixture and a few failed to germinate. The pure lots were described briefly and typical plants bagged for starting pure line cultures from which full descriptions will be made and herbarium specimens kept.

It is of interest that the duration of some of these varieties, as grown at Coimbatore, varied considerably from that recorded in their natural habitats.

9. *Cotton*.—The only material that has come to anything is that resulting from the Cambodia-Spence cross mentioned in last year's report. The selections made from this material

were still very mixed. On the whole they show considerable promise for growing as a dry crop, being heavy yielding, high ginning percentage and long lint, though all are inclined to be rather weak. Seed of many of these will be sent to Mr. Hilson for trying in the Ceded Districts and to Mr. Thomas for trial in Tinnevely.

10. *Miscellaneous*.—The ordinary routine work went on in the Botanical Garden where large numbers of plants were raised for putting out on the Estate round the ever-increasing quarters. Lack of water is the limiting factor in any attempt to beautify the surroundings of the College.

An increasing number of seed-germination tests were made for various members of the district staff.

11. *Publications*.—A paper entitled "The Inheritance of Characters in Rice I" was submitted and accepted for publication as a Memoir.

I am pleased to be able to state that the whole staff has worked hard and well throughout the year.

AGRICULTURAL COLLEGE,
COIMBATORE,
28th April 1917.

F. R. PARNELL,
Government Economic Botanist.

APPENDIX VI.

ADMINISTRATION REPORT OF THE GOVERNMENT LECTURING BOTANIST FOR 1916-17.

I have the honour to submit herewith my annual report for the official year ending with 31st March 1917.

2. *Staff*.—I was in charge of the office throughout the year except for one month during which period the senior assistant was in charge of the office. The temporary staff sanctioned for the herbarium continued throughout the year. B. V. Gopalakrishnan was appointed as acting artist from 26th February 1917.

3. *Leave*.—I was on privilege leave for one month during the year. Both my senior assistant and the teaching assistant were granted privilege leave, a month and a half for the former and two months and fourteen days for the latter. The artist was given at first six week's privilege leave and his leave had to be extended by six months on account of his illness.

4. *Tours*.—During the year I was on tour for sixty days on botanical exploration in the districts of Tinnevely, Salem, Bellary and North Arcot. The senior assistant was away from head-quarters for twenty-eight days touring in Chingleput, Anakapalle and Samalkota for studying the grasses and collecting specimens for the herbarium. At the request of the Deputy Director of Agriculture, I, II and III Circles, my teaching assistant was sent for twelve days to Hagari to study the weeds and grasses growing on the farm. The temporary systematic assistant was away from head-quarters for fifty-four days for collecting specimens for the herbarium on Kollimalais, Tinnevely hills and Nilgiris. The sub-assistant and the plant collectors were on tour for forty-nine and forty days respectively mostly accompanying me and my assistants.

5. *Systematic Botany*.—During this year specimens were not sent to Kew for the preparation of Flora, as Mr. Gamble does not want them for some time and he has not as yet asked for them. This year five new species were described in Kew bulletins from the Madras collections sent so far and they are *Microtropis Stocksii*, Gamble, from the Anamalais, *Ventilago lanceolata*, Gamble, from Kanoth, Malabar, *Turpinia malabarica*, Gamble, from the Anamalais, *Buchanania Barberi*, Gamble, from Nadarai in Travancore and *Vernonia Ramaswamii*, Hutchinson, from Agastiyarmalai of the Tinnevely district. Specimens of three species of *Strychnos* were forwarded to Kew.

6. From the recent collections about 1,200 plants were identified, 1,020 sheets were incorporated into the herbarium chiefly consisting of specimens collected in the districts of Salem, Chingleput, Malabar and South Kanara, and 5,300 sheets were mounted. Several specimens of grasses and other specimens were presented to the herbarium by Mr. Fischer. The fruit collection was supplemented by about 90 specimens.

7. Specimens to the extent of 414 were identified for various correspondents, the chief of them being Lady Bourne, Dr. Barber, Col. Fearnside, Messrs. Parnell, Fischer, Anstead, Fyson, Panchapakasa Ayyar, Venkata Rao and Rao Sahib Rama Rao.

8. The study of the common grasses of the plains was continued during the year and detailed descriptions of about 30 of them were written and several slides and photographs were prepared to study the histology of the leaf and stem of these grasses. This will be continued as time permits, with a view to publish a handbook on some of the

common grasses of this Presidency. The artist prepared 51 drawings of weeds and grasses. While studying the grasses of the plains three new species of grasses were met with. One species of *Cynodon*, which is new, was till now mistaken for *Cynodon dactylon* the well-known species of *Cynodon*. This was named *Cynodon Barberi* and its description prepared by me and my hariat grass. This was named *Cynodon Barberi* and its description prepared by me and my senior assistant was published in the journal of the Bombay Natural History Society. A species of *Chloris* found growing in the Central Farm, Coimbatore and in the Bellary district appears to be an undescribed new species and it will be named after reference to Kew. Another grass *Sporobolus scabirifolius* recently described as new by Bhide and occurring in the Bombay Presidency, was found growing in several fields on the Farm at Coimbatore.

9. The need for an additional artist for my section is very keenly felt considering the amount of work I have on hand. In this connection I have to thank Messrs. MaoRae, Parnell, and T. V. Ramakrishna Ayyar for allowing their artists to work in my section now and then on several occasions.

10. *Teaching*.—During the year 62 classes were held for the third year students in Botany, the subject matter dealt with being histology, morphology and a portion of physiology. For the first and second year students 26 and 24 classes were held respectively in accordance with the printed syllabus of lectures. A few lantern lectures were also given. The usual terminal examinations and final examination for Proficiency certificates were held. A special diploma examination according to old rules was also held in Botany for one student. My book "Elementary Botany" was published in April 1916.

11. I attended the fourth Indian Science Congress held at Bangalore, and presided over the Botanical section and contributed a paper on "The Flora of the Tinnevely Hills". I also attended the Educational Exhibition at Saidapet. My teaching assistant Mr. P. S. Jivanna Rao and the systematic assistant Mr. K. Cherian Jacob attended the Science Congress and the latter read a paper on "Pollination in *Alysicarpus*."

12. During this year His Excellency the Governor, Sir Claude Hill and the Commissioner of Agriculture visited the Laboratory and the herbarium.

AGRICULTURAL COLLEGE,
28th April 1917.

K. RANGA ACHARYA,
Government Lecturing Botanist.

APPENDIX VII.

ADMINISTRATION REPORT OF THE GOVERNMENT ENTOMOLOGIST FOR 1916-17.

I have the honour to submit herewith my report for the year ending 31st March 1917.

2. *Staff*.—For the whole of the year under review, I continued to act as Government Entomologist due to the absence of Mr. Ballard on military duty. The following important changes took place during the year in the personnel of the staff and I must say that the work of the section suffered to some extent on that account:—

M. R. Ry. C. Narayana Ayyar, Junior Assistant, who proceeded on three months' privilege leave in March 1916, left the section on transfer as Agricultural Demonstrator in May.

Senior Assistant M. R. Ry. Y. Ramachandra Rao, whose services were placed at the disposal of the Imperial Entomologist for two years to study lantana insects, was relieved on the 15th November. Thus, from the beginning of the official year to the 15th November I had only two Assistants and for nearly a month afterwards Mr. Isaac was the only Assistant left. Two new men, Messrs. T. V. Subrahmanya Ayyar, B.A., and John A. Muliyl, B.A., who were appointed later, joined duty on the 11th December 1916 and 3rd January 1917, respectively.

E. S. Pasupathi Ayyar, who was appointed as my Silk Sub-Assistant for work at Kollegal, in place of silk Fieldman Raghavendra Rao who was dismissed, joined duty on the 17th May.

3. *Tours*.—During the year I was in camp for 117 days in all. The tours included visits to the following localities:—

- (a) Kollegal, to inspect the work of the Silk Sub-Assistant.
- (b) Madanapalle, to supervise mango hopper spraying in the Bhummanagadda Criminal Settlement tope.
- (c) Bellary and Kurnool, to study crop pests and note the extent of damage done by the Deccan grass hopper (*Colemania*) pest during the year.
- (d) South Malabar, in connection with the study of the new coconut pest (*Conthayla rotunda*, Hamp) reported from there last year.
- (e) Nilgiris, to investigate cockchafer pest of cinchona in the Dodnabetta plantations.
- (f) The Gōāvari delta, to investigate the relation between the budrot disease of palmyra trees and the palm beetles, the latter as probable carriers of the disease; so far as

- (2) A departmental leaflet on the same "The Mango Hopper Pest and its Control."
 (3) An illustrated article to the Agricultural Journal of India on the same "The Mango Hopper Pest and its Control in South India."
 (4) A departmental leaflet on "A few Home-made Remedies against some Common Plant Pests."
 (5) A paper read by me at the last Park Fair Exhibition in January 1916 on "Insects in Agriculture." This was published in the "Book of the Madras Exhibition" and also in the Agricultural Students' Journal.
 (6) Instructions to village officers for reporting on insect damage and forwarding specimens.
 (7) The following five notes to the departmental year book—
 (a) "Notes on the life-history and habits of the Eye Fly-Siphonella funicola, de Meij" by me.
 (b) "Notes on the life-history of "Megacoelum stramineum, Wlk" by Mr. Ballard.
 (c) "Adisura atkinsoni, Moore" by Mr. Y. Ramachandra Rao.
 (d) "Note on the egg-laying habits of the Agathi Weevil" by me.
 (e) "A new pest of the coconut palm on the West Coast" by me.

(8) Sixteen short notes on various insects to the Imperial Entomologist to be included in his bulletin on second hundred notes on Indian insects. Eight of these were prepared by me, seven by Mr. Y. Ramachandra Rao and one by Sub-Assistant Susainathan.

The second and third parts of my last year's paper "A catalogue of new wasps and bees of India described since 1897" appeared in the Journal of the Bombay Natural History Society during the year.

9. *Miscellaneous*.—Exhibits of insect show cases, diagrams, silkworms, etc., were taken to the Tiruppur and Lalgudi exhibitions.

