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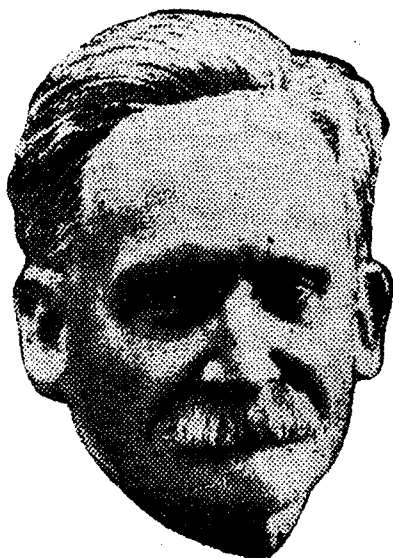
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PARTHENOGENESIS IN COTTON 188

By R. BALASUBRAMANIAM, B.A., B.Sc., (Ag.)

Assistant to the Cotton Specialist

The production of a cross between the American and Asiatic cottons, has been receiving the attention of various breeders in the world, and there was a time when there was no subject on which greater diversity of opinion existed than the possibility of this cross within the genus. Major Trevor Clarke (1870) held that the hybridization between these was not possible, while Gammie (1903) is mentioned as having successfully crossed *G. hirsutum* and *G. roseum*, *G. hirsutum* and *G. obtusifolium*, and probably these crosses are now lost. Zaitzev (1925) of Turkishtan station produced hybrids between *G. hirsutum* and *G. herbaceum*, but unfortunately the first generation did not produce any fruit due to sterility of pollen, although the plants produced a large number of flowers. Denham (1924) in his cytological studies in cotton, offers an explanation to this unsolved difficulty, and ventures a solution by way of finding out a diploid mutant of the Indian cotton. It will not be out of place to quote a few lines of his work.

'The abrupt separation of the genus *Gossypium* into two groups, in which the chromosome number is twice that of the other, is in itself a matter of great interest. It is known that interspecific hybrids can be made with comparative ease in either of the groups, but as far as can be ascertained, no plant breeder has yet been successful in crossing an American or Egyptian cotton with a true Indian cotton. (It has been stated that this cross has been made in Russia, but no reference can be made to it in the available literature and it is probable, that the cross has now been lost.) The fact of the difference may perhaps open a further possibility for the

plant breeder who wishes to make the cross between Indian and American cottons, if it can be assumed that there is any hope of finding a diploid mutant of an Indian cotton (which would probably reveal itself as suitable for cytological examination by its abnormal size), it might be reasonably expected to prove a fertile parent for the experiment.' The research is highly interesting and educative at this period, setting down the impossibility as due to the inherent differences in chromosome number. In spite of the obstacles presented by way of the chromosome difference, Zaitzev claims to have succeeded in achieving what has been considered hitherto impossible, and he attributes his success to a large extent to the favourable conditions. He claims that the failures and sheddings are due to premature rupture of the style, consequent to the closing and twisting of the corolla, coupled with the slow and retarded growth of the pollen tubes in an altogether strange medium. He is of opinion that the differences are surmountable and may be made to result in the production of viable hybrid seeds, if only the technique of artificial crossing is a little modified.

In the Cotton Breeding station at Coimbatore definite attempts were made from the year 1922 to 1925 to get a cross, if possible, between *G. hirsutum* (Strain No. 1) and *G. indicum* (Strain No. 14). Early flowers were tackled, and in a majority of cases *G. indicum* was the ovule parent. The reciprocal cross was never successful and the flowers exhibited a tendency to shed a few days after artificial pollination. This might be due to the slow growth of the pollen tubes of *G. indicum* in *G. hirsutum* stigma and thereby failing to supply the necessary stimulus in the early stage, or it may be that *G. indicum* pollen failed to supply the full complement of twenty-six chromosomes possessed by the *G. hirsutum* ovule, resulting in poor endosperm development, and failure to unite with the egg cell, followed by the early abscission. The following method was adopted during these three years. The castrations were done on the day before flowering in the evenings, or in the mornings at about 7 A.M. on the day of flowering, but in either case the buds remained unopened at the time of emasculation. The *indicum* flowers open at about 9 A.M. in the morning, and simultaneously with the opening out of the corolla, the anthers begin to dehisce. The petals were completely removed by scissoring of just over the base of the ovary without in any way injuring the ovary or the stigma. The filaments were then cut off, taking care not to rupture the stigma or anthers, and in fact every precaution was taken to exclude the chances of pollen, being deposited on the stigma. The bud was then completely covered up, to prevent insect or wind pollination. One or two flowers of the male parent were also covered up to prevent the deposition of foreign pollen. On the day of opening of the flower at about 9 A.M., the pollen from the male parent was dusted on to the emasculated buds after carefully examining the stigmatic surface for any stray pollen and the flowers were completely covered up without letting an ingress to insects. The tissue bags were allowed to remain on the plants for about three or four days.

About sixteen crosses were tried in the year 1922-23 and over forty crosses in 1924-25, all of these with *G. indicum* as the mother parent. Every one of the attempts pointed towards success in the early stages, since they exhibited increase in the size of the fruit from the third or the

fourth day, and shedding commenced only after the eighth day. The shedding was very pronounced after the twentieth day in both years, the susceptibility being at its maximum between twenty and thirty days. A surmise that a critical period is existent at or about the twenty-second day after flowering is not improbable, if we give due attention to the closeness of agreement in the two different years, conducted under different conditions. The true nature of changes that take place in the inner mechanism of such a boll is not known, and it is impossible to venture a hypothesis without a critical cytological study.

The bolls that were crossed, were picked up after shedding and examined. All the external evidences of fertilization were there, as the formation of lint on seeds, development of ovules into seeds, etc. The seeds were normal in size though the interior was not completely filled up, and the testa alone was well formed without the full development of the embryo. It might be tentatively put forth that the initial necessary stimulus required by the *G. indicum* flower, for the growth of the ovary, was supplied to a large measure by the pollen of *G. hirsutum*, and that the other changes taking place in the inner mechanism of the boll later on, when the growth period was over, retarded the formation of viable hybrid seeds followed by an abscission of bolls in a majority of instances.

The swelling up of the ovary continued to the time of shedding and a perceptible fall in size was noticed to occur a day or two before the shedding. To find out how closely it agreed with the growth of normal bolls, a series of measurements were taken, on a number of bolls whose dates of flowering closely approximated to the flowering time of crossed flowers. In the tables 1 and 2, the results are presented for the two years. The age of boll, average measurement of shed bolls, and average measurements of normal bolls are given. It was surprising to note the closeness of agreement between the two measurements in the two years. The crossed bolls appeared to be bigger in the majority of instances, and this might be due to the initial bigger ovary to start with as the difference was noticed even at the beginning. The bolls attained their maximum size between twenty-one to twenty-three days and thereafter remain fairly steady till about the time of bursting when a little shrinkage was noticed. This shrinkage was more pronounced in crosses. The increments in size of boll (Plates I and II) showed that the rate of growth fell down, after three weeks and the abrupt descending curve as the boll matured, indicated the sudden cessation of growth, shrinkage indicative of premature opening, and the inevitable abscission. This type of curve is characteristic of the crosses in both the years, and it is possible that the stimulus for parthenocarpy is very much in excess and in advance of the tendency for parthenogenesis. It is also likely that the dehydration commences in the carpel after attaining the maximum growth in about three weeks in the absence of the usual balance of growth between the boll contents and the covering of a normal boll. Although the measurements indicated the closeness between normal and the crossed bolls, the flatness and a formation of carpellary grooves foreshadowing early opening, pointed towards the partial or total lack of development of the ovules.

Although every one of the attempts proved successful, inasmuch as all of them developed into bolls of varying ages, the percentage of mature bolls capable of giving seeds was very low. As many as nine bolls were got in

1922-23, and 18 bolls in 1924-25, but many of them gave immature seeds. Four bolls out of 18 in 1924-25, gave few good well-formed seeds with lint, and presented healthy normal external characters. The stray instances of good boll production recorded, naturally threw a halo of doubt on the achievements, if they could be styled as such. This might be attributed to errors of technique, but it must not be accepted off-hand, considering the necessary precautions taken in the matter of bagging, etc. If any foreign pollen had been transferred, it must have been during the few seconds of dusting with *hirsutum* pollen. In the absence of any accidental errors of technique it must be a cross or the outcome of parthenogenesis.

In angiosperms, parthenogenesis is not a common occurrence although a few genera do exhibit it. With the available literature, it was not possible to mention the name of any writer, who has drawn the attention to this phenomenon in cotton; and under the present circumstances it seemed worth while to investigate the problem in a systematic way at least to dispense with one phase of the possibility.

Seven plants were selected in a plot of *G. indicum* (Strain No. 14) sown in the month of October, in lines 3' x 3' apart. The castration or the decapitation was done on two sets of plants (1) in which all bolls and flowers were removed previous to the day of experiment since it has been definitely shown by Mason (1922), that the presence of bolls on the plants inhibits the development of latter bolls increasing the tendency to shed and (2) in which the normal conditions were allowed to prevail. Flowers were tackled in the first and the second weeks of March, when flowers were produced in large numbers and this period corresponded to the period of maximum production. The decapitations were done in the following manner. By mere emasculation, it was thought that the danger of pollen sticking on to the stigma lurked, in spite of the many precautions taken, and with a view to eliminate this error, the whole staminal column with the stigma was cut just over the ovary after removing the corolla. Such a procedure would cause an acute shock to the flower, resulting in increased shedding, but we would be treading on surer grounds if we were to succeed in getting a boll. All the treated flowers were dated, numbered, and covered by tissue paper bags, which were removed only on the fourth day after flowering.

Over 700 flowers were handled in the year 1924-25, and a shedding record was maintained and wherever and whenever possible, the cause of shedding was given. To collect the shed bolls the plants were shaken early in the morning, and such of them that shed, were collected and examined. Some of them shed due to the weight of paper bags, rough and violent handling, insect attack or wind, while some others got dried up in the plant and would not fall even after violent shaking. These bolls were not included. In almost all the treated buds the ovary began swelling up to fifth or the sixth day when growth appeared to stop, followed by contraction, shrivelling, and shedding and sometimes abscission occurred even when the bolls were quite healthy. Unfortunately no measurements were taken this year, to find out whether the growth keeps pace with the normal ones, and as such the results are the results of eye judgments. In 1922-23 about 25 flowers were castrated but they were not covered. The measurements indicated the increase in growth till the fourth or fifth day, and decrease in size after that in the majority of cases. The swelling up

perhaps indicates a tendency towards fruit formation but these seedless fruits are thrown out before they are many days old, due perhaps to the lack of initial stimulus. Whether these exhibit a tendency towards parthenocarp is again doubtful.