A set of coloured lantern slides of insect pests was sent to the Assistant Director of Agriculture, I Circle, for demonstration at the Andhra Conference at Cocanada.

The Imperial Entomologist visited the Laboratory in December and gave help in the matter of identification of insects, etc. His silk Assistant also visited Coimbatore and Kollegal, and was given all help to study the silk industry in the district.

Mr. Ansoorge, I.C.S., Assistant to Mr. Maxwell Lefroy, the Silk Expert, visited Coimbatore and I took him round the silk weaving and dyeing centres of Coimbatore.

His Excellency the Governor of Madras, the Revenue Member of the Viceroy's Council, the Members of the Industrial Commission and the Agricultural Adviser to the Government of India were the distinguished visitors to the Laboratory during the year.

AGRICULTURAL COLLEGE,
26th April 1917.

T. V. RAMAKRISHNA AYYAR,
Acting Government Entomologist.

APPENDIX VIII.

ADMINISTRATION REPORT OF THE GOVERNMENT MYCOLOGIST FOR THE YEAR 1916-17.

I have the honour to submit my annual administration report for the year ending 31st March 1917.

2. I was in charge throughout the year except for three weeks from 26th April to 17th May 1916 when the Government Agricultural Chemist was in charge. There was no change in the laboratory staff. The permanent head clerk joined duty in the office on the 1st of June and was promoted to library clerk on the 17th of November, his place being taken by the second clerk to the Deputy Director of Agriculture, I to III Circles, Bellary. K. Sakkaram Rao was confirmed as second clerk, and K. R. Ramamurti as second artist.

3. I had privilege leave for three weeks, my First Assistant for one month and six days, Second Assistant for one month and fifteen days, Third Assistant for one month, one sub-assistant for one month and two days, another for one month and twenty-seven days, the second artist and the plant collector for one month each, and the second clerk for one month and twenty-seven days. The Second Assistant was granted leave on medical certificate for six months from 4th December 1916.

4. I was on tour for 99 days, the First, Second and Third Assistants for 67, 19 and 44 days respectively, the three sub-assistants for 65, 67 and 63 days respectively, and the plant collector for 42 days. We toured in the districts of Gōdāvari, Kistna, Salem, Trichinopoly, Coimbatore, Nilgiris, Malabar and South Kanara and in connection with diseases of *Hevea brasiliensis* in the States of Cochin and Travancore. I attended the annual meeting of the United Planters' Association of Southern India and gave an address on abnormal leaf-fall on

Hevea and the symptoms of disease caused by the *Phytophthora* on *Hevea* and with my First Assistant attended a Mycological Conference at Pusa.

5. The spraying of arecanuts with Bordeaux mixture against Mahali disease caused by *Phytophthora arecae* (Col.) Peth in Malabar was undertaken by the Deputy Director of Agriculture, V and VII Circles, and two of my Assistants took the apparatus and chemicals to the infected area and helped at the beginning of operations. In spite of the present adverse circumstances the work was greater than in the previous year.

6. The bad-rot of palmyras in the Gōdāvari and Kistna districts was kept under observation. The general examination consisting of removing about 18 leaf-bases from each tree within about 50 yards of every diseased tree and examining its soft basal sheaths for the characteristic disease spots was finished over the whole infected area and in a few places was done a second time. The trees were recorded in three classes: inwardly infected trees are those that at the time of examination show no outward symptoms of disease but are discovered to be infected during the examination. Outwardly infected trees are those that have rows of spots on their green expanded leaf-blades, while dead trees are those whose central shoot is dead. The numbers of infected trees for the whole area are—

	Inwardly infected palms.	Outwardly infected palms.	Dead palms.	Total.
1914-15	9,721	35,293	32,002	77,016
1915-16	32,458	17,412	37,572	77,442
1916-17	25,269	10,498	20,897	56,164

During this year the total number of infected trees is considerably smaller than last year and the percentage of recovery of the inwardly and outwardly infected trees operated on remains high. It is just over 95 per cent. The people are accordingly still voluntarily bearing the cost of the operations exclusive of the pay of the special staff, but if only they would assume the responsibility of dealing with diseased trees themselves, greater progress in reducing the disease will be made. They are still too inclined to wait for the periodic visit of the special officer instead of dealing with a diseased tree whenever it shows the first symptoms of disease.

This disease among coconut palms on the West Coast is still present, but does not seem to be increasing to an appreciable extent.

7. A scheme for dealing with the leaf-disease of coconuts in Cochin State was drawn up for the Diwan. It consisted in spraying the young leaves in the monsoon with Bordeaux Mixture and in manuring to strengthen affected trees that had become starved owing to the large reduction of the green leaf surface.

8. A considerable amount of cultural work has been done with the *Phytophthora* on *Hevea brasiliensis* and a comparative study of it with *Phytophthora Faberi* on cocoa pods received from Mr. Petch, the Mycologist of Ceylon, has been made. Cross inoculations are being made with these two fungi on *Theobroma Cacao* (cocoa) and *Hevea brasiliensis*, but the results are not yet complete. Field work with the *Phytophthora* on *Hevea* was impossible in the dry weather, as the fungus will not develop except in moist conditions. It has been successfully inoculated into *Manihot Glaziovii* (cassia). Oogonia have been found in nature on the fruits, but their germination has not been observed. Four blocks of 100 acres each in widely separated parts of the rubber growing area have been set apart for experiment with regard to the reducing the disease. Dead branches and fruits are being removed as efficiently as possible and this will be finished before the break of the monsoon.

9. A root-disease of coffee in the Nilgiris is being investigated. *Fomes australis* has been found near the base of the stem of the dying and dead coffee bushes and in the same estates on dying and dead *Grevillea robusta* (silver oak) and on dead *Citrus Aurantium* (orange). The fungus has been brought into culture from coffee and is developing fruits. Inoculations made on the upper part of the roots of coffee, *Acacia decurrens* and *Grevillea robusta* in the cold weather have not as yet affected the plants, though in some cases examined the fungus has penetrated the roots to a small extent. The preventive measures taken against the disease on the estates have checked its spread.

10. The measures taken against the outbreak of *Colletotrichum Camelliae* Mass. (brown-blight) on tea were very successful. The infected fields were lined and forked: the infected leaves were picked off and destroyed and the bushes were sprayed with Bordeaux Mixture three times. In the succeeding season there was a marked improvement in the character of the wood and in the amount of leaves carried by the plants. The disease was not entirely absent, but there was no more than in fields on the rest of the estate. A nursery that had been so severely attacked by this fungus, that the Visiting Agent and the Manager had decided to destroy it and start afresh, was sprayed with Bordeaux Mixture and recovered so well that 77,000 seedlings became available for planting out.

11. The leaves and young shoots of a belt of Eucalyptus Globulus in the juvenile stage on the Nilgiris were turning brown and dying and some of the plants had died back completely. On the brown spots both Cercospora eucalypti Oke. and Mass. and Pestalozzia funerea, Desm. were found. The dead and the badly attacked plants were removed, the brown leaves were picked off and destroyed and the plants were sprayed twice, some with Bordeaux Mixture and some with Burgundy Mixture. The disease was checked in both cases and the plants recovered.

12. Grape vines in Krishnagiri are attacked by Gloeosporium ampelophagum Sacc., Oidium Tuckeri, Berk. oidial stage only, and Plasmopara viticola (Berk.). Four vineyards of about 20 vines each have been taken over for spraying experiments which are still in progress.

13. Twenty-five calls were made for advice with regard to diseases on crops and forty-two specimens of diseased plants were sent for investigation.

14. The usual courses of lectures were given to the first, second and third year students. An exhibit of Blister blight on Tea was prepared and sent to the Deputy Director of Agriculture, Planting Districts, to be circulated to Planters' Associations to enable tea planters to recognise the disease at once should it ever come to South India. Exhibits were sent to the Tiruppur Cattle Show and to the Lalgudi Exhibition in each case accompanied by an assistant to demonstrate, and a lantern lecture on Plant Diseases was given at college by my First Assistant.

COIMBATORE,
24th May 1917.

WILLIAM McRAE,
Government Mycologist.

APPENDIX IX.

ADMINISTRATION REPORT OF THE GOVERNMENT SUGARCANE EXPERT FOR 1916-17.

I have the honour to forward the following report of the work done in the Cane Breeding Station during its fourth year, April 1916—March 1917.

2. The following were the movements and changes of the staff during this period. The scientific staff remained unchanged with the exception of a sub-assistant E. S. Pasupati Ayyar having been transferred to the Entomology department, his place being taken by Rangaswami Pillai. The Assistant Farm Manager T. S. Venkatarama Ayyar was transferred to Koilpatti and his place was first taken by V. S. Ramaswami Ayyar and later on by D. Panakala Rao. Privilege leave was enjoyed by the Farm Manager, the Chief Botanical Assistant, the Chemical Assistant and Assistant Farm Manager, V. S. Ramaswami Ayyar, for periods varying from a fortnight to three months. The periods of leave were subordinated to the exigencies of work and a Farm Manager being indispensable, C. V. Sesha Acharya acted during Mr. Mangesha Rao's absence.

The Government Sugarcane Expert transferred his office during the year to the hills for two periods of one month each. He visited Assam in September to inspect the crops growing at Kamrup Farm and to collect seed of wild Saccharums growing there. A longer tour to Burma occupied January and February, the object being to determine the probable suitability of that province for sugarcane growing. The crops on the Assam ground proved to be excellent and in Burma there are very large areas capable of growing sugarcane of good thick varieties.

Messrs. T. S. Venkataraman and K. Krishnamurti Rao attended the Science Congress at Bangalore and read papers there. Two plant collectors were sent to North India and various parts of the Madras Presidency to make detailed measurements of different varieties of canes. A temporary clerk was sanctioned for six months for collating and averaging these figures and other work of a similar nature in the office.

3. The main work on the Farm, that of raising cane seedlings, has been markedly successful during the past year.

(a) The arrowing of cane varieties was less free than last year, presumably for climatic reasons, but, all the same, the number of varieties flowering has considerably increased. This can be seen from the table of cane varieties, thick and thin, flowering during the past four years.

	Thick varieties.	Thin varieties.
1913-14	0	0
1914-15	5	4
1915-16	35	86
1916-17	62	34

The steps taken in 1915 to induce the canes to arrow have thus apparently been highly successful and during the past year we have, for the first time, found it unnecessary to obtain arrows outside the precincts of the farm.

(b) The number of arrows covered by bags was 400 as against 300 last year. Crosses attempted were 210 as compared with 100; probable crosses obtained 4,000 instead of under 300. Pans sown were 900 for 800 and total seedlings raised 99,000 in place of 30,000, the previous record. Although much is still left to be done in obtaining crosses between desirable parents, the results are better each year and this difficult problem appears to be approaching a favourable solution, as will be seen in the next section.

(c) With the increasing number of seedlings obtained which are worthy of further trial, it has been found necessary to place a limit to the number grown each year. This number is at present fixed at 400. These are grown in short rows side by side and it is proposed each year to reject the poorest to make room for the additional ones selected. Trials on a field scale are out of the question, but it is worth considering whether a few acres of good sugarcane land should not be acquired in the neighbourhood, where twenty or thirty larger plots may be grown each year.

A considerable improvement has been made in the class of seedlings obtained. Hitherto we have had to be content to select whatever seedling showed high sucrose content from whatever parents it was derived, and whether it was considered useful for North India or not. Owing to the larger number of probable crosses obtained during the past arrowing season, we shall be able to concentrate our attention more upon canes suited to North Indian conditions. This will be seen from the following table of selections each year.

	suitable for growth in Madras Presidency	for North India
1911-13	0	5
1912-14	28	10
1913-15	156	11
1914-16	96	97

In 1916-17 it will probably be possible to select all our seedlings for North India, if necessary, in that we have succeeded in raising 4,000 probable crosses between thick and thin canes in place of something under 300, the previous record. In this work we have been greatly assisted by chance seedlings which we have designated "rogues". These are very occasionally present and, while of thick cane parentage, present many of the characters of thin canes, but with greatly increased vigour. Their sucrose content is, it is true, almost universally poor, but they flower approximately with the thick canes and it is as male parents that they are chiefly used.

(d) The increasing number of seedlings to be dealt with has rendered it necessary to economise space in planting them out, and this has been rendered possible with the gradual improvement of the land. In the first year, on the Botanical garden, pits 3' cubed were dug and filled with earth and manure so as to ensure the lives of the few seedlings obtained. In succeeding years these pits were reduced first to 2' and then to 1½' cubed. An experiment of planting some seedlings in trenches next caused us to substitute this method for pits, as the preparation work was much simpler. This year the trenches will be closer together and the treatment will further approximate to that of ordinary cane cuttings. This change, of itself, speaks for the great improvement which is taking place in the saline land on the farm. The following are the numbers of seedlings grown for testing chemically in successive years:—48, 2,067, 2,400, 3,400, 4,100, and it is proposed to put down 5,000 this year.

(e) The efforts at bringing the seedlings rapidly into line with the normal planting and reaping seasons have been successful. The selected seedlings are now planted at the proper time,—February, for thick seedlings and March, for thin ones. The result of this is felt, not only in greater ease in comparing the seedlings with growing varieties, but also in an actual rise in the sucrose they contain at crop time.

In view of the increasing number of selected seedlings and the near approach of the time when it will be possible to distribute some of them for further trial to various provincial farms, a register has been opened in which are collected all details of the history of these seedlings from the start. A further register has been opened with all the information we can gather as to the parents of the seedlings, and the general character of seedlings which we may expect to obtain from them. This latter register is intended to act as a guide as to which parents are selected for the work of each year.

4. During the past year a Memoir (referred to as completed in last year's report), dealing with the characters of seedling canes and the work of the farm since its commencement, has been issued from the press. With the rapid accumulation of observations, several new lines of work are opening up, all of which it is hoped will in time be dealt with as Memoirs of the Agricultural Department.

(a) Casual observations as to characters of two closely allied indigenous cane varieties of South India, Nānal and Chent, reveal the fact that these two canes are advanced representatives of two great classes of canes scattered all over the provinces of India, differing among themselves in size to such an extent that their relationship has not been noted before. Thirty-three of these varieties growing on the farm have been brought together and somewhat

exhaustively studied. As stated in a preliminary note, published in the Agricultural Journal of India, they are called the Sunnabale and Sarotha classes and, with their accurate description, a large part of the less obvious classification of Indian canes has been rendered clear. The study of the general characters of these two classes has been completed and it is intended to summarise these in a Memoir which is nearing completion.

(b) This work has entailed numerous measurements of the lengths of successive organs of the cane plant, and it has transpired that these measurements may be plotted out in curves which have very definite characters for the different organs, for the different varieties and groups and even for the localities in which they are grown. The results are so instructive as to the growth of different varieties in different places, that it is proposed to collect and compare them and attempt to trace through them the effect of different conditions upon the growth of the cane plant. A very large number of measurements have now been made in various parts of India, and it is proposed to present the results of this study in another Memoir.

(c) A casual dissection of the underground parts of a few cane clumps has resulted in the discovery that the different classes of canes, from the wild *Saccharum spontaneum* to the thick tropical canes, show a series of distinct stages between these two extremes. The stools of about 20 varieties have been dissected and these suggest that a definite formula can be evolved for each class of canes, which will throw light on its relative stage of development from the wild *Saccharum*. A further corroborative series of dissections is included in the year's work, which will complete the series. It is proposed to present this study also in Memoir form.

(d) Continuous observations have been made from the start on the wild *Saccharum*, especially *Saccharum spontaneum*, which is generally regarded as the form from which cultivated sugarcane has been derived. It has been demonstrated that at least three varieties of this species occur, some of them much thicker than the common *kani* grass, and that they correspond to well-defined geographical regions. Seedlings have been raised from these three varieties and they have been freely used in crossing with various thick and thin canes. If time permit, it is intended to collect the observations and dissections made of these and other wild species of *Saccharum* and publish them.

(e) Two papers were read at the recent Indian Science Congress at Bangalore: (1) A study of the sucrose variations in successive cane joints, by Messrs. T. S. Venkataraman and K. Krishnamurti Rao, and (2) Arrowing in the sugarcane, with special regard to selfing and crossing varieties, by the former. These two papers have been passed for publication in the special Congress number of the Agricultural Journal. A paper has been compiled by Mr. K. Krishnamurti Rao on "The effect of salinity on cane juice" and this contains a resume of all the observations made at the Cane Breeding Station on this point. The Government Sugarcane Expert prepared a paper on "India as a sugar producing country" for the Industries Commission, and he also wrote the chapter on Agricultural Botany for the Board of Scientific Advice.

5. As a result of organization, the Chemical section continues each year to deal with a larger number of analyses. This year there were 5,847 as against 4,530 last year. Dr. Harrison again lent the services of his assistants during the busiest period but, by a modification in the work, these were only needed for four months against six months last year. The first analysis of the juice of the seedlings now deals only with Brix and sucrose determinations. Then follow a series of potty analyses, and the final, full bulk analysis is made of only those seedlings which possess a certain richness in sucrose. This figure varies a good deal from year to year, presumably because of climatic differences and the nature of the soil in the plot but, generally speaking, for thick canes 17 per cent of sucrose is required and 14 per cent for thin canes. Those seedlings with less than this quantity of sucrose in the juice are not proceeded with further.

The number of varieties to be analysed continues to increase. A careful study has been made of the local ripening time, and this appears to be March—April. Arrangements have accordingly been made to plant the thick and thin varieties of canes in February and March respectively, so that they may have time fully to mature, and, as a result of this, the analyses of the North Indian varieties have shown distinctly higher sucrose contents than in any previous year.

6. A great improvement has been noticeable during the year in the general growth and colour of the cane plots, whether seedling or varietal. This may fairly be traced to the improved condition of the land, although more seasonable weather and well distributed rainfall have probably had a good deal to do with it. The main line of work in this direction has been the continued digging in of green crops of daincha (*Sesbania aculeata*) and field bean (*Dolichos lablab*), the addition of silt and the contents of weed pits to the soil, and the keeping open of surface drains at short intervals. But a useful innovation has been introduced and is now stereotyped, in the growth of daincha with the cane crop. It is sown immediately the cane shoots appear above the ground, cut twice when it overtakes the cane shoots and over-shadows them, and finally dug out and placed in the trench between the rows, when the cane leaves cover the ground. One of the chief objects is to prevent evaporation from the surface

of the soil during the hot weather, as this has been found to bring up the salts from the sub-soil. The new method of growing daincha effects this, but cane trash is also placed on the surface if necessary, or a constant mulch of soil is kept by intercultivation. Immediately a cane crop is harvested and the stools dug out, the land is ploughed and daincha or lablab is sown according to season, the lablab in the dry season and daincha if there are rains.

A large series of weed pits have been opened for the reception of cane refuse, the remains of such crops as cotton and cholam and weeds of all kinds. We have by this means been able to add 40 to 50 cart-loads of the contents of weed pits per acre before a cane crop. An experiment was made of placing cane and cholam stubbles at the bottom of the trenches in which the canes were planted. This, as was expected, attracted great numbers of white ants, but these were kept in check by irrigating with crude oil emulsion and the germination has been, on the whole, extremely good. Rats have always been a serious trouble in the plots and the services of a local caste have been used to smoke them out at intervals. By the use of the "White ant exterminator," lent by the Entomology section, whereby fumes of sulphur and arsenic are blown in instead of smoke, a great improvement has been effected, and the pest has been of little importance during the past year. Jackals, which caused much damage at first, are being effectively dealt with by wire netting and the careful closing of all doors towards dusk. They appear now to be completely under control. A severe attack of mealy bug on the thin canes last year was dealt with by trashing and rubbing with fish oil emulsion and it is trusted that there will be less danger from this troublesome pest in the improved growth of cane. It is always worst on ill-grown and struggling canes, in the dry weather.