The shedding began by about the third day and proceeded with increasing rate up to the seventh day or the eighth day when a decline was noticed ending abruptly by the seventeenth day. Comparing the interval of shedding percentage in the two series, treated and untreated, there seems to be a difference of one day as regards the mean day of shedding. It might be that treated plants retained the bolls longer than the other, but it must be sufficiently corroborated before hazarding the statement. The mean interval for treatment 1 is $8.67, \pm 0.155$ while in the other it is 7.766 ± 0.18 . The difference by the probable error of the difference, works out to 4.79 times, giving high odds in favour of the series 1, or in other words the difference is statistically significant. A certain number of flowers were dated and shedding noted. The mean of normal bolls was at 11.00 days, as against 21.62 days of the crosses. The decapitated flowers were the first-shed, the normal coming second in order of merit, while the crosses were retained the longest. This point with the percentage of success and agreement of measurements taken in conjunction with the continued growth ovary till the twenty-second day or thereabouts, once more suggests the evidence of stimulus by the *G. hirsutum* pollen, favouring in most cases a tendency akin to the parthenocarp with the production of phenospermic seeds in the majority of instances, and resulting in about five to ten per cent in the production of good, well-formed seeds. Of the 700 attempts that were made, only seven developed into bolls, and were picked after the lapse of the normal growing period. They appeared healthy, but were smaller than normal bolls. Out of the seven bolls, only four gave good seeds with lint, while the rest contained immature or hollow seeds with little or no lint on them. The percentage is as low as two but it goes to indicate that the crosses obtained may be the result of parthenogenesis.

In 1925-26 further attempts were made to corroborate the behaviour in previous years, and it was deemed worth while to include another set of experiments into the group. In addition to the usual castrations and bagging, a number of flowers were dusted with N. 14 pollen after decapitation and covered, to know whether the stray pollen if deposited, during the short interval of few seconds between cutting and covering, may not be the cause of such development of boll. Out of 100 attempts made, only two exhibited tendencies of growth, but finally shed. This set at rest a probable plea that the growth of bolls might have resulted from the deposition of pollen by agencies not forecasted for in our adoption of a set of precautions to exclude them.

The same experiment in another modified form was undertaken. Here a number of flowers were treated and left uncovered giving thereby a chance for the agencies to play their role, but the result did not prove in any way conflicting to the previous statements. Out of the 300 attempts, seven bolls of normal age were obtained though reduced in size and the mean interval of shedding worked out to 8.89 days.

The pollen stimulus is sufficient to induce parthenocarp and parthenogenesis, while the drastic decapitation probably supplies the necessary

stimulus although greatly reduced, for inducing parthenogenesis in a smaller percentage of instances. Another interesting feature is the development of one or two seeds only in the picked bolls. Comparing the crossed and emasculated lots, the degree of development attained by the boll and the boll contents are very much in advance in the former, and this is also indirectly shown by the mean shedding intervals. Cytological studies to find out the nature of changes in the ovule, and the conditions favouring such a development, will form the subject of a further enquiry.

SUMMARY

1. The pollen of *G. hirsutum* supplies the necessary initial stimulus for the growth of the ovary till about the nineteenth day, when the development of boll is almost over.

2. It is suggested that a critical period is existent about the twentieth day.

3. The growth rates of the cross bolls are same as that of the normal, but there is an abrupt decline indicative of premature bursting.

4. A small percentage of parthenogenesis is present in *G. indicum*, and this seems to be rather corroborated by the identity of success in the two experiments.

5. Parthenocarpy is present but the seedless fruits are thrown out early. Probably the foreign pollen favours this, resulting in many cases in phenospermic seeds.

6. The few bolls that happen to be the outcome of parthenogenesis are much smaller in size, and contain only one or two seeds.

I wish to take this opportunity to thank Mr. R. C. Broadfoot, Cotton Specialist, Coimbatore, for the facilities given to me for carrying on the problem.

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TABLE 1

1922-23

Age of boll in days	Averages			
	Length in mm.		Breadth in mm.	
	Normal boll	Shed boll	Normal boll	Shed boll
4	8.3	8.9	6.3	7.0
5	9.9	9.9	7.4	7.6
6	10.3	10.8	7.6	8.2
7	11.1	12.2	8.5	8.9
8	12.9	13.5	9.5	9.8
9	14.7	15.2	10.5	11.2
10	16.9	16.8	11.7	11.5
11	18.0	18.3	12.6	12.3
12	20.2	19.6	13.7	12.9
13	21.6	21.2	14.3	13.8
14	22.6	22.5	14.9	14.7
15	23.4	24.4	15.5	15.8
16	24.4	26.0	15.9	16.7
17	24.9	26.8	16.2	17.5
18	25.4	27.4	17.1	17.6
19	25.8	27.8	17.7	18.3
20	25.8	28.1	17.7	18.9
21	25.8	28.5	17.8	19.1
22	25.8	28.9	17.8	19.1
23	26.0	29.0	18.0	19.1
24	26.0	29.0	18.0	19.1
25	26.0	29.0	18.0	18.8
26	26.0	29.0	18.0	18.7
27	26.0	29.2	18.0	18.7
28	26.0	29.2	18.0	18.3
29	26.0	29.2	18.0	18.1
30	26.0	27.3	18.0	17.6
31	26.0	27.3	18.0	17.3
32	26.0	26.6	18.0	17.3
33	26.0	26.4	18.0	16.9
34	26.5	26.3	18.5	16.9
35	26.5	24.5	18.5	16.3
36	26.5	24.5	18.5	16.3
37	26.5	24.5	18.5	16.3
38	26.5	23.0	18.4	16.3

TABLE 2
1924-25

Age of boll in days	Averages			
	Length in mm.		Breadth in mm.	
	Normal boll	Shed boll	Normal boll	Shed boll
4	8.0	10.2	6.0	7.8
5	...	11.3	...	8.5
6	...	11.3	...	8.7
7	10.0	13.1	7.3	9.3
8	11.7	13.8	7.7	9.8
9	12.8	15.1	8.0	10.5
10	12.8	16.8	8.8	11.3
11	14.3	18.1	9.3	12.0
12	15.7	19.8	10.7	12.9
13	17.5	21.9	11.0	14.0
14	18.5	22.7	12.3	15.2
15	21.3	24.7	13.3	15.6
16	22.8	26.0	14.3	16.8
17	23.0	26.6	15.0	17.3
18	24.3	26.9	15.0	17.7
19	25.3	27.3	16.0	17.9
20	25.3	27.8	16.3	18.0
21	25.3	27.8	16.3	18.0
22	25.3	27.8	16.3	18.0
23	26.0	27.8	16.3	18.1
24	26.0	27.8	16.3	18.1
25	26.0	27.8	16.3	18.1
26	26.0	27.8	16.3	18.3
27	26.0	27.8	16.3	18.3
28	26.0	27.0	17.0	18.0
29	26.0	27.0	17.0	18.0
30	26.0	27.0	17.0	18.0
31	26.0	27.0	17.0	18.0
32	26.0	26.0	17.0	18.0
33	26.7	26.0	17.0	18.0
34	27.0	26.0	17.0	18.0
35	27.0	26.0	17.0	17.0
36	27.0	26.0	17.0	17.0
37	27.0	25.0	17.0	16.0

Plate 2.

1924-25

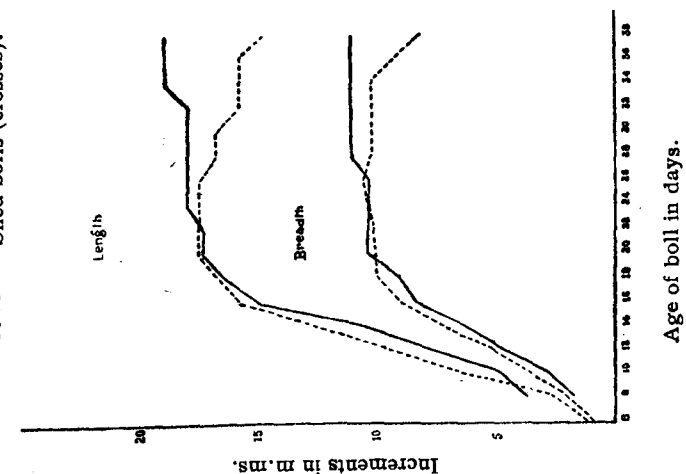
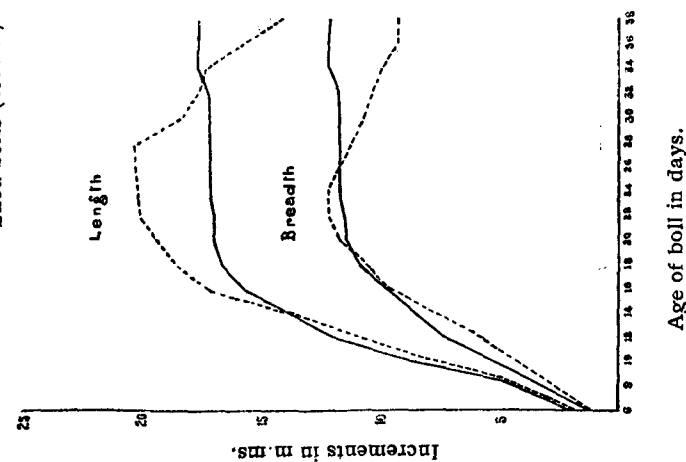
— Normal bolls.
- - - - - Shed bolls (crosses).

Plate 1.

1922-23

— Normal bolls.
- - - - - Shed bolls (crosses).

THE COST OF MILK PRODUCTION AT HOSUR AND MADRAS CITY

By T. MURARI, B.Sc. (OXON), F.L.S.