The digging of weed pits was made the occasion for a careful study of the sub-soil in different parts of the farm. This brought to light the presence of a thick, hard, dark layer impregnated with various harmful salts, at a depth of one to two feet, which is undoubtedly responsible for the saltiness of the land, and emphasises the need for checking surface evaporation as much as possible. Below it, there is a free soil with good drainage, but it is too thick to be pierced economically. The number of plots, often consisting of a single row of plants, continues to increase rapidly, the numbers for the past four years being 169, 229, 700, 1400. The latter figure is not likely to be exceeded, and it has needed some thought to divide up the available land into three sections, one of which is to be under sugarcane each year. The need is felt now for larger plots of the best selected seedlings, and varieties for which there is a large demand, and the question of adding five acres of good sugarcane land to the farm is being examined.

An attack of plague in the villages adjoining culminated in September in a succession of positive rat-falls on the farm necessitating the evacuation of all the buildings, and the staff were accommodated in sheds in the fields. This greatly hampered the work in various directions, but the measures taken were effective and no casualties occurred on the Estate.

7. During the year the farm and office have been visited a great many times and several inspections of special importance have taken place. Among the more distinguished visitors may be mentioned His Excellency the Governor, the Hon'ble Sir Claude Hill of the Viceroy's Council, the Agricultural Adviser to the Government of India, the Members of the Industries Commission, the Hon'ble Mr. Buckley, the Commissioner for Land Records and Agriculture, and Mr. Couchman, the Director of Industries. Besides these practically all the senior officers of the local Agricultural Department and many other gentlemen. The work of the staff has, on the whole, been very satisfactory and this has been the case under very trying circumstances, because of the outbreak of plague.

AGRICULTURAL COLLEGE,
27th April 1917.

C. A. BARBER,
Government Sugarcane Expert.

APPENDIX X.

ADMINISTRATION REPORT OF THE GOVERNMENT AGRICULTURAL ENGINEER FOR THE YEAR 1916-17.

THE PUMPING AND BORING SECTION.

Till the 31st of July 1916, this was a branch of the Department of Industries. As per G.O. No. 523, Revenue, dated 7th March 1916, the control of this department was transferred to the Department of Agriculture.

I joined the department on the 1st of August 1916 and immediately took charge of the Pumping and Boring Department (including minor industrial plants) and the following staff was placed under my control:—

Executive Staff.

- 10 Supervisors (from Public Works Department Cadre).
- 22 Mechanics.
- 40 Boring Maistries.
- 2 Surveyors.

Clerical Staff.

Central office establishment—
 1 Head Draftsman.
 1 Assistant Draftsman.
 1 Tracer.
 2 Clerks.
 District office establishment—
 3 Clerks.
 Menial establishment—
 13 Peons.

My staff has since been further strengthened by the appointment of M.R.By. V. Rangachar Avargal (one of the supervisors) as my Assistant Agricultural Engineer, one foreman for the workshop, one accountant, two clerks, one typist, one store-keeper, one stock keeper and three peons.
 For executive purposes, the staff is distributed as shown in Table I.

TABLE I.
 Distribution of the Staff.

Section.	Headquarters.	Supervisors.	Mechanics.	Maistrics.	Total.
Visagapatam	Visagapatam	1	1	5	7
Bezwada	Bezwada	1	3	7	11
Gooty	Gooty	1	1	2	4
North Arcot	Vellore	1	1	2	4
Chingleput	Madras	1	1	2	4
South Arcot	Cuddalore	1	4	3	8
Tanjore	Tanjore	1	2	2	5
Trichinopoly	Trichinopoly	1	4	7	12
Tinnevely	Tinnevely	1	2	2	5
Coimbatore	Coimbatore	1	1	6	8
	Total	9	22	40	71

Besides these, one supervisor is in charge of the Power Drills and one in charge of Sugarcane Experiments. Two mechanics have also been appointed for Sugarcane Experiments.

Receipts and Expenditure.

Items of receipts.	1915-16.	1916-17.	Items of expenditure.	1915-16.	1916-17.
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Inspection fees	1,345 0 0	1,040 0 0	Salaries	...	4,550 0 0
Compounding fees	8,528 12 0	3,050 0 0	Establishment.		
Boring fees	20,145 6 9	21,273 6 1	Permanent	22,514 10 1	13,857 14 8
Testing fees	3,355 6 0	5,208 5 0	Temporary	22,171 0 3	20,681 1 3
Erection fees	5,001 10 0	4,228 12 0	Travelling allowance	14,118 12 1	16,119 1 7
Miscellaneous fees and from workshop.	7,055 4 8	2,826 13 1	Supplies and services.		
Experiments.			Works	31,433 9 4	31,078 10 3
Singanallur sugarcane crushing.	3,065 7 5	1,915 0 0	Tools and plants	23,703 11 5	4,098 6 2
Chittavadiagai sugarcane crushing.	1,469 2 1	485 9 7	Refunds	3,969 2 0	3,303 9 6
			Contingencies.		2,577 5 6
			Sugarcane experiments at Singanallur.	6,903 2 10	1,418 8 2
			Sugarcane experiments at Chittavadiagai.	5,073 5 1	1,612 6 3
			Motor tractor	1,875 5 9	1,289 10 1
Total	44,904 0 11	40,032 13 9	Total	1,81,802 10 10	1,00,536 9 4

2. The above is a statement of receipts and expenditure of the Pumping and Boring Department for the year 1916-17. The corresponding figures for 1915-16 are also given for comparison.

It will be observed from the foregoing statement that during the year under report, the receipts on account of the hire of pumping engines have increased, those on account of boring charges remain about the same and for other items there is a reduction. On the sum total, a decrease of 11 per cent is shown compared with the previous official year. The decrease in the inspection and compounding fees is only apparent, as fees for work done in 1916-17 were collected in advance at the end of the previous official year. The great reduction in the receipts from the workshops is due to the fact that experiments in the Industrial Department for which the necessary articles were usually prepared in the Departmental Workshops were not so extensive this year and the Industrial Department were probably getting their work done elsewhere. The receipts shown for the year under report from Sugarcane Experiments is the net amount, while for the previous year, the receipts included the cost of working the factory, the actual figures as shown in the Administration Report for the year 1915-16 being Rs. 8,065-7-5 as gross receipt, Rs. 1,831 as expenditure, and Rs. 1,234-7-5 as net receipt. The reduction in revenue from Chittavadiagai factory is due to the damage done to the building by the cyclone and as the repairs could not be completed in time, work in the factory commenced late in the season. The amount of Rs. 4,223, collected and shown under receipts, as erection charges, gives a fair estimate of the work done for the ryots in that direction. These charges, being calculated at a general rate of 2½ per cent on the cost of the machinery installed, denote that plants to the value of Rs. 1,70,000 have been erected for the ryots.

Regarding expenditure, there is a general reduction. The decrease is due to a part of the establishment having been retained in the Department of Industries, a reduction in the purchase of tools and plants and in the capital expenditure on the Sugarcane Factories at Pallapalayam and Chittavadiagai, these works having already been completed during 1916.

Pumping.

3. On the 31st of March 1916, there were 12 pumping plants and 12 industrial plants in course of erection and of these, 13 were completed before the 31st of March 1917. During the year, 7 pumping stations and 18 industrial plants were taken up for erection and 13 of these were completed before the 31st of March 1917.

4. Out of the 25 installations taken up for erection by the department, only seven were new plants and of these three were for irrigation purposes, three for rice hulling and one for hulling and ginning. The development of lift irrigation and industrial enterprise is on the wane as the number of plants installed this year to replace cattle and manual labour, are fewer than in previous years. The reason is obvious. It was reported last year that the marked decline of the industrial enterprise and of the advancement of lift irrigation, was attributable to the stringency in the money market and the shortage of machinery, most of the manufacturing firms in England having been taken over by the Government for munition purposes. The small capitalists to whom the hire-purchase system was a boon could no longer look forward to that system, as the firms in India were able to dispose of the limited stock of machinery they had, for cash payment. These conditions still prevail and if they were "bad" during the last official year, they were "worse" during the year under report. We have now in addition to contend with the high price of fuel and the difficulties of shipment and railway transport and these have been contributory to reducing the number of new installations which might have been installed. Three years ago, the price of liquid fuel was As. 2-7½ per gallon. Since then it has been gradually rising and the ryot has now to pay as much as As. 6 per gallon. Consequently ryots prefer to wait until the conditions are more normal again so that there is little hope for much expansion in the development of power plants just now.

5. A noticeable feature in the erection of installations undertaken this year, is that most of them are second-hand plants, re-erected by the department in compliance with the special request of the owners, as they were originally erected by private erectors in a very slipshod manner. These private erectors are not employees of any engineering firm but are men who have been in most cases thrown out of employment and have set up on their own account as erectors. I have specially undertaken to do this re-erection work on behalf of the ryot, to impress upon him the necessity of obtaining the advice and assistance of the department and to prove to him the disadvantages consequent on employing incompetent workmen to erect machinery. The ryot is beginning to realise this and is taking advantage of the help offered him. This is a satisfactory feature of the development of the work of this Department and an indication of the extent of its educative effect on the ryots.

It would be a great desideratum for this department to be in the position to send properly certified drivers to take charge of ryot's installations. The ryot now pays anything from Rs. 8 to Rs. 40 per month for his driver. The driver is incompetent and takes no interest in his work and the ryot has to do as the driver wants, whether it is wrong or right, in fact the driver is the master; the department has no hold on this class of drivers. Arrangements are being made to open out a register of drivers holding Government certificates of competency so that any ryot who values his plant can apply to this office and have a suitable man sent to him. A note on the advisability of having competent drivers has been written and will be freely circulated.

6. With reference to the installations erected by the department this year, I have to say that there was nothing done in the Vizagapatam and Bezvada districts and only one was erected in South Arcot and Coimbatore districts. There were possibilities of development of Lift Irrigation in the Kistna district but some half a dozen applications were rejected, by the Department of Public Works, for utilizing the waste water from the drainage canals for irrigating an aggregate area of three to four thousand acres, by engines and pumps. In Coimbatore, enquiries were not wanting and a few of them applied for State loans under the new rules. A few were ineligible for the loan and others declined to take the loans as the conditions of the repayment within five years, were considered too hard. It is their opinion that the term of repayment should be extended to twelve years.

7. The number of applications for investigations and advice was 125 for the year under report (vide Tables II and III) while the corresponding number for the previous year was 136 and as stated above, the number of installations actually erected was considerably less than those erected during the previous years. This remark applies alike to pumping and industrial installations. Fifty-eight of these enquiries were for pumping, 20 for boring and 87 for industrial plants. Of these, only 25 matured and in some cases, the requisite plants were erected and in others, orders were placed for the machinery.

TABLE II.

Statement of applications for investigation and advice, 1916-17.

Year.	Number.
1902-03	1
1903-04	10
1904-05	24
1905-06	21
1906-07	40
1907-08	51
1908-09	33
1909-10	41
1910-11	64
1911-12	111
1912-13	134
1913-14	152
1914-15	136
1915-16	125
1916-17	943

TABLE III.

List of applications for investigation and advice, 1916-17.

Number.	Sections.	Pumping.	Boring.	Industrial.	Total.
1	Vizagapatam	1	3	1	5
2	Kistna	5	1	3	9
3	Gooty	7	2	6	15
4	North Arcot	9	8	2	19
5	Chingleput	8	4	2	14
6	South Arcot	5	...	3	8
7	Tanjore	2	2	4	8
8	Trichinopoly	5	1	6	12
9	Tinnevely	6	6	7	19
10	Coimbatore	10	3	3	16
	Grand Total	58	30	37	125

8. During the year under review, only four loans were sanctioned, representing a sum of Rs. 13,100. Three of these were granted by the Revenue authorities under the Agricultural

Land Improvements Act, and one of Rs. 4,300 was granted by the Director of Agriculture under the special rules framed on this subject. This does not appear to be very encouraging, but the fact is, as stated in a preceding paragraph, the return of the loans within five years is considered quite impracticable, as the increased profits due to pump irrigation cannot, within five years, be expected to cover the cost of the whole machinery plus other expenses.

9. Table IV is a statement of compounding fee payers. The number of owners, who availed themselves of the compounding fee system in 1916-17, is almost the same as during 1915-16, i.e., 234 as against 236 and being almost equally divided between pumping and industrial plants, 111 of the former and 123 of the latter. Many of the installation owners have had a poor season on account of the difficulties of transport and shipment and the high price of fuel and other stores which have to a great extent paralysed the industry and trade, so that a decrease in the number of compounding fee payers should have been expected; but in spite of these circumstances, there is practically no fall in the number and this is to be regarded with some amount of satisfaction and it is proof of the appreciation of the services rendered by this department. During the latter half of the year, a great many of the owners of installations have had the benefit of my personal inspection of their plants. I have thoroughly examined upwards of 200 installations, having, since the 7th of September 1916, spent 126 days in touring, covering some 7,800 miles by rail and 1,100 miles by road. I have, in several cases, induced the owners of installations to use suitable lubricants and to discontinue the use of such oils as groundnut, castor, coconut, etc., especially for engine cylinders. I have also to say the inspections of the supervisors and mechanics are now more efficient as they have all had opportunities of being with me during my examinations and inspections and they are endeavouring to follow my methods.

TABLE IV.

Statement showing the number of compounding fee payers since the introduction of this system.

Section.	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17.
Vizagapatam	...	4	1	7	1	4	5	Pumping plants ... 1 } 2 Industrial ... 1 }
Kistna	...	...	...	4	6	7	30	Pumping plants ... 8 } 37 Industrial ... 29 }
Gooty	1	...	...	1	2	10	14	Pumping plants ... 7 } 16 Industrial ... 9 }
North Arcot	3	10	8	11	8	16	19	Pumping plants ... 15 } 17 Industrial ... 2 }
Chingleput	7	8	9	11	7	7	17	Pumping plants ... 14 } 22 Industrial ... 8 }
South Arcot	8	7	6	6	18	18	21	Pumping plants ... 15 } 23 Industrial ... 8 }
Tanjore	1	1	2	19	31	58	64	Pumping plants ... 8 } 46 Industrial ... 38 }
Trichinopoly	3	2	2	9	12	20	22	Pumping plants ... 13 } 27 Industrial ... 14 }
Tinnevely	2	1	2	10	16	21	21	Pumping plants ... 12 } 20 Industrial ... 8 }
Coimbatore	2	3	5	13	16	35	23	Pumping plants ... 18 } 24 Industrial ... 6 }
Total	27	36	35	91	117	196	236	Pumping plants ... 111 } 234 Industrial ... 123 }

Boring.

10. During the year under report, thirty-two hand drills, two power drills and three torpedoing sets were employed. The total depth of the boreholes was 22,323 feet and the number of boreholes 379, as against 24,750 feet and 495, respectively, for the previous year. Of the 379 boreholes, 248 were successful and probably in some cases, if the boreholes abandoned had been sunk deeper, water would have been struck. Some had to be abandoned on account of striking salt water, others on account of meeting very hard rock, as the hand drills are not suitable for boring in hard rock, at any rate to any great depth; but as power drills become available, these boreholes will be deepened.

11. Since the commencement of boring operations (1907) 427 boreholes were provided with permanent lining pipes. Out of the 248 successful borings for the year under report, 80 were provided with permanent lining pipes making a total of 4,248 feet of piping used, almost the whole of it being supplied by the department. During the previous official year, only 39 boreholes were supplied with lining pipes and the total length used was 3,124 feet. The percentage of successful boreholes lined with permanent pipes during the year under report is a record being 21 per cent of the total number of such boreholes—vide table V.

TABLE V.

Statement showing details of borings made in the different divisions from the beginning of operations.

Divisions.	Borings in fresh wells.			Borings in existing wells.			Total number of borings.	Number of boreholes provided with lining pipes.	Length of supply pipes.	Total feet bored through.
	Success-ful.	Failure.	Total.	Success-ful.	Failure.	Total.				
Vizagapatam.										
From the beginning to 31st March 1916.	79	62	141	18	19	37	178	28	...	15,963
From April 1916 to 31st March 1917 ...	29	11	40	...	4	4	44	12	...	2,646
Total ...	108	73	181	18	23	41	222	45	804	18,609
Kistna.										
From the beginning to 31st March 1916.	299	62	361	140	77	217	578	47	...	24,892
From April 1916 to 31st March 1917 ...	61	25	86	18	8	26	112	21	1,012	7,356
Total ...	360	87	447	158	85	243	690	68	1,012	32,248
North Arcot.										
From the beginning to 31st March 1916.	21	22	43	18	76	94	137	6	...	2,955
From April 1916 to 31st March 1917 ...	3	6	9	6	7	13	22	3	55	555
Total ...	24	28	52	24	83	107	159	9	55	3,510
Bellary.										
From the beginning to 31st March 1916.	11	4	15	1	6	7	22	...	...	668
From April 1916 to 31st March 1917 ...	...	...	...	...	...	...	...	...	...	...
Total ...	11	4	15	1	6	7	22	...	...	668
Coimbatore.										
From the beginning to 31st March 1916.	7	9	16	108	78	186	202	2	...	4,348
From April 1916 to 31st March 1917 ...	1	...	1	10	12	22	23	...	...	744
Total ...	8	9	17	118	90	208	225	2	...	5,092
South Arcot.										
From the beginning to 31st March 1916.	64	47	111	54	39	93	204	4	...	9,733
From April 1916 to 31st March 1917 ...	...	...	...	2	1	3	3	2	188	403
Total ...	64	47	111	56	40	96	207	6	188	10,136
Chingleput.										
From the beginning to 31st March 1916.	264	210	474	367	264	631	1,105	218	...	49,776
From April 1916 to 31st March 1917 ...	5	10	15	25	6	31	46	17	737	3,082
Total ...	269	220	489	392	270	662	1,151	235	737	52,858
Tinnevely.										
From the beginning to 31st March 1916.	114	25	139	390	64	454	593	8	...	17,747
From April 1916 to 31st March 1917 ...	15	2	17	48	16	59	76	7	212	2,391
Total ...	129	27	156	438	80	513	669	15	212	20,138
Trichinopoly.										
From the beginning to 31st March 1916.	65	9	74	68	77	145	219	5	...	5,727
From April 1916 to 31st March 1917 ...	2	2	4	5	12	17	21	1	84	754
Total ...	67	11	78	73	89	162	240	6	84	6,481
Tanjore.										
From the beginning to 31st March 1916.	48	15	63	29	8	37	95	29	...	8,052
From April 1916 to 31st March 1917 ...	12	6	18	11	3	14	32	17	1,156	3,489
Total ...	55	21	76	40	11	51	127	46	1,156	11,541
Abstract.										
Total borings from the beginning of operations to 31st March 1916.	867	465	1,332	1,193	708	1,901	3,333	347	...	1,39,875
Total borings from 1st April 1916 to 31st March 1917.	128	62	190	120	69	189	379	80	4,248	22,328
Total ...	1,095	527	1,622	1,313	777	2,090	3,712	427	4,248	162,198

12. Although the total depth bored during the year under report was less than that for the previous year, the average depth of the boreholes was greater. It will be seen from table VI that the average depths have been steadily increasing since the commencement (1907).

This accounts for the decrease in the total number of feet bored because the greater the depth of a boring, the slower the progress.

TABLE VI.

Comparative statement showing the depth of borings put down from the beginning of operations. (1907.)