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It is not necessary for us to impress on the readers the importance of milk as a human food. Though consumption of milk *per capita*, in this country, cannot be compared with that in Sweden, Denmark, England or America, general requirements are becoming gradually, but very slowly, higher. The increase in travel mainly due to the bus service which connects remote places has considerably increased the number of coffee shops and hotels. These eating places have in turn created a demand for a regular supply of milk. This demand, be it noted, is in addition to the usual demand in the cities, towns and villages for general daily household requirements. Though there is a definite demand for milk, it is, however, to be regretted that there is no strong public opinion for the production of clean milk.

When there is demand for milk there appear milk-vendors to satisfy this demand. From the point of view of milkmen as well as of the consumers the transaction depends mainly on costs. The producer wishes to sell his product at a small profit over the cost of production, while the consumer wishes to purchase his requirements at as low a price as possible. We decided to work out the cost of production of milk at Hosur and Madras in order to find out if the dairy industry in this presidency is really paying.

The prevailing conditions at Hosur except for the lack of sufficient rainfall are suited for cattle breeding. The main function of this farm is cattle breeding so as to raise high-class bulls for sale to the ryots. Incidentally a large quantity of milk is naturally produced and it is fed to the calves so as to produce the kind of animals we have.

The stock consists of Crossbreds, Scindhies, Ongoles and Kangayams. In finding the cost of upkeep for dairy cows, both their lactation and dry periods have to be taken into consideration. These periods, being different in the different breeds, render the calculation difficult. However, an average has been worked out to get the ratio of milch to dry cows, taking all the breeds together. It is found that, for the year 1930-31, out of a dairy herd of 140 cows, 74 were in milk and 66 dry. The cost of milk production, as detailed below, has been arrived at on the basis of the above herd and by collecting data from various registers maintained on the farm.

THE COST OF MAINTAINING 140 COWS CONSISTING OF 74
MILCH AND 66 DRY FOR THE YEAR 1930-31

Items of Expenditure.

	Amount		
	RS.	A.	P.
Concentrated and bulky food	13,800	5	7
Grazing	3,640	0	0
Attendance including Maistries, Milkmen, Herdsmen, Water-carting, Fodder-carting, etc.	2,973	0	0
Housing (1½ per cent depreciation on the value of buildings, viz., Rs. 38,000)	570	0	0
Depreciation at 15 per cent on the value of cows, i.e., Rs. 23,875	3,581	0	0
Veterinary charges	140	0	0
Cost of maintaining three breeding bulls	430	4	8
Assessment on 280 acres of land at Rs. 1-8-0 per acre... ..	420	0	0
Sundries : chains, buckets, feed troughs, etc.	560	0	0
Total	26,114	10	3

Receipts.

	Amount		
	RS.	A.	P.
74 Calves at Rs. 5 each	370	0	0
Dung at Rs. 9 from an animal per annum	1,260	0	0
Total	1,630	0	0

Milk produced 2,61,366 lb.

Deducting the value of calves and dung from the cost of upkeep it would be found that to produce a quantity of 2,61,366 lb. milk the farm has incurred an expense of Rs. 24,484-14-3. This works at Rs. 0-1-6 a lb.

It has already been noted that the stock at Hosur consists of Kangayams, Ongols, Scindhes and Crossbreds. If Kangayams, except for the few good milkers, and poor milkers in other breeds had been eliminated, as would be the case under proper dairying conditions, the cost of milk production would considerably be lower. Nevertheless, despite a very limited demand for milk in the locality the farm does not lose on the sale of milk. It must however be added that the cost of management, that is, pay of officers and ministerial staff has not been taken into account. This has been left out, for it would not be quite fair as the staff on the farm is not meant for dairying alone as there are other aspects of animal husbandry involved. From the commercial point of view however, the less the overhead charges the better. Again, it has to be pointed out for reasons already stated that the dairy equipment is not up to date. The cost of putting up the refrigerators and sterilizers would naturally add to the cost of production, but it would result in producing the cleanest milk possible, which is most necessary for building the nation.

It would now be interesting to follow the method adopted by the Madras City milkmen. We do not wish to go in length with regard to general conditions concerning this trade as Mr. Krishnan Nambiyar has

detailed elsewhere (November 1931 issue). Briefly the average common milkman of Madras has no proper stabling under hygienic conditions. He purchases cows in milk, kills the calf by starvation and sells the cows as soon as they become dry. His method of marketing is to milk the cows in front of the customers' door in the street. When customers are not particular he milks the cows at his house and distributes the milk rarely without adulteration. In his trade he often sells buffalo milk adulterated with water as cow's milk. It may be added incidentally that most of the cows sold do not generally return to the villages nor are they maintained during the dry period for re-sale to the owner. Generally they are purchased by the butcher.

COST OF MILK PRODUCTION BY THE MADRAS MILKMAN

Expenditure.

	RS.	A.	P.
Cost of 3 Ongole cows giving about 2½ measures on an average for 10 months lactation at Rs. 150 each	450	0	0
Interest on Rs. 450 for 10 months at 12 per cent.	45	0	0
Cost of ropes, utensils, etc.	5	0	0
The milkman's wages for 10 months at Rs. 15 per month.	150	0	0
License fee on 3 cows	5	0	0
Rent on stalls for 3 animals for 10 months at Rs. 2 per head per month	60	0	0
Cost of feeding 3 cows for 10 months :			
Per day :—			

	RS.	A.	P.
Gingelly cake 3 vis. at 8 vis. per rupee	0	6	0
6 measures wheat bran at 18 measures per rupee	0	5	4
6 measures Bengal-gram husk at 18 measures a rupee	0	5	4
Redgram husk at 20 measures a rupee	0	4	10
Salt	0	0	6
4½ twists of paddy straw	0	4	6
Total per 3 cows per day	1	10	6
Total for 10 months or 300 days	496	14	0
Unforeseen expenses	3	2	0
Grand Total	1,215	0	0

Receipts.

Selling price of 3 cows when dry	150	0	0
Cost of raw dung of three animals for 10 months at Rs. 5 per head per month	150	0	0
Total	300	0	0

The average quantity of milk produced by 3 cows during the period at 2½ measures per head per day : $2\frac{1}{2} \times 3 \times 30 \times 10 = 2,250$ measures,

The cost of producing 2,250 measures of milk is Rs. 1,215 minus 300, or Rs. 915.

Cost of one measure of milk is Rs. 0-6-6. (One measure is 4 lb.).

The sale price of one measure being Rs. 0-8-0 the profit is Rs. 0-1-6 per measure.

From the above figures it will be noted that the milkman does make a profit. It must however be remembered that in most cases, excepting rich owners and contractors, the milkman has no reserve in case of animals dying of disease. Again the milk yield given here is a conservative estimate. In practice, it is doubtful if the average cow gives the expected quantity, for the milkman in his anxiety to make large profits does not feed his stock as well as he should. Again, if the cows are well stalled and milking is done and preserved under hygienic conditions, the milkman is likely to make very little profit, as the cost of production would naturally be higher. As matters stand, if the Madras City milkman produces really clean milk, the price of milk is likely to go up.

My thanks are due to Messrs. M. P. Kunhikutty and P. K. Krishnan Nambiyar for working out the figures mentioned in this communication.

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WHY IT IS CHEAP TO MAINTAIN A HEAVY MILKER

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AND

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General condition of cattle management in this country indicates that no selection is made strictly from the utility point of view. Sentiment very often without rational reasoning affects animal husbandry. It is common knowledge that a vast number of cattle including buffaloes and sheep are not worth their keep. Any traveller will notice how indifferently our cattle are maintained. The ryot does not yet, despite the continual depression in the economics of the country, understand the value of keeping a productive animal. Again, we have Pinjarapoles for the weak and old animals when there are thousands of useful animals starving in the country. It would be far more useful for Pinjarapoles to buy up young and useful dry cattle meant for the slaughter houses and maintain them during the dry period and sell them back to milkmen. In the interest of the country it would be very useful and humane to kill all useless animals by the humane method instead of starving the cattle to death.

In our opinion there is no doubt that, when the economics of raising useful animals are brought home to the ryot, he will not lag behind in adopting new ideas. It is with this object in view that we wish to show the ryot why it is cheap to raise cows that give more milk than poor milkers. Let us for convenience select cows each giving 5 lb., 10 lb., 15 lb., 20 lb., 25 lb., and 30 lb. For the purpose of the illustration we need not take into account capital outlay, the cost of labour, housing, depreciation on buildings and animals, medicines, utensils, etc., because these items will be more or less common to all animals irrespective of yield.

Supposing that the cows under consideration require a maintenance of 10 lb. hay and 25 lb. fodder or silage and we decide to give $\frac{1}{2}$ lb. cake and $1\frac{1}{2}$ lb. bran mixture for every 5 lb. milk produced then our cows will get ration as follows:—

	Production ration.		Maintenance ration.	
	Cake.	Bran mixture.	Hay.	Fodder or Silage
	lb.	lb.	lb.	lb.
Cow yielding 30 lb. milk	... 2½	8	10	25
" " 25 "	... 2	7	"	"
" " 20 "	... 2	5	"	"
" " 15 "	... 1½	4	"	"
" " 10 "	... ½	3½	"	"
" " 5 "	... ½	1½	"	"

Taking the cost of hay at 80 lb. per rupee, fodder ensilage at 200 lb. per rupee, oil cake at Rs. 3-2-0 per 100 lb., rice bran at Rs. 3-4-0 per 100 lb., cotton seed at Rs. 4-12-0 per 100 lb. and wheat bran at Rs. 3-12-0 per 100 lb., the cost of maintaining a cow giving 5 lb. comes to Re. 0-5-3 per day, the details being given below:—

	RS	A	P
Hay, 10 lb. ...	...	0	2 0
Silage, 25 lb. ...	...	0	2 0
Cake, ½ lb. ...	...	0	0 3
Bran mixture, 1½ lb. ...	...	0	1 0
		0	5 3

Working on the above method the cost of feeding cows according to milk yield works out as follows:—

	RS	A	P
Cost of feeding a cow yielding 5 lb. ...	...	0	5 3
" " 10 " ...	...	0	6 7
" " 15 " ...	...	0	7 5
" " 20 " ...	...	0	8 4
" " 25 " ...	...	0	9 8
" " 30 " ...	...	0	10 7

Now, taking the cost of feeding cows it would be interesting to see what the cost of producing 1 lb. of milk would be, from poor milkers and heavy milkers. This works out as given below:—

	RS	A	P
5 lb. cow produces milk at	...	0	1 0.6 per lb.
10 "	...	0	0 7.9 "
15 "	...	0	0 6.0 "
20 "	...	0	0 5.0 "
25 "	...	0	0 4.6 "
30 "	...	0	0 4.2 "

It would now be seen how it is more economical to keep the best doer than the poor milker. Working on similar lines it will be found that the best type of animal, be it buffalo, work animal, sheep or goat, the most profitable is the best 'doer'.