Number.	Year.	Total depth bored through.	Number of borings put down.	Average depth per boring.	Borings.		Borings.		Borings.		Remarks.
					0' to 50' depth.	Per centage on total number of borings.	50' to 100' depth.	Per centage on total number of borings.	100' to 250' depth.	Per centage on total number of borings.	
1	1907-08	9,000	259	36' 0"	...	...	...	...	...	...	
2	1908-09	8,600	187	51' 0"	...	...	...	...	...	...	
3	1909-10	7,000	133	52' 6"	...	...	...	...	...	...	
4	1910-11	8,100	209	40' 0"	...	...	...	...	...	...	
5	1911-12	15,100	347	44' 0"	...	...	...	...	...	...	
6	1912-13	20,400	540	40' 0"	...	...	...	...	...	...	
7	1913-14	18,800	494	39' 0"	...	...	...	...	...	...	
8	1914-15	28,000	645	43' 0"	497	77	115	18	38	5	The greatest depth of boring was 183'.
9	1915-16	24,750	495	50' 0"	320	65	138	27	37	8	The greatest depth of boring was 182'.
10	1916-17	22,328	379	59' 0"	228	60	101	27	50*	13	* Of these 7 have been over 200', the greatest depth being 252' 6"

Looking again at table VI, it will be seen that the percentage of borings sunk below a depth of 100 feet has increased from 5 per cent in 1914-15 and 8 per cent in 1915-16 to 13 per cent during the year under report. The number of borings of over 100 feet depth is 33 and 37 in 1914-15 and 1915-16, respectively, but for this year 50 have reached a depth of over 100 feet, and of these, seven are over 200 feet, the deepest being 252' 6". During the previous years, the deepest was 183 feet.

13. The results of the boring department for the year under report are very satisfactory, in spite of the difficulty there has been in obtaining lining pipes and other materials for constructing boring tools, etc. The cyclone which visited parts of the Presidency and the abnormal rain over certain portions, also interfered with the progress of the works.

14. During the year, the boring sets were used mostly for ryots for improving the water-supply for agricultural purposes. Out of 379 borings, 327 were for the improvement of water-supply for irrigation, the others were for improving the quality or supply of water in wells for other purposes.

15. It will be noted in table V that the greatest progress was made in the Kistna district where 112 borings were undertaken making a total depth of 7,356 feet, Vizagapatam and Tanjore sections came next; the deepest borings were sunk in the Tanjore district, the greatest depth reached being 252' 6". Gooty section was conspicuous by total absence of any boring activity and is very backward in this respect. Only one application was received and that towards the end of the official year. The contemplated trial borings in Bantanahal recently inspected by me, will be used as a demonstration and the supervisor will be told to advise the people of the benefits of borings for water.

16. During the year, two power drills of the percussion type were at work but one of them had to be stopped as the engine proved to be of insufficient power for deep boring, but another power drill of the rotary type was completed and is now at work in the Hosur Remount Depot for increasing the supply of drinking water. The number of borings put down by the power drills was two in alluvial soils and two in rock. Out of these two were successful. The greatest depth reached was 332 feet.

17. The cost of borings with power drills in alluvial soils are given below:—

Boring up to	Rs.	A.	P.	per
100' depth	1	0	0	a foot.
Do. 100' to 150' depth	1	8	0	"
Do. 150' to 200' "	2	8	0	"
Do. 200' to 250' "	3	8	0	"
Do. 250' to 300' "	4	8	0	"

An extra charge of Rs. 50 is made to cover the cost of transporting the machine.

The cost of boring with hand drills are as follows:—

10' to 50' depth	...	...	...	...	1	4	0	a foot.
50' to 100'	...	...	...	...	2	0	0	"
100' to 150'	...	...	...	...	3	0	0	"
150' to 200'	...	...	...	...	4	8	0	"

It will be seen from these figures that there is a distinct advantage in favour of power drills for boring below 100 feet. I intend when it is convenient to do so to send one of these power drills to Tanjore district, where as mentioned in a previous paragraph, sub-artesian springs are found below a depth of 150 feet.

18. Statement VII gives the number of applications for boring during the year. Sixty-one applications were pending on 31st March 1916, 233 were received during the year and on 31st March 1917, 73 were awaiting disposal. The reason why so many could not be dealt with during the year was that though the number of applications received was increasing, the number of boring sets in use was practically the same as in the previous year. But during this year I hope to be able to have a few more hand boring sets available for work, so that I shall be able to keep better pace with the demand.

TABLE VII.

Statement of boring applications received during 1916-17.

Number.	Section.	Applications			
		Pending on 1st April 1916.	Received in 1916-17.	Disposed of in 1916-17.	Pending on 31 Mar. 1917.
1	Visagapatam	4	22	19	7
2	Kistna	12	49	47	14
3	Gooty	1	1	1	1
4	North Arcot	5	11	11	5
5	Chingleput	1	28	26	3
6	South Arcot	...	3	3	...
7	Tanjore	8	36	29	15
8	Trichinopoly	8	10	14	4
9	Tinnevely	11	44	45	10
10	Coimbatore	10	25	23	12
11	Applications for power drills	2	4	3	3
	Total	61	233	221	73
12	Applications for torpedoing operations	8	12	10	10

19. A few of the borings this year exhibited interesting results and it is worthwhile to refer to them briefly.

In Vizagapatam section, at Fakiruddinpalaiyam near Pithapuram, an underground supply was tapped at a depth of 125 feet and the water rose almost to the surface of the ground. The estimated supply was about 200 gallons an hour at a depth of four feet from ground-level.

In another case in Bezwada section, at Pedamaddali village in the Gudivada taluk, a remarkable result was obtained. While boring in a well 32 feet deep, ordinarily dry, in which only rain water collected, a very strong spring was tapped at 70 feet depth and the water shot up 5 feet above the top of the lining pipe and filled the well within a few minutes to a depth of 7½ feet from ground-level. The supply at the top of the lining pipe has been estimated at not less than 500 gallons per minute. This is phenomenal. The discharge is capable of supplying a 5-inch diameter centrifugal pump being sufficient to irrigate about 40 acres of wet cultivation.

Since the commencement of boring operations during the last ten years, there has not been a single instance of an artesian spring having been tapped except the boring at Nelpathur the year before last, where a strong spring was tapped; the water shot up 25 feet above ground level, but unfortunately, was extremely saltish. During the year under report, in Pattukkottai taluk of the Tanjore district, boring trials in the villages of Kurichi and Thambikota proved the existence of artesian springs. In three of these boreholes, artesian springs were tapped at 100 to 150 feet depth the water overflowing the pipe, the static levels of the water being from 10 to 32 feet above ground level and the discharge about 100 gallons per minute at a depth of 25 feet below ground level. At Ammapet, a village in the Papanasam taluk, a sub-artesian spring was tapped at a depth of 140 feet and the water rose to about 20 feet below ground level, yielding 120 gallons of water a minute. These results were instrumental in inducing a large number of applications in that district, so much so that eight boring sets have been engaged in this district against five during the previous year.

These springs were in alluvial tracts. The borings in other sections were almost all in rock and nothing of particular note is to be recorded.

Torpedoing.

20. Three torpedoing sets are in use in the department. Five cases were successful. For the small fee of Rs. 10 which a ryot has to pay, the results achieved are encouraging.

Pumping Sets.

21. The pumping sets of the department are of two kinds; one in which kerosine oil is used as the motive power and the other in which liquid fuel is used. The former are high speed engines and the pumps are directly coupled to the engine. These are used practically only for sinking or deepening wells and to ascertain the yield of a well when a ryot requires a power pump, so that he can have a suitable pump of his own installed. The latter are low speed engines, the pumps being driven by means of flexible belts. These are hired out for various periods to enable the ryot to irrigate his lands. Ryots have hired them in many cases for periods of six months at a time.

22. A statement of applications for testing and pumping engines and a comparison of the demands in this direction for the last four years are given in the Table VIII; it may be noted that the demand is steadily increasing. There are only 14 pumping sets in this department, of which two are required for motive power, one for the workshops and the other for the Leather Trades School. With the number available, 54 out of 57 applications have been disposed of during the year as against 31 out of 38 during the previous year. Consequently the revenue of the department has risen from Rs. 3,355 to Rs. 5,208, which represents the hire paid for these pumping engines. The growing demand for these pumping sets is a good sign of their popularity and with a view to meet as far as possible the numerous requisitions from the ryots, it is proposed to purchase during the current official year (1917-18) four more plants which have been sanctioned by the Government. These pumping engines are issued to ryots on a system of hire and they are generally appreciated by agriculturists, not only on account of the timely relief given to their crops when lifting has to be immediately resorted to while his other natural resources of irrigation fail, but also to arrive at a fair idea of the cost of irrigation by power pumps. To some, the employment of these engines has been a source of increased profit. I may quote instances of two ryots in Cuddapah district who availed themselves of the services of the pumping sets of this department, that were substantially benefited by them. One was able to obtain last year a profit of Rs. 1,000 by growing indigo over an area of 8 acres which he could not have realised with ordinary lifting appliances. Another was able to raise 14 acres of indigo resulting in a net profit of Rs. 2,000. These two ryots will install pumping plants of their own, when normal conditions are restored. The work of these pumps have as well a demonstrative value in establishing the economy in time, labour and the cost of lifting water with power pumps and the comparative advantages of engine power over manual or cattle power.

TABLE VIII.

Comparative Statement of Applications for testing and pumping engines during 1913-14, 1914-15, 1915-16 and 1916-17.

Number.	Purpose.	1913-14.			1914-15.			1915-16.			1916-17.		
		Number pending on 1st April 1913.	Number received in 1913-14.	Number disposed of in 1913-14.	Number pending on 1st April 1914.	Number received in 1914-15.	Number disposed of in 1914-15.	Number pending on 1st April 1915.	Number received in 1915-16.	Number disposed of in 1915-16.	Number pending on 1st April 1916.	Number received in 1916-17.	Number disposed of in 1916-17.
1	For irrigation purposes (Crude oil sets).	6	6	...	10	8	2	12	12	2	12	12	2
2	For construction of wells, etc., (After kerosine high speed engines).	28	28	...	20	18	2	22	19	5	38*	42	1
	Total	34	34	...	30	26	4	34	31	7	50	54	3

* Testing engine for—
 Cleaning existing wells ... 5
 Construction of new wells ... 19
 Mining purposes (mica) ... 2
 Testing the yield of wells for installing engines ... 9
 Testing the yield of borehole for sinking wells, etc. ... 38

Mapping of under-ground water supply.

23. Two Surveyors have been appointed for this work. Up to 31st of March 1917, 3,712 boreholes have been put down, of which levels of 1,220 have been connected with mean sea level. The work in the Chingleput and Tanjore districts has been completed and levelling work is in progress in South Arcot and Vizagapatam districts. The study of the boreholes so far sunk in the Chingleput district will be taken up in the course of this year. The borings in the Tanjore district are too few in number to draw any conclusive inference of the under-ground water supply.

Workshops.

24. The total number of works done during the year are 220, besides a number of small odd jobs and the value of the work done is tabulated below :—

	RS.	A.	P.
Pumping and boring works	11,300	1	1
Department of Industries	1,502	6	8
Miscellaneous works	730	11	0
Works done for private parties	132	15	9
Total	13,666	2	6

The total quantity of stores purchased during the year was Rs. 16,207-2-10 and the labour charges paid, Rs. 5,032-11-3.

25. In the year under review, four lathes and a drilling machine were lent to the Perambur Workshops; they were returned in November last. These have been subsequently lent to Public Works Department Workshop for war work and they have not been returned yet. During the year, the execution of some special works deserves mention: (1) The completion of a rotary power drill (the drill has now been sent to Hosur Remount Depot where it is working satisfactorily). (2) The construction of a hand pump for testing the supply from boreholes (all the boring sets will be provided with one such pump). (3) A device for measuring the discharges of pumps under various heads (every type and size of pump purchased through this department is tested for its capacity and efficiency, with this arrangement).

26. *General.*—The services of this department were not merely restricted to the ryots alone but were rendered to other Government departments in 27 cases. The total value of the help so rendered may be estimated at about Rs. 1,500.

Sugarcane Stations.

27. There are two power crushing mills belonging to the department, one has been working at Pallapalaiyam near Coimbatore and the other at Chittavadigai near Hospet.

Pallapalaiyam Factory.—The plant consists of a 12 B.H.P. oil-engine, a three roller mill with rollers 12 inches in diameter and 18 inches long, improved furnaces, an engine shed, a cane shed, a store shed, a jaggery shed, a boiling shed, a small office and Supervisor's quarters.

During the year under report, the factory was worked on contract system for a hire of Rs. 333 per mensem, all other charges to be met by the contractor. It was also arranged that the contractor should make all disbursements and sales with the knowledge of the departmental supervisors, so as to enable the latter to arrive at figures from which deductions could be drawn. The following data were therefore available; the work commenced on the 8th August and closed on the 21st January with a stoppage of 22 days in the month of September on account of the breakage of the top roller and shaft. The actual number of working days was 164 of 12 working hours a day and the total number of cart-loads crushed 3,106, the weight of each cart-load being estimated to be half a ton. The outturn of jaggery was 1,662 pothis of 250 lb. each giving an average of 10.13 pothis i.e., 2,584 lb. per day of 12 hours. The contractor's gross earnings for crushing charges amounted to Rs. 4,985-14-9, the cost of fuel and labour charges incurred by the contractor, Rs. 2,373-9-0 and the hire paid to the department, Rs. 1,665. There is therefore a net gain of Rs. 947-5-9 to the contractor or As. 10 per pothi of jaggery. According to these figures, a pothi of jaggery can be produced with a power plant for Rs. 2-6-0. I think this rate can be still further reduced.

The estimated value of the machinery is Rs. 10,500.

Interest at 4 per cent	Rs. 429
Depreciation during working period at one-twelfth of the value of the machinery per annum	365
Depreciation during non-working period at 2½ per cent per annum	155
Repairs	300
Total	1,240

There is, therefore, a net profit of Rs. 425 to the department on 1,662 pothis. A reduction of As. 4 therefore is possible so that a charge of Rs. 2-2-0 per pothi will just cover the expenses of maintenance by the department. If the factory could be worked for two seasons in the same year, further reduction would be possible.

I have not tabulated the scientific results of the work of this station, because the figures given by the supervisor are not accurate as there was no weighing machine available for weighing the cane and consequently the figures are mere estimates and would therefore be misleading.

28. However, it is satisfactory to note that, as a result of the demonstrative character of the work at Pallapalaiyam and the attractive profits earned by the contractor even with a set of hired machinery, two factories, one at Irigur and another at Coimbatore were erected by private parties on the same lines of details as at Pallapalaiyam factory and these have been reported to be working satisfactorily.

The ryots acknowledge the superiority of the crushing and resulting jaggery over the results of the bullock-driven mills, but they complain of the expense in taking the cane from the fields to the mill. This can be got over by supplying them with a light tramway but nothing can be done in this direction till after the war as there is a very small stock of this material in India at present and the prices are prohibitive.

29. As for the quality of the jaggery, it is always better than that obtained by the ryots' mills, but they do not generally get a better price for it because the people seem to think the ryots' jaggery is good enough for them but at Chittavadigai the ryot who utilized the power plant this year has been able to get Rs. 2 per pothi more than for the ryots' jaggery.

30. *Chittavadigai factory.*—This consists of a set of machinery, viz., 14 B.H.P. oil engine, three roller crushing mills with rollers 12" diameter and 18" long, cane shed, jaggery shed, boiling shed, jaggery stores and supervisor's quarters, a room in which, is used as the office.

The cyclone and heavy rains of the year damaged the furnaces, jaggery shed and other buildings and repairs could only be commenced about the end of December. It was rather late but could not be helped. The plague, cholera and malaria scared away the local coolies and even the very few men that remained were monopolised by Public Works Department contractors for the annual repairs of irrigation channels. However, under these adverse circumstances, the factory was started on the 15th February and worked till 4th April off and on, on the whole for 31 working days. One hundred and sixty pothis of 250 lb. each, of out-jaggery were made and Rs. 495-9-7 was collected towards the crushing charges. The out-turn was rather unsatisfactory owing to the causes mentioned above which were beyond control, but as many figures have been collected as was possible which should prove of interest.

The results of the year's work at this station are given in Tables IX and X of this report.

TABLE IX.

CANE CRUSHING FACTORY AT CHITTAVADIGAI.

Name of owner of cane.—M.R.Ry. Theyappa Avargal.

Cane crushing from 21st to 23rd March 1917.

Work done.		Cost.		Deductions.			
		Materials.	RS. A. P.	Percentage of juice to cane			
Hours of crushing	20	Liquid fuel	5 10 0	Do.	jaggery to juice	...	72.36
Pounds of cane crushed	32,129	Lubricating and kerosene oil	2 8 0	Do.	jaggery to cane	...	18.63
Pounds of juice obtained	23,248	Trash	7 8 0	Do.	jaggery to cane	...	13.48
Pounds of jaggery obtained	4,331	Lime	0 5 0	Do.	wet megass to cane	...	27.18
Pounds of wet megass.	8,731	Gingelly oil	0 5 0	Cost per			
		Total	16 4 0		Material.	Labour.	Total.
Pounds of } Dry fuel for } megass furnace	4,337				RS. A. P.	RS. A. P.	RS. A. P.
	2,852			One ton cane	1 2 2	1 8 3	2 10 5
				One ton juice	1 9 0	2 1 6	3 10 6
				One ton jaggery	8 6 6	11 4 0	19 10 6
Total fuel	7,189	Labour.					
		Driver	2 0 0	Fuel for engine per ton			
		Jaggery makers	4 8 0	cane	...	1.49	.41
		Furnace man	3 0 0	Fuel for engine per ton			
		Scum remover	2 4 0	juice	...	1.93	.54
Pounds of cane crushed per hour	1,606.5	Male coolies	2 10 0	Fuel for engine per ton			
Total number of pans struck	35	Female coolies	1 2 0	jaggery	...	19.35	2.91
Average number of pans per day	11.7	Total	21 12 0	Fuel for furnace per ton			
Pounds of jaggery per pan	123.7	Materials and labour.	38 0 0	cane	...	501	.96
				juice	...	692	1.32
				Fuel for furnace per ton			
				jaggery	...	3,718	7.12

TABLE X.

CANE CRUSHING FACTORY AT CHITTAVADIGAL.

Name of the owner of cane—M.R.Ry. Gururaj Gound Avargal.

Cane crushing from 27th March to 1st April 1917.

Work done.		Cost.		Deductions.	
		Materials.			
Hours of crushing ...	43.5	Liquid fuel ...	Rs. A. P. 11 4 0	Percentage of juice to cane ...	71.21
Pounds of cane crushed ...	73,845	Lubricating and kerosene oil ...	5 0 0	Percentage of jaggery to juice ...	15.75
Pounds of juice obtained ...	52,549	Trash ...	12 8 0	Percentage of jaggery to cane ...	11.21
Pounds of jaggery obtained ...	8,280	Lime ...	0 10 0	Percentage of wet megasse to cane ...	28.60
Pounds of wet megasse ...	21,125	Gingelly oil ...	0 10 0		
		Total ...	30 0 0	Cost per	Material Labour Total.
Pounds of (Dry fuel for } megasse furnace. (Trash ...	10,547 5,115			One ton cane ...	Rs. A. P. Rs. A. P. Rs. A. P. 0 14 7 11 4 1 2 2 3
Total fuel ...	15,662			One ton juice ...	1 4 6 1 12 2 3 0 8
				One ton jaggery ...	8 1 10 11 2 9 19 4 7
		Labour.			
Pounds of cane crushed per hour ...	1,697.6	Driver ...	4 0 0	Fuel for engine per ton cane ...	GALS. Rs. 1.21 .34
Total number of pans struck ...	68	Jaggery maker ...	9 0 0	Fuel for engine per ton juice ...	1.74 .49
Average number of pans per day ...	11.3	Furnace man ...	6 4 0	Fuel for engine per ton jaggery ...	10.82 3.04
Pounds of jaggery per hour ...	121.7	Scum remover ...	3 12 0	Fuel for furnace per ton cane ...	4.75 .76
		Mould coolies ...	4 6 0	Fuel for furnace per ton juice ...	6.68 1.08
		Female coolies ...	12 8 0	Fuel for furnace per ton jaggery ...	4.238 6.75
		Weighing coolies ...	1 14 0		
		Total ...	41 12 0		
		Total Material and labour ...	71 12 0		

31. The crushing mills have been working satisfactorily but the top rollers should be fitted with toggle gear so that if a stick or iron bar were put into the rollers with the cane, there would be less chance of breaking the mill than there now is. Mills of this size are not generally fitted with this gear, nevertheless in my opinion they should have it.