RURAL STUDIES—MADATHUPALAYAM VILLAGE, COIMBATORE DISTRICT

By P. GOPALARATNAM, L. Ag.

Assistant to Cotton Specialist

Madathupalayam is a hamlet situated to the north-west of Avanashi and is separated from it by a large area of cultivated land. As part of the Union, the village is entitled to the conveniences of roads, lighting and sanitary upkeep. The Avanashi tract has itself long been noted for its tobacco crop, and recently it has become the proud home of cambodia cotton under irrigation.

An account of the village which is given below, epitomises the conditions of the inhabitants and the crops in this region.

The extent of this hamlet is a little over 200 acres. The village is a level plain situated in a valley and enjoys fairly copious subterranean water supply. The place is characterised by the presence of red soils of shallow depth which are nowhere deeper than a foot, but are underlain by gravel of varying size, which facilitates free drainage. The shallow depth, however, is corrected by an annual dumping of tank silt, which is a regular feature of the preliminary cultivation of the lands.

The tract enjoys an annual rainfall of about 28", the major portion of which is received during the north-east monsoon. The month of October, in general, records the largest portion of the precipitation. The heat in summer is tempered by occasional showers which, when they fall, contribute to the success of the irrigated crops grown during this season. There are two breaks in the year when no rain falls. The first period starts with January, and the second with June, and these help in the maturing and the harvesting of the crops that are grown.

The dwelling houses number less than a hundred and vary from *pukka* tiled houses to an apology for a hut. The Vellala Gounders are the sons of the soil and form the major portion of the population. The chucklers are

an indispensable adjunct to the Gounders and form the next largest community. An *Andy*, a carpenter, a blacksmith, two barbers and twenty *valyans* bring up the total. There is no potter or washerman attached to the village but they are secured from the neighbourhood. The village does not possess any school to give tuition either by day or night, and the ryots' children go to Avanashi for their education. Very few in the village know to read or write.

The Goundan is self-reliant, thrifty, and minds his own business but generally is indifferent to the adoption of new methods. He raises his crops, and his wife manages the household, and works in the field. A small vegetable garden and a cow or a buffalo are looked after by her. She gathers the harvest, disposes of the vegetables, milk, butter and ghee at the shandy near or, in case of demand, at her own house. With the money realized, and supplementing, at will, the income which her husband gets from the crops he raises, she maintains the whole family.

The chucklers are dependents on the Gounders and individual families get attached to each holding. The men serve the cultivators throughout the year while their women occasionally render help in odd works on the farm. The *Andy* is the village priest. He daily worships in the village temple. He also does pooja at the shrines in the several farmsteads. Further he has to meet the daily requirements of plate-leaves for the Gounder families in the village, for which he gets 48 *vallams* (two m. m.) of grain annually from each family. The carpenter mends the wooden ploughs and attends to repairs of mhote pulleys, frames and other odd jobs for which he is paid at two *vallams* of grain for each mhote or a pair of animals working in a year. The smith repairs and renews all the worn-out iron parts of implements and in return gets 20 *vallams* of grain from each farm. The wood and iron materials however are supplied by the land-owner. The *valayan* keeps ward and watch in each garden area but takes no further part in its activities. His remuneration is 8 *vallams* of grain and one goat or sheep every year, but is however obliged to make good, at his own cost, the value of any property lost. The *chuckli* is the *mamool* distributor of water when the mhote is working and does sundry other pieces of work including the stitching and mending of leather buckets, ropes, etc., for which alone he is paid extra.

Crops.—The two chief money crops of this village are cambodia cotton (*Gossypium hirsutum*), and tobacco (*Nicotiana tabacum*). The grain crops, which are next in importance, are ragi (*Eleusine cordana*), and cholam (*Sorghum vulgare*). A smaller area is occasionally put down to cumlu, (*Pennisetum typhoideum*) tenai (*Setaria italica*) and pulimanji (*Hibiscus cannabinus*).

Gardenland.—The area under this class of land which is all irrigated from wells is 120 acres and is distributed amongst 57 cultivators. There are two ryots holding 30–40 acres each, while the rest of the land is owned by others. Instances of 8–12 partners for a single acre are not wanting. There exist two dozen wells, some are fitted with two mhotes and some with three. An appreciable portion of this area is raised with dry crops or even with paddy (*Oryza sativa*) in the rainy weather. Two-thirds of the area is on an average put down to ragi or cotton in each holding, while cholam and other crops occupy the rest of the area.

Cambodia is raised from October to May and is followed by ragi. This in turn may be succeeded by a tobacco crop or by cambodia itself. If the succeeding crop is tobacco it is immediately followed by cholam and ragi without any rest for the land. The growing of tobacco permits a cereal like cholam being cultivated in the interval between tobacco and ragi.

In every holding there are a few cocoanut trees and palmyrahs which meet the needs of the household and are also tapped largely.

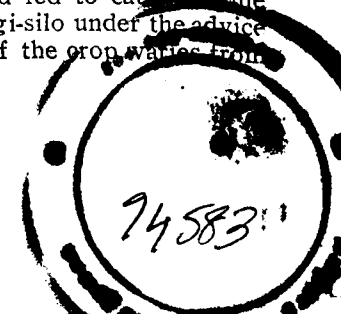
Dryland.—Dry crops in this village are not of great importance except for a large number of types of cholam each of which is a favourite with a particular ryot. As many as ten types of cholam are raised in this locality. Cholam is often sown mixed with one pulse or another, viz., horse-gram (*Dolichus biflorus*), green-gram (*Phaseolus mungo*), and black-gram chiefly (*Phaseolus mungo var. Radiatus*, Hook). Pulses are also cultivated as pure crops in long narrow strips. The area of dry land is 85 acres and the soils are red, and are about 8-10 inches deep with a layer of *kankar* underneath. White babul (*Acacia leucophloea*) is the only tree found thriving best in the soil.

Cropping.—**Cotton.** Cotton is of recent introduction in the gardenland area of the village. Mr. Vittaldas Sait of Tiruppur, a big dealer in cotton, is reported to have brought cambodia seed from the South and distributed it to a few cultivators some 15 years ago. From this small beginning cotton has made much progress, displacing the wheat crop which was a favourite for several decades. Cambodia crop has adapted itself to the local conditions and the quality of the crop has so much improved that the cotton of the tract has acquired a distinct reputation to be called by a special trade name 'Tiruppur cambodia'. The crop follows ragi which is very well manured. After the harvest of ragi, the cotton seeds are sown broadcast and covered by ploughing and cross-ploughing with the country plough. If, on the other hand, it does not immediately follow another crop, the land receives rest for 10-12 weeks. Two or three ploughings are given at intervals and the seeds are broadcast as before and covered. It is the experience of the local ryots that ploughing the land in the dry state does harm to the crop raised, up to an extent of 15 per cent. In the absence of any rain at the time of sowing, every ryot makes it a point to irrigate the land before commencing the preliminary cultivation. The seed rate varies from 30-50 lb. an acre and the high seed rate seems to have been fixed upon for the reason that any chance for failure will create blanks which cannot be advisedly filled up later. The seeds sown germinate fairly well and finish up in a week's time. The number of irrigations depends upon the kind of soil and the prevailing climatic conditions of the place, but are generally more than in any other part of this District. The crop grows luxuriantly and by about the beginning of January commences to produce flowers. The picking of kapas commences from about the end of February and the final picking comes off somewhere about the first week of June. The average acre yield is 1,000 lb. The major pests such as stem weevil (*Pemphres affinis*) and spotted boll worm (*Earias*) have their toll, as is the case in any other cotton-growing area. Unlike for other crops, wages for collecting kapas are paid in cash and the rate for an adult woman varies from 3 to 4 as. a day. The quantity of kapas collected per head ranges from 20 to 50 lb. per day depending upon the age of the crop and the skill of the picker. As the kapas is collected the produce is stored and disposed of to local dealers who transport

it to the Cotton market at Tiruppur where the whole produce is auctioned at regulated conditions. The rate per *Pothi* of 260 lb. of kapas is a variable factor and the present rate stands at Rs. 28. The expenditure on the crop averages about Rs. 30 per acre excluding irrigation charges which come to a little over Rs. 25. The very high cost of cultivation is due to hand-weeding necessary in the earlier stage of the crop. A major portion of the cotton area at Madathupalayam has been brought under seed-farms by the Agricultural Department, and the whole management was transferred to the Co-operative Department last year. It is a noteworthy practice in this village that annually the fences are repaired just before picking commences for the season. During the cotton season the cultivator and the permanent coolies watch the crop during the night, by taking turns.

Tobacco.—The other money crop is tobacco. It is, as already said, grown after ragi. Seedlings are raised in a nursery specially prepared for the purpose and planted in October when two months old. After the harvest of ragi, well-to-do ryots pen sheep at 2,000-3,000 per acre, plough, prepare the land and form beds after which the seedlings are transplanted about 2 feet apart. The practice of planting tobacco seedlings in ragi stubble does not obtain in the village. The varieties grown are locally known as *Yerumaikappal* and *Barakappal*. They are respectively long-and-narrow and broad-leaved types. Both the types are chiefly used for chewing purposes. The crop requires greater attention than the other crops from the time of planting right up to the day of disposal of produce. Irrigations are given frequently so as to keep the soil free of cracks. The crop is cut in the evening, allowed to lie in the field overnight. In the morning the cut plants are gathered into small heaps and left for a day when they are stripped and dried in the sun and shade for about 3 weeks. 750-1,000 lb. of cured leaf is on an average obtained from an acre. The value of the cured leaf varies from Rs. 150-200 per Baram of 500 lbs. (local unit). In cases where the crop does not receive any manure directly, it is benefited by the residual effect of the heavy application of manures to the preceding crop of ragi. The belief is strongly held that tobacco should not succeed cholam. Apart from the parasite *Bodu*, the crop is in some years badly infested with plant-lice, when the spraying of contact poisons like tobacco decoction seems to have some beneficial effect.

Ragi.—In order of importance ragi comes next and is mainly used for consumption. This receives careful attention from the cultivator. Land is very well prepared and all the available manure such as tank silt, village rubbish, cattle manure, is applied and in addition sheep also are penned whenever available and possible. Nurseries are prepared at intervals and the seedlings are planted when 3 to 4 weeks old, from about the middle of June till the end of July at intervals of a week, so that the crop might be economically raised and may escape the downpour of rain in October. (The cropping is so adjusted that the latest crop of ragi will be harvested before October.) It seems peculiar in this village that the disbursement of the wages for this crop which are always paid in kind, is deferred until after it is harvested. The ragi stalks are dried, stacked and fed to cattle in due course of time. Of late, some ryots are preparing ragi-silo under the advice of the local agricultural demonstrators. The yield of the crop varies from 1,500 to 2,000 lb. grain per acre.



Cholam.—Summer cholam occupies about 50 acres every year. It follows tobacco or seasonal cholam and is sown broadcast and covered with country plough. In this village manure is not applied to cholam for the following two reasons, viz., the insufficiency of manure, and the practice of applying it in heavy doses to the ragi crop. The thinnings of cholam are not wasted but when available are used for transplanting in the gaps. It is the common and time-honoured custom for poor cultivators to resort to the system of collecting the thinnings from the neighbouring rich ryots and plant them in their own so as to save the cost of seed. The two varieties grown during the season are yellow and white-grained. The white gives a greater output per acre and occupies a larger area. This cereal is sown rather thick with a view to obtain thin stalks for feeding purposes. The crop comes to harvest in July. The acre yield varies from 1,000–1,200 lbs. of grain and about a ton of straw.

Paddy.—In years of good rainfall, raising the paddy crop in garden land is in vogue. The varieties grown are *Anaikomban* and *Samba*. Nurseries are raised in July or August and the seedlings transplanted in September or October. The seed rate is 10 *vallams* to transplant an acre, and the seedlings are planted in bunches. Yield varies from 2,300–3,000 lb. (about 15–20 *salagais*) of paddy and 2–3 cartloads of straw.

Details of cost of cultivation of the five crops treated above are found in the annexure.

Usually labour is paid in kind and a man gets one *vallam* a day and a woman $\frac{3}{4}$ *vallam*. Juveniles get half the quantities of their respected adults. During cotton season, wages are invariably paid in cash 4 as. a man, 3 as. a woman. In respect of labour the village is self-contained.

The cattle of the village are either Kangayams or *Natu-madu* (local breed). A pair is required to manage a unit area of $2\frac{1}{2}$ acres garden and 6 acres dry land as the cultivation in garden land is rather intensive. Groundnut cake and cotton seed are given to milking animals, and as for the quantity there is no hard and fast rule, but these rations are regulated by the quantity of milk obtained. Besides, cows and one or two she-buffaloes are also maintained by each ryot. Each cultivator owns a flock of sheep and a few goats which he pens in his field.

Assessment in the village varies from Rs. 1-2-0 to Rs. 1-11-0 per acre.

In the case of absentee landlords the land is either leased or given on *varam*. The lease amount varies from Rs. 50–100 per acre, and if given on *varam*, 50 per cent of the gross receipts is realized. In either case the assessment is borne by the landlord. The owner has to finance his tenant for the purchase of cattle, and the capital which along with the interest is recovered in yearly instalments. At the present day the *varam* system alone is paying to the tenants, as the prices have considerably fallen. For any reason, the cotton crop is let on lease, the tenant has to pay cash which varies from Rs. 60–80 per acre, depending on the quality of the soil.

The price of garden land ranges from Rs. 750–1,000 and that of dry land from Rs. 350–500 per acre.

My thanks are tendered to the Cotton Specialist, M. R. Ry. V. Ramanatha Ayyar Avl., for kindly deputing me to Avanashi for a period of eight months to conduct the experiment on the time of sowing cotton, which facilitated my enquiry into the conditions of the village.

ANNEXURE

COST OF CULTIVATION OF CROPS PER ACRE.

Cambodia (irrigated)

	Rs.	A.	P.
Carting tank silt 30 cartloads (5 pairs and 5 men) ...	6	4	0
Ploughing with country plough (2 pairs and 2 men) ...	2	8	0
Cost of cotton-seed $1\frac{1}{2}$ maunds at Rs. 1-8-0 a maund ...	2	4	0
Sowing seed by broadcasting ($\frac{1}{4}$ man) ...	0	1	0
Covering the seed with country plough and marking beds (1 pair and $\frac{1}{4}$ man) ...	1	9	0
Forming beds and levelling (6 men) ...	1	8	0
Hand-weeding twice (30 men) ...	7	8	0
Hoeing (6 women) ...	1	2	0
Mammuty hoeings two (14 men) ...	3	8	0
Irrigations 10 (20 pairs and 20 men) ...	25	0	0
Guiding water (10 men) ...	2	8	0
Picking kapas (20 women) ...	3	12	0
Total ...	57	8	0

Tobacco.

Ploughing and cross-ploughing (4 pairs and 4 men) ...	5	0	0
Cost of penning sheep (2,000–3,000 sheep) ...	15	0	0
Covering the manure by ploughing and marking beds (2 pairs and $2\frac{1}{4}$ men) ...	2	13	0
Forming beds and levelling (6 men) ...	1	8	0
Cost of tobacco seedlings required ...	6	8	0
Supplying and transplanting seedlings (4 men and 2 women) ...	1	6	0
Hand-watering twice (8 men) ...	2	0	0
Total irrigations 12 (24 pairs and 24 men) ...	30	0	0
Guiding water (12 men) ...	3	0	0
Topping and suckering four times (4 men) ...	1	0	0
Cutting plants and heaping (4 men and 1 woman) ...	1	3	0
Labour for curing (15 men) ...	3	12	0
Total ...	73	2	0

326

	Rs.	A.	P.	
C. Ragi.				
Ploughing with country plough twice (4 pairs and 4 men) ...	5	0	0	It
Carting tank-silt 60 cartloads (10 pairs and 10 men) ...	12	8	0	ered
Covering manure by cross ploughing and marking beds (2½ pairs and 2½ men) ...	2	13	0	for
Forming beds and levelling (6 men) ...	1	8	0	rice
Cost of ragi seedlings required ...	3	0	0	are
Transplanting:—				f is
Irrigation (3 pairs, 3 men and 1 man to guide water) ...	4	0	0	the
For supplying seedlings and transplanting (10 women) ...	1	14	0	nd
Hand-weeding and hoeing (12 women) ...	2	4	0	es
Mammuty-hoeing (8 men) ...	2	0	0	a
Later waterings 7 (14 pairs and 14 men) ...	17	8	0	n
Guiding water (7 men) ...	1	12	0	e
Harvesting ear-heads and carrying (8 women) ...	1	8	0	
Cutting ragi-stalks, drying and stacking (6 men) ...	1	8	0	
Thrashing ear-heads and storing (2 pairs; 2 men and 1 boy). ...	2	10	0	
Winnowing of grain (2 men) ...	0	8	0	
Total ...	60	5	0	
D. Cholam (irrigated)				
Moistening the field (3 pairs; 3 men and 1 man to guide water) ...	4	0	0	
Ploughing with country plough (2 pairs and 2 men) ...	2	8	0	
Cost of 16 lbs. of cholam seed ...	1	0	0	
Labour for broadcasting seed (½ man) ...	0	0	6	
Covering the seed by ploughing and marking beds (2 pairs and 2 men) ...	2	8	0	
Forming beds and levelling (6 men) ...	1	8	0	
Hoeings two (12 women) ...	2	4	0	
Irrigations 4 (8 pairs and 8 men) ...	10	0	0	
Guiding water (4 men) ...	1	0	0	al
Scaring birds (1 boy for 2 months) ...	6	0	0	and
Harvesting (4 women and 6 women to cut ear-heads and 2 for carrying) ...	2	4	0	ive,
Thrashing and cleaning (2 pairs, 4 men and 2 women) ...	3	6	0	for
Total ...	36	6	0	d by
E. Paddy (under wells):—				lop
Ploughing in puddle (4 pairs and 4 men) ...	5	0	0	
Levelling (½ pair and ½ man) ...	0	10	0	
Cost of seedlings required ...	5	0	0	
Supplying seedlings and transplanting (8 women) ...	1	8	0	
Hand-weeding twice (8 women) ...	1	8	0	
Waterings 15 (30 pairs and 30 men) ...	37	8	0	
Cutting the crop and carrying (6 women, 2 men and 2 boys). ...	1	14	0	
Thrashing and cleaning (2 pairs, 2 men, 3 women and 1 boy) ...	3	3	0	a
Total ...	56	3	0	

RATES OF THE LOCALITY.

1 pair and 1 driver	...	...	Rs. 1-4-0 per day.
1 man	...	...	" 0-4-0 "
1 woman	...	...	" 0-3-0 "
1 Boy	...	...	" 0-2-0 "

N.B.—Excepting for cotton, labour is always paid in kind and the corresponding money equivalents are given in all the above cases.

NOTES ON SUGARCANE CULTIVATION IN HOSPET

By M. V. RAGHAVA RAO, L. Ag.

District Agricultural Officer, Kurnool.

Introductory.—On account of the rapid and continued fall in prices of almost all commodities any suggestion which aims at a reduction in the cost of production of the crops should be welcome to the ryot. In the following lines an attempt is made to describe the cultivation of sugarcane, an important crop in the Hospet taluk on simple yet scientific lines, and also to indicate how an appreciable saving could be effected in the initial stages.

In the Hospet taluk under the Tungabhadra channels ryots leave a portion of their sugarcane crop unharvested as 'stand-overs' for seed purposes, as the tendency of the ryot there, is to repeat a crop year after year on the same land. It is known that the top portions of canes, which are usually removed and thrown into the manure pit or fed to cattle, make excellent material for seed purposes. Generally the ryot experiences difficulty in getting all his cane crushed in time, to prepare his land for the next crop, be it the same crop or a different one. If he would only preserve the top portions from each of which two setts are easily got, then this difficulty is overcome.

Method of preservation of tops.—The tops should be spread in two or three layers under the shade of a tree on a bedding of wet paddy straw or cane trash and carefully covered over with the same material. The covering should be kept moist by sprinkling water on it once or twice during the day. At the end of a week or ten days these tops are ready for planting. The interval of 10 to 12 days during which these cane tops retain their vitality should be enough for the ryot to complete the crushing of his canes and devote his attention to the raising of nurseries therefrom.