32. Even better jaggery can be made at these factories but the owner of the canes has a rooted objection to the removal of the scum which forms during the boiling of the juice and he will not cut off sufficient length of the green tops of the canes. If the jaggery were being made for a refinery, it would be paid for according to the total available crystallizable sugar in it and the ryot would get a very poor price for his jaggery if he crushes green tops. I however hope to persuade the ryot gradually to remove the scum and cut off more of the green tops before crushing. At Pallapalayam, I noticed that they use a plank in which are cut by hand a number of square tapered holes. The massequite is poured into these holes and when it has set the jaggery is taken out of the moulds. I suggested making these holes round instead of square, so that they could be done by a drilling machine in about one-tenth the time with a more uniform size and at a very much lower cost, but the ryots said they would have no sale for jaggery from round moulds. This shows that some of the ryots are not easy to deal with.

Motor Ploughing.

33. The department has two of these, one a 45 B.H.P., the other a 22 B.H.P. Scarcely anything more than trying them has been done. The large one had an accident and broke the connecting rods and bolts and the crank chamber and the smaller one due to faulty design so frequently breaks down that no work can be got out of it. I have suggested getting a new engine of a different type for the smaller one and will experiment with this before doing anything to the larger tractor. I am of opinion that these tractors when got to work satisfactorily will be of immense importance to the department.

Other works.

34. One of my first duties was to report on how to increase the water-supply for the college and farm at Coimbatore. I made certain suggestions which were approved of by the Director. Two of those suggestions have been carried out and the capacities of the wells

have been practically doubled and the Government Chemist reports that the water is a distinct improvement in quality.

I have designed in the rough the following machinery. Working drawings will be put in hand as soon as time can be found in the drawing office:—

- (1) Machine attached to winnower for separating grain from heads.
- (2) Automatic seed drill.
- (3) Light carriage for carrying bundles of hay, or other agricultural produce.
- (4) Spraying machine.
- (5) I have made in the workshop a hay-stacking machine for the Principal, Agricultural College, Coimbatore, and the Principal has expressed his satisfaction of the machine.
- (6) I have also designed a cooking range for the Hostel at the Coimbatore College. The working plan is ready and the estimate for the work is in hand.
- (7) A plan and an estimate have been made for a seed store for the Deputy Director, V and VII Circles.

35. In conclusion, I would like to express my appreciation of the help given me by my assistant M.R.Ry. V. Rangachar Avargal, B.A., A.C.E. He was appointed as Assistant Agricultural Engineer on 1st August 1916 and has worked hard in this office and has been a great help in the administration of this department.

MADRAS,
23rd May 1917.

F. T. T. NEWLAND,
Government Agricultural Engineer.

43

Government of Madras
REVENUE DEPARTMENT

G.O. No. 3141, 4th October 1917

Agricultural Department

Recording, with remarks, the report on the administration of the — during 1916-17.

READ—the following paper:—

*Letter—from G. A. D. STUART, Esq., B.A., I.C.S., Director of Agriculture,
Madras.
Dated—the 28th July 1917.
No.—R.O.C 756-Govt.*

Order—No. 3141, Revenue, dated 4th October 1917.

Miscellaneous

Recorded.

2. The Government agree with the Director that, in spite of the damage

caused at a few stations by unprecedented rainfall, there has been good progress during the year.

3. The efforts of the department have been mainly directed towards improving the quality and outturn of the crops which are of greatest economic importance to the Presidency. The experiments in breeding new strains of paddy and sugarcane and in bettering the methods of their cultivation have been successful. The Government congratulate Dr. Harrison, Mr. Parnell and Dr. Barber on the profitable issue of their labours in connexion with paddy soils, paddy breeding and sugarcane, respectively, and they appreciate the importance of the work done by Messrs. Parry & Co. in enhancing the output of sugarcane.

4. The results attained in improving the quality of Tinnevely cotton and eliminating *pulichai* may fairly be counted a very good achievement. The Government note the Director's testimony in this connexion to the work done by Messrs. R. Thomas, G. F. Paddison, A. R. Loftus-Tottenham and the buying firms which have so loyally co-operated. It is hoped that the difficulties encountered in carrying through similar improvements in the 'Northern' and 'Western' area will before long be overcome.

5. The Government are glad to observe that increased attention is being devoted to the more important dry grains, groundnut and pepper, and that substantial progress has been made in preparing the new coconut stations on the West Coast for regular work. Investigation of the pulses of this Presidency must await the much-needed increase in the expert staff.

6. The prospects of Madras indigo have assumed a new aspect in the light of Mr. W. A. Davis' investigations, and it is hoped that Dr. Marsden's researches will assure the future prosperity of this important industry. The sericultural work of the department, though of minor importance in this Presidency and conducted on a very modest scale, has yielded promising results, and the possibility of its expansion is engaging the careful consideration of the Director. A site has recently been selected for the potato farm on The Nilgiris and the Government desire that the Director should keep in close touch with the work that is shortly to be taken in hand there. It is regretted that, owing to the difficulty in securing a competent officer for the post of mycologist for the planting districts, it has not been possible to open stations for the study of tea, coffee and rubber.

7. The development of live-stock operations is necessarily slow. Sheep-breeding at Hagari has been on too limited a scale to be of great practical value. More definite results are expected with the transfer to the department of the Bantanahal

reserves, which appear to be admirably suited for the purposes for which they have been selected. The defective water-supply in the Lam reserve is disappointing, and has seriously set back the opening of a cattle farm. It is hoped that in the course of the current year Mr. Carruth will have advanced his preliminary survey of the conditions of stock-breeding and dairy-farming sufficiently to enable him to indicate in general terms the lines on which this important branch of the administration should proceed. In this connexion the Government would suggest the desirability of the Deputy Director of Live-stock keeping in close touch with the work that is being done by the Veterinary department. The output of the Coimbatore dairy was especially creditable in view of the two epidemics with which it was assailed. The Government note with approval the interest taken by the department in fodder crops and grasses. They would be glad to know what success has attended the experiments in the preservation of fodder during seasons in which fodder is not generally procurable.

8. The decrease in the incidence of palmyra disease in Kistna and Godāvari is a decisive justification of the care and money expended. The success of this campaign is largely due to the advice of Mr. McKae. Useful work has also been done on other crop pests in spite of the rise in the cost of chemicals and lack of staff, and there is reason to believe that the ryots are beginning to appreciate the value of prophylactic measures. The growing popularity of superphosphate, fish manure, daincha and kolinji, the expansion of drill cultivation, and the increasing demand for iron ploughs, are encouraging features of the year's report. The fact that the improved cultural methods advocated by the department are being adopted in tracts situated outside the sphere of the department's demonstration work is evidence of the prestige which the department has already won. Land-owners, no doubt, are slow to appraise skilled agricultural labour at its proper value, but the figures quoted by the Director indicate that the policy of training coolies and maistris deserves extension. The Government recognize the usefulness of co-operative societies as intermediaries between the department and the ryots for the distribution of seeds, manure and implements, and they are confident that the Director is awake to the need for yet closer collaboration between his own staff and that of the Registrar.

9. During the year under report the immediate control of the department was transferred from the Board of Revenue to the Government, and the work of the department was organized in seven 'circles,' each of which will eventually form a Deputy Director's charge. The Pumping and Boring establishment was also taken over from the Department of Industries, and Mr. Newland was appointed Agricultural Engineer. The Director gives an interesting account of the work of the engineering establishment, and the Government are satisfied that this work is proceeding on sound lines.

10. Much interesting information is embodied in the report and its enclosures as to the activities of the scientific experts attached to the department. The Government recognize that the work of these officers is a condition precedent to improvements in the field, and they concur with the Director in his appreciation of its high quality. Mr. R. C. Wood deserves special commendation for his efficient management of the college and the central farm, and Mr. Stuart himself for his able and sympathetic administration of the department.

11. A summary of the receipts and charges of the department as reported by the Accountant-General is appended. The statement does not include the charges on account of the Pumping and Boring establishment.

(True extract)

A. R. KNAPP,
Acting Secretary to Government.

To the Director of Agriculture.
" Registrar of Co-operative Societies.
" Director of Industries [through Home (Education) Department].
" Home Department.
" Local and Municipal Department.
" Public Works Department.
" Agricultural Adviser to the Government of India.
" Secretary to the Government of India, Revenue and Agricultural Department.
Editors' Table.

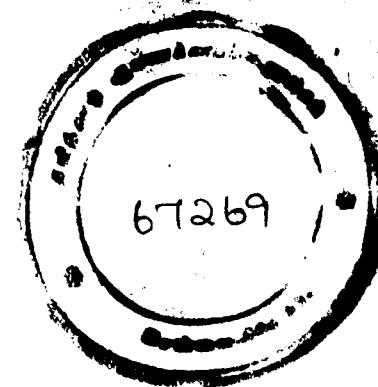
[Appendix.

APPENDIX

Receipts.				Rs.
Central Research and Teaching Institute	...	...	...	28,075
District farms receipts	...	...	...	27,284
Sugarcane-crushing plant receipts	...	...	...	2,797
Sale of cotton lint and seeds	...	...	...	58,853
Sale of green manuring seeds	...	...	...	11,851
Sugarcane-breeding station	...	...	...	855
Miscellaneous	...	...	...	6,992
				1,35,657

Charges.				Rs.
I. Director of Agriculture	...	...	...	65,319
II. Agricultural Research and Agricultural College and Central Farm	...	...	...	2,42,000*
III. Deputy and Assistant Directors of Agriculture and executive subordinates, clerks, etc., and charges on account of district farms.	...	...	...	2,32,874†
IV. { Improvement of cotton cultivation	...	...	...	68,078
{ Distribution of green manure seeds	...	...	...	15,968
{ Improvement of paddy cultivation	...	...	...	6,086
{ Sugarcane-crushing plant	...	...	...	3,528
V. Deputy Director for Planting Districts	...	...	...	7,607
				6,40,960

* This includes Rs. 3,687 spent on new works in connexion with the paddy-breeding station.
† This includes Rs. 13,282 spent on new works in connexion with district experimental farms.



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[illegible]