Method of raising nurseries.—The land intended for raising nurseries should be forked well and beds of 3' x 4' with alternate channels should be formed and a dose of cattle manure applied. As sugarcane is a twelve-month crop and responds best to a liberal application of manure and a copious supply of water, the latter helped by good drainage, 50 cartloads of well-rotten cattle manure should be applied per acre. Then the setts are spread in the beds so that they touch one another and when the bed is full water is to be sprinkled liberally and the setts covered with about 2 inches of earth which should be made moist by sprinkling water over it gently but liberally. After two days, the field should be irrigated by allowing water to

flow into the beds very slowly but at the same time taking care that it permeates every bit of the bed. The second irrigation may be given after the next 6 days after which the field should be irrigated regularly once a week. Germination is perceptible from a week to a fortnight and the seedlings should be transplanted within three months. This period is about the maximum period during which seedlings should be transplanted; because experience has shown that the longer the seedlings are kept in the nurseries the greater are the percentages of loss in the field. The best period for transplanting seedling is between the ages of one and two months.

Method of transplanting.—Just before transplanting commences, furrows should be formed on the land just sufficient to accommodate the setts. Before the plants are removed the nursery should be well irrigated, so that the hold of the soil on the roots of the plants may be slackened, all the leaves, except the top young involute leaf, should be clipped with scissors or secateurs leaving about 1 to 1½ inches of leaf surface on the plant. Then the plants should be removed from the nurseries carefully with a trowel, and packed in baskets. Transplanting should be done with care and with the least injury possible to the roots. After inserting the plants into the furrows which received irrigation previously they should be covered with earth. Then another slow irrigation should be given to the furrows to help the plants to keep in position.

The second irrigation which should be liberal is given on the third day after transplantation and subsequent irrigations may be given regularly once every week. In about 10 days the plants will establish themselves. Generally there will be 5 to 10 % failures, depending on the care bestowed on the job. Under the conditions prevailing at Hospet 10 cents of land could be transplanted with seedlings raised on a cent of nursery. Needless to say that the nearer the field is to the nursery, the greater will be the saving in labour and loss.

The other improvements recommended are:—

(i) *Use of trench system to plant canes.*—The canes are generally planted in shallow trenches and as the canes grow the trenches are obliterated; otherwise when the plant grows tall and heavy it will not have enough anchorage to stand erect. After every irrigation or rain the plant will have a tendency either to topple over completely or to lean on one side due to heavy weight at the top unless it is propped. In so doing some of the roots will be broken and the growth is arrested or at any rate interfered with to some extent. On account of this, during the later stages such plants will vary in maturity and thus the quality of jaggery is impaired.

(ii) *Use of labour-saving implements.*—In Hospet taluk there is no regular hoeing and weeding. In the early stages, only partial weeding is done and people do not pay any attention to hoeing. By hoeing and weeding they can at least increase their crop by 10 per cent. For want of hoeing and weeding many of the cane plants die during the early stages especially in places where there is scarcity of water. In addition hoeing results in saving in the number of irrigations. For hoeing their crops they can use the Planet Junior hand-hoe and weeder if they are to work the implement from the beginning of the crop. With this implement, if the

soil conditions are favourable an active man can finish hoeing of about 80 cents in an 8-hour day without much trouble.

The last but not the least suggestion is to improve the method of making jaggery. The improvements suggested are (1) milling of fresh mature canes to extract juice, (2) boiling of juice as quickly as possible without further addition of fresh juice to half-boiled juice, (3) removal of scum to purify the jaggery and to get good colour and (4) boiling in level-bottomed pans instead of the usual round bottomed pans in use.

SUNN-HEMP

IN THE NORTHERN TALUKS OF GANJAM

By M. GOPAL RAO

Assistant Agricultural Demonstrator, Berhampore

Introductory.—Sunn-hemp (*Crotalaria juncea*) has been under cultivation in the northern taluks of Ganjam from very early times. There is a considerable export of the fibre to foreign countries under the name Gopalpur hemp. The cultivation of this crop is in the hands of 'kevtus' or fishermen, other castes being prohibited by custom from growing it, though when the prices were tempting, others also occasionally took to its cultivation. Ghumsur, Aska and Chatrapur taluks and the estates of Kallikota and Atagada are the chief growing centres, the first of these being known to supply fibre of the best quality.

Varieties.—Two varieties are commonly grown, viz., 'sanno choni,' a local variety of 2½ months duration, and 'boddo choni', a Sambalpur variety of 3 to 3½ months' duration. The fibre of the latter is longer and whiter than that of the former, though coarser and weaker. The outturn, however, is larger.

Soil.—Light and well-drained soils in both dry and wet lands are sown to the crop but during years of high prices and good demand heavier soils are also sown. The produce of the lighter soil is fine, white and strong while that of the heavier soils is coarse, dull white and less strong.

Rotation.—On dry lands, sunn-hemp (usually sown in June), is followed by ragi, chillies or sweet-potatoes. On wet lands it is followed by paddy, which is itself followed by a pulse crop. The sowing is usually done earlier on wet lands, the local variety being usually chosen to facilitate an early harvest. Where transplanting of paddy is in vogue, as in parts of the Chatrapur taluk, but under a precarious irrigation source, and where the crop is liable to the grasshopper pest, the introduction of this crop will help the ryot in mitigating his losses.

Preparation of the land.—Two ploughings are usually given between March and May. Good surface tilth is considered sufficient, deep ploughing being deemed unsuitable. The H. M. Guntaka No. 1 will be therefore a suitable implement for preparing the land for this crop.

Manuring.—Eight to ten cartloads of cattle manure are usually applied. Heavier manuring is considered detrimental as it may induce rank growth and lodging.

Seed supply.—The seed of 'sanno choni' is produced locally, only the excess of requirements reaching the markets. The seed of the Sambalpur variety is obtained from Orissa and stocked for sale by merchants at Purushothapur and other places, local production not having been found generally feasible owing to the pods often dropping down before the seed matures, probably due to the effects of heavy rains. Owing to fluctuations in the area sown to this variety, the merchants find it difficult to adjust their stocks to the demand, which is very often over or under their expectations.

Sowing.—The seed is generally broadcast at 60-75 lbs. per acre according to the fertility of the soil. The seed is covered by ploughing twice and drawing a levelling board to compact the soil.

After cultivation.—No weeding or hoeing is done as the crop is sown thick and does not allow weeds to grow.

Pests and diseases.—The only pest of importance on this is the leaf-eating caterpillar (*Ulethesia pulchella*), but as the growth of the crop is generally vigorous at the time it is usually grown, it is not generally damaged to any large extent. This pest however often causes considerable damage to the pods.

Harvest.—The crop flowers when about 4 feet high, within about 6 weeks after sowing, in the case of the local variety. The pods ripen in about 6 weeks more. The crop is generally harvested when the pods are fully ripe, in the middle of September in the case of the local variety, and early in October in the case of the Sambalpur variety, the crops being about 6 and 7 ft. high, respectively, at this time. If the bearing is not satisfactory the crop is harvested somewhat earlier. The best colour and fineness of fibre are obtained when the crop is harvested before the seed sets, but the fibre is weak. The best combination of fineness, colour and strength is obtained when the seed is set but before the seed is quite ripe. When the seed is ripe the fibre loses its colour and fineness, but gets stronger.

When allowed to seed, the crop is pulled out and the pod-bearing portions severed and collected into gunnies and threshed. The seed is then dried and mixed with ashes and preserved in straw bundles. The remaining portions of the plant are made into small bundles about 3 lbs. each in weight. The bottom portions of the plants in the small bundles are removed to a length of about 1" and bigger bundles are made each consisting of 16 small bundles. These big bundles are then retted and fibre extracted.

Retting and extraction of fibre.—The retting is done in tanks or other places where clean water is available. The bundles of green stems are first stooked in groups of three with the lower one-third under water for a day and then laid flat on water and weighted down with lumps of earth for four nights. On the next day the bundles are taken out and each small bundle is beaten against water, with both the hands about three times, this being done from both ends of each bundle. Some of the green matter is thus removed. This is followed by rubbing each bundle (held in the left hand) with the right hand, and thus, further cleaning and washing of the stalks are done. Then the bundles are held at the bottom end between the thumb and the next finger and worked in water with a reciprocatory motion and the fibre thus separated from the stalks at the bottom up to a foot. The stalks are then stooked on the ground with bottom ends upwards, and allowed to dry partially.

The bundles are then taken up and broken at nearly half the length and placing each individual bundle between the knees the retter separates and strips the fibre from the lower end (top-side) and also removes the stalks which come off to the point at which they were broken. Then grasping the fibre close to the remaining portion of the stalks the bundles are heavily shaken with the result that these fall off automatically, thus liberating the hanks of fibre. The separated hanks of fibre thus obtained are hung up for a day either in the direct sun or underroof, according to the weather. After drying, the fibre is freed of dirt by vigorous shaking. The produce is now ready for the market.

Particulars of cost of cultivation (local variety) are noted below :—

Particulars of operations	Expenditure when labour is valued	Cash expenditure	Remarks
	RS. A. P.	RS. A. P.	
Ploughing, 4 pairs of cattle and 4 men	4 0 0	...	...
Levelling, 1 pair and 1 man	1 0 0	...	...
Manuring, 8 carts farm-yard manure.	4 0 0	...	...
Seed, 60 lbs. @ 1½ annas a lb.	5 10 0	...	...
Covering by ploughing twice drawing a levelling board, 3 pairs and 3 men	3 0 0	...	...
Harvest, bundling, carting, etc., 20 men @ 5 annas	6 4 0	3 2 0	The ryot does part of the work himself.
Retting and extraction of fibre, 20 men @ 5 annas	6 4 0	3 2 0	...
Rent on land	25 0 0	25 0 0	Rs. 35-0-0 per acre is paid, but as another crop is also raised, only Rs. 25 are charged to this crop.
Total	55 2 0	31 4 0	

Yield.—About 750 lbs. of fibre may be expected and, at Rs. 50 per candy of 500 lb., it is worth Rs. 75. The net profit in case the whole labour is valued will be about Rs. 20 and, when only the cash expenditure is taken into account, it will be about Rs. 44. In the case of the Sambalpur variety also the same figures hold good except that, on account of the seed having to be purchased at a cost of Rs. 6, the net profits are reduced by this amount.

Marketing.—There is a limited demand for the fibre locally for agricultural purposes and fishing nets. Most of the fibre, however, is exported to foreign countries, the centre of trade being Gopalpur. Messrs. Gordon, Woodroffe & Co. and Rally & Co. are the chief dealers. The ryot sells

the stuff to middlemen who often make advances to them and therefore dictate their own prices for delivery at Gopalpur to the agents of the firms named above. Here it is hackled further by hand, cleaned and pressed into small bundles of 200 pounds. Sometimes, when the market is dull, the ryots are obliged to take the fibre to Gopalpur for want of a middleman to purchase the stuff, and in this case he has to pay a godown rent to the agent. From Gopalpur the small bales are conveyed to Vizianagaram or Cocanada by train, via Jagannadhapuram the nearest railway station. At the above two places, the smaller bales are further pressed into bigger ones and exported to foreign countries. Though the fibre is thus not exported from Gopalpur direct as it once used to be, and has to be again taken to Jagannadhapur railway station, the whole produce goes there first, as the firms have their godowns and presses there. The total average quantity of fibre pressed and sent out from Gopalpur for the last 10 years is estimated as 1,500 candies of 500 pounds each per annum.

Conclusion.—From the figures given above, sunnhemp may be said to be a fairly remunerative crop under normal market conditions considering the ease with which it can be grown. Sunnhemp fibre compares favourably with other fibres, and no other country appears to compete with India in its production. It is therefore one of the crops which may with advantage be encouraged, of course, with such improvements as may be possible, to make the commodity more easily marketable. As sunnhemp is also a good green manure or fodder crop, it can be used as such in case there is no demand for the fibre. It is very sparing in its demand on the soil and is, in fact, one of the best of recuperative crops.

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Notes and Comments

Production of Paddy in the Madras Presidency.—A note in a recent issue of the *Hindu* states that investigations by the Bureau of Statistics show that the production of paddy in the Presidency is below its requirements.

A Land Mortgage Bank for Travancore.—In commemoration of the assumption of ruling powers over the State of Travancore, His Highness the Maharaja of Travancore was graciously pleased to grant one lakh of rupees as nucleus for the formation of a Land Mortgage Bank for Travancore.

Agricultural Education.—We understand from a note in the *Madras Mail* that the Government of Madras have not accepted the recommendation of the Committee for the selection of students for the Agricultural College, Coimbatore, to increase the number of students to be admitted into the College. The Government have, however, accepted the recommendation of the Director of Agriculture to institute short courses on a number of subjects like farm management, dairying, plant pathology, malting, manures and their uses, and crop improvement.

Dr. Bernard A. Keen.—It is learnt with great regret that Dr. Keen has relinquished charge of the Directorship of the Agricultural Research Institute, Pusa, and sailed for England in the middle of November. Dr. Keen is an agricultural scientist of great reputation and it is a great misfortune that Indian Agricultural Science should lose his inspiring personality and the benefit of his direction and advice in agricultural research.

Should the agricultural graduate go back to the land?—Mr. C. S. Krishnaswami initiated on the 23rd November a debate on the question 'Should the agricultural graduate go back to the land?' This question is of great practical interest not only to the students of agricultural colleges and their parents and guardians but also to the country at large. It has added interest at the present moment owing to the inability of the agricultural department to absorb into it most of the graduates turned out by its Agricultural College, and the closing of other avenues of Government employment. Mr. Krishnaswami was, therefore, none too soon in focussing attention on this topic and in discussing the issues involved. His well-thought-out paper was followed by a lively discussion in which the officers of the department and the students in session at the College took part. A striking and hopeful feature was the optimistic note struck by some of the present students in discussing the future of the new agricultural graduates, to whom the chances of Government employment, for the present at any rate, are very poor. Mr. Krishnaswami discussed the question under three main heads: (1) Is the agricultural graduate going back to the land? (2) Will he go back to the land? (3) Should he go back to the land? His answer for the first two questions was in the negative. So far all agree with him. In answer to the third question, he said that the agricultural graduate should not go back to the land, and that he should be employed by the State. Here

most people will find it difficult to agree with him. The agricultural graduate *should* go back to the land. That is not merely an ideal. That is the object in providing a course of agricultural education. Because he has not so far gone to the land or he cannot go back to the land in future it should not be laid down that he should not go back to the land. It is not his fault that he does not take to his own farming; nor is it the fault of the training he has received. He cannot go back to the land because he sees and knows clearly that everything is against him. He cannot command capital at a reasonable interest and in time for his requirements. Transport conditions are not favourable to him. He is not protected from foreign competition. There is no adequate organization for agriculture. These and many other defects must be remedied and inducements placed before him. No other agency but the State can do it. It is not enough if the State provides education and employs him for research and demonstration purposes. The State must help him in going to the land and thriving there.

Rice as food.—Many people are under the impression that rice is an inferior cereal as food. It is not so. D. D. Van Slyke and his associates have investigated the proteins of rice. They find that *oryzenin* the chief protein of rice resembles in its general amino-acid make up, the proteins of animal tissues and egg albumin in a much higher degree than do the proteins of wheat or maize. They are, therefore, of the opinion that this explains the extensive and exclusive use of rice diet throughout the Orient in spite of its low protein content. Compared to wheat, rice is considered inferior because of the high polish given to the latter and the consequent loss of vitamins and mineral matter.

Gleanings

A new Cultivator which ploughs, cultivates and harrows in one operation.—Messrs. Howards' (England) 'Austral' rotary cultivator consists of a number of L-shaped blades rotated by power taken directly from the engine of a tractor. The blades pulverise the soil with great thoroughness and it is claimed that at one operation the implement performs the work of plough, cultivator and harrow. The drive is taken from the power take-off of the tractor to the cultivator blades, which as they force their way through the soil, press the tractor forwards, helping to propel it. With its forward drive it is suitable for loose or hill land, and the machine can be backed for working in awkward places. The cultivator is attached rigidly to the tractor, thus enabling it to be turned in an extremely short radius. —*The Farmer and Stock Breeder*, October 12, 1931.

Demonstration of Harvester-Threshers.—A demonstration of harvester-threshers (the combine) was carried out in the last week of August, 1931, in Peterborough, England. The land is a heavy clay, with some fairly stiff gradients, and it was recorded, notwithstanding a heavy rainfall immediately preceding the demonstration, that all the machines worked satisfactorily and without stoppages. Indeed, in one field of badly-laid oats, the harvester-thresher was used with good effect after an attempt to harvest with binders had been abandoned. The greater part of the work done was what is known as 'straight combining', the corn being cut, threshed and bagged in one operation, with a rate of progress of about *two acres per hour*.

During the demonstrations, the grain, as it came from the machines, was loaded on to lorries and taken direct from the field to the drying apparatus at the mill. One parcel was, however, taken by the purchaser without being artificially dried.—*The Journal of the Ministry of Agriculture*, October, 1931.

The Cotton Plant, a new source of Rayon (Artificial silk).—Once the wealthiest class of American citizens, the cotton grower in America is now faced with unprecedented fall in prices, and many a cotton crop has not been harvested last season. The extensive manufacture, use and popularisation of rayon has been partly responsible for this. But it will be a surprise to learn that where rayon has been the rival of cotton in the past, it now promises to be the rescuer of it. In a series of experiments directed by the University of North Carolina last year and still in progress, it has been found that the entire cotton plant is capable of utilisation in the manufacture of rayon. The experiments give promise of an output of cellulose costing only about one-twentieth of what it now costs to supply that material from lint alone which has been used to some extent to produce the cellulose from which rayon is manufactured. The vast bulk of rayon made in U.S.A. is from wood pulp. The process, briefly described, is to extract the pulp or cellulose, by means of a chemical treatment which dissolves out the lignin, fats, resins and other materials, then to treat the cellulose with other chemical agents—the principal one being sodium hydroxide—and finally to force the resulting viscous substance through exceedingly fine perforations somewhat like those of a sprinkler. Tiny threads emerge, which are dried and then resemble silk in appearance and often it is so difficult to distinguish them from the latter. These threads are then woven into rayon fabrics.

The supply of wood pulp, from spruce, though abundant at present, cannot be relied upon in the future as the industry advances, and therefore the possibility of utilising cotton plant at a low cost is a great achievement and the problem of having an adequate supply of raw material has been permanently settled. This would appear to be a boon to the cotton growers in these days of low prices, and the expenses involved in picking are saved.

For the rayon industry, the whole plant is cut like hay and all the plant, stalk, lint, seed, etc., except the roots, is utilised. The mass in its entirety is available for conversion into its constituent substances, of which the main one is cellulose. However, the seed, which is valuable otherwise for its oil, has to be removed. This is done by putting into the gin the entire cotton plant and the seeds are removed. The lint obtained is of course mixed with much of the trash and dirt, but then the whole mass without the seed, is put into the pulp mill and the process continued.

It is said that from a broadcast crop about 5,000 lbs. of crop will be available for the process, and from this the cellulose yield may be about 3,250 lbs. For production of a crop for rayon manufacture, a thick crop can be grown without practically any intercultivation. That would mean a great saving in the cost of cultivation. The harvest will be done by machines and the whole plant will be baled and sent to the factory. The rayon industry is, therefore, likely to revolutionise the growing and marketing of cotton in the near future.—*Scientific American*, October, 1931.

Correspondence—Queries and Answers

I. Joint Loans in Rural Co-operative Societies

Mr. V. MATHRUDUTHAM AYYAR, B.A., Melur, Madura District, writes :—

The model by-laws of the primary rural societies are defective in many particulars and need to be improved so as to be fruitful to the members for whom they are intended. One by-law in particular needs urgent improvement. By-law 53 permitting joint loan has been framed with a view to joint action and 53 (3) enables joint agricultural improvement by raising the amount from Rs. 1,000 to Rs. 5,000 for the purchase of manure.

This apparently useful by-law has not been availed of by most of the members. This is because the main object of agricultural improvements has been narrowed down by restricting the purchase to one small item, namely the purchase of manure. Necessary accessories for agricultural improvements are cattle, seeds, manures and implements. Manure costs only a moiety of the entire agricultural needs and the bigger need is cattle for which large sums are borrowed yearly by individual members. Joint cultivation and agricultural improvements can be effected only through the use of improved implements. Hence for 'better farming', the joint loan by-law should facilitate purchase of the above-mentioned four accessories and the restriction of Rs. 1,000 for the additional purposes named should be removed. This should help to improve the object of the society mentioned in by-law 2 (3) from one of 'hiring to the members', to purchase by the members.

In the words of the famous Irish co-operator, Sir Horace Plunkett, 'Co-operation is a means to better farming, better business and better living'. If the Co-operative Credit Society and especially rural credit society is a means to this end, we should try our best to help and provide facilities to the villagers to live a better life also. Most of our villagers are notorious for lack of decent living houses. All the diseases and epidemics that the villagers are subject to are mainly due to this lack. In villages people are crowding into hovels like beasts and birds, and even those who can take pride in a decent house are not free from the constant and devastating scare of fire havoc to their cottages every now and then, which counts as its toll, grains, moveables and sometimes also cattle. If the villagers should live a decent life, well-built houses with sufficient light and ventilation and free moving space should be provided for them wherein to live and to store up their grains and protect their cattle. In innumerable cases villagers are selling away their harvested crops for lack of safe keeping and hence model by-law 44 (6) permitting crop loans has not met with that amount of success which it is intended to. People have been driven in consequence to purchasing seeds from local merchants with all its limitations, with the result that they reap a poorer harvest.

Enabling them to build good houses instead of mud huts and thatched roofs, would build up their economics by considerably raising their saving capacity and would enable them to lead a better and healthier life. Rural reconstruction would have no meaning without this. Many are the cases of loans obtained for building purposes in rural societies, but if this purpose should also be included in by-law 53 (3) we would be helping the villagers to joint action and joint purchase, thus saving them considerably from middlemen's profits in the purchase of building materials. It would result in the wholesale transformation of houses in villages from dilapidated mud huts to attractive buildings. I suggest therefore that in view of the above reasons, by-law 53 (3) be amended as follows :—

'The total amount of any such joint loan shall not be more than Rs. 1,000 or, in the case of a loan for the purchase of manure, seeds, implements or cattle for agricultural purposes or building materials or either of the above, Rs. 5,000.'

It is hoped that the Registrar of Co-operative Societies who has sound practical experience of villages and villagers, would appreciate the difficulties and deem it necessary to include the above purposes also in the model by-laws of rural co-operative societies, thus making the societies far more useful.

II. The Fate of Prickly-Pear

M. S. writes to us :—

Although the M.A.S.U. Parliament in its session on August 7, 1931 voted against the resolution of Mr. Vellingiri Gounder, it is unfortunate that it did not realise the seriousness of such a hasty step. A problem of such agricultural importance cannot be said to

have been decided by a show of hands at the nick of the moment after being carried away by the oratorical talents of speakers.

Analogies are often misleading, but the simile of the house dog may be stretched a little further and it may be asked 'Are we wise to decide in favour of killing all dogs simply because some of them might have encroached on the liberties of some other people? Where is the alternative to the house dog?'

Could it not be more useful if the resolution could be modified and be made to run thus: 'The entire destruction of prickly-pear is not in the interests of our country' so as to make it possible to retain some amount of it to meet the needs for fencing—say—a few cents for a village? If the pear should encroach further we shall call upon the entomologist for slight help but not *all* help!

The challenge of Mr. Vellingiri Gounder has not been answered, probably not even taken up seriously. The poor landowner or cultivator does want a fence, which should not admit any trespass, but at the same time, not encroach on his own land, and it should be within his own means. Before an alternative is suggested and actually *demonstrated* to be useful, is it wise to remove from the hands of the cultivator a 'costless' fence?

Let our Entomologist think of another parasite to keep the cochineal insect in control and not allow it to complete the destruction. Let the Chemist think of some poisonous spray which keeps down the reproductive rate of the population. Or let another breeding expert rise up to evolve a type of prickly-pear with no spreading habit, but probably with a tendency to grow taller, if need be a pear with less spines, but still with spines enough to prevent trespass. Let the breeder make the fruit spineless for utilising the same as food. The Chemist might investigate why and how the prickly-pear renders the soil more fertile? Could it be that it has a deeper root system or it feeds on salts? Or after all is it due to the accumulations of night-soil and other fermentable rubbish?

A wiser thing might have been to appoint a strong committee consisting of the Entomologist, the Chemist, Mr. Gowder and a breeder of wide reputation, to go thoroughly into the question and report in another session of the Parliament.

It is time that the Department do take immediate steps to experiment on alternative fencing materials, live or dead, to replace the fast-disappearing prickly-pear!

All is not lost! While there is still some of the prickly-pear existing, it is possible either to keep its enemy in check or nurture a portion of it separately to be able to supply to the cultivator probably as freely as it is now being done along with the insects.

Dr. T. V. Ramakrishna Ayyar, Entomologist, replies as follows :

I am sorry there are no very serious points in this letter to require any reply. If your correspondent has not understood my comparison, it was to this effect, viz., that of muzzling a single dog—the rabid and destructive prickly-pear which has grown terribly out of control and become a regular public nuisance and a menace to the country. I did not advocate the killing of all dogs but only the rabid dog which has become a terrible menace. If the comparison conveyed a different meaning I am indeed very sorry. In their activities parasites are as good as the cochineal insect itself and they do not know how much or how far man wishes to be helped; their work is wholesale unless care is taken. So there is no point in speaking of parasites. The suggestions to the chemist, breeder or the entomologist are all excellent and high sounding. I dare say such suggestions would not have been made if the writer has perused the valuable reports of the various investigations of the Australian Prickly-pear Commission.

The voting was done on the proposition before the house and not on any imaginary one. I would be the first to vote for such a proposition as suggested by the writer if such a one appears feasible and practicable. There is no good of impracticable propositions and wise provisos which will never be put into action. If the prickly-pear has been keeping within its bounds or has been kept by us in proper control till now, the cochineal would not have come to the country! We have to tackle realities and not any conditional things. We have not taken the least care to control the prickly-pear till now nor will we ever do so; and it is only now, because the beneficial insect is doing its good work, we are awake and up against it! Even now I say in spite of the cochineal, it is not difficult for any one who really feels, to retain his prickly-pear fence provided he takes some care and does not as of old leave the pear to its own fate as before; if he does the latter the fate of the prickly-pear will be death!

Reviews

I

Cow-keeping in India.—By ISA TWEED. 5th Edition. Revised by S. N. SINGHA, G.B.V.C., Professor of Surgery and Obstetrics, Bengal Veterinary College. Crown 8vo. Illustrated. Cloth Rs. 6-8-0. Thacker, Spink & Co., P.B. 54, Calcutta.

'TWEED'S COW-KEEPING IN INDIA' is written in simple language which can be easily understood by laymen. Though the language is non-technical a great number of important points are explained. There are some points like correlation of colour with hardness which need scientific investigation. The chapter on breeding is also useful to a lay man who wishes to take to cattle-breeding for the first time.

There is room for improvement in the illustration of cattle of various breeds. The book could be recommended to all those interested in cow-keeping.—T.M.

II

Season and Crop Report of the Madras Presidency for the Agricultural Year 1930-31.

We are in receipt of this interesting report kindly supplied by the Director of Agriculture. It is available for sale and can be obtained from the Superintendent, Government Press, Madras. Price not stated. The following extracts will be of interest to our readers :—

Remission of land revenue given for the year are as follows :—Vizagapatam Rs. 61,649; East Godavari Rs. 68,336; Kistna Rs. 63,755; Kurnool Rs. 43,162; Bellary Rs. 71,538; Anantapur Rs. 1,06,251; Cuddapah Rs. 30,763; South Arcot Rs. 68,616; North Arcot Rs. 37,269; Chittoor Rs. 32,952; Trichinopoly Rs. 95,236 and Tanjore Rs. 11,04,708.

Area cultivated.—37.6 per cent of the total area of the Presidency was cultivated, or 53,475 square miles out of 1,42,233 square miles of the total area. The area available for cultivation is said to be 90,119 square miles, of which 18 per cent was fallow and 23 per cent was other cultivable waste, and the rest of the area was cultivated as noted.

Area irrigated.—26.7 per cent or 14,302 square miles of the area cultivated, was irrigated. Of this area Government canals served 40.4 per cent, private channels 1.6 per cent, tanks Government and private 39.5 per cent, wells 13.6 per cent and other sources as spring channels 4.9 per cent. Besides, wells supplemented other irrigation sources to the extent of 4.3 per cent. The area under irrigated paddy and groundnut were the highest or among the highest reported.

Area sown with crops.—Food crops occupied 78 per cent of the total and this is the highest reported since 1922-23. The area under non-food crops has been decreasing since 1928-29. Of the non-food crops, the area under groundnut and fodder crops was the highest or among the highest reported.

Prices.—Prices of the principal food grains continued to be lower than in the corresponding part of the previous fasli. The rate of fall having been more rapid than in the previous fasli, the divergence between the prices of corresponding months was increasing throughout the fasli.

Trade.—There was a net fall in the total of imports and exports under foreign trade by about 21 per cent and 28 per cent respectively due mainly to world trade depression and fall in prices and partly due to political conditions.

The Report supplied contains full statistical information on the above, besides cattle, agricultural population, etc. Detailed statistics are given for all crops of the Presidency under various heads such as classification of area, areas irrigated in each district under different sources, areas of crops irrigated, total number of oil engines, tanks, wells, etc., used in the Presidency, area sown with crops in each district compared with normal, percentage area under main crops to total area sown, normal yield per acre of the different crops in each district, seasonal factor and the total produce of principal crops, prices of produce during the harvest season, number of live stocks, ploughs, etc. The statistics include one for rainfall for each month in each district compared with average of previous 51 years.

College News and Notes

Games.—The College team arranged a friendly contest with the Stanes High School early in November in cricket. The game ended in a win for the visitors. The several college tournaments mentioned in the previous issue are being continued with great enthusiasm.

The Cross Country Race.—In connection with the College Day Sports the Cross Country Race was run on the 5th December. There were as many as 16 competitors but only a fourth completed the course. The track was the same as followed in the previous years. K. Bushanam of the third year class came up first in 39'42½" while the College record is 35'50". Srirama Reddi and Ayyadurai of the second year class came second and third respectively.

Mr. S. V. Duraiswamy Ayyar.—On the recommendation of the Director of Agriculture the Research Studentship in Economics and Marketing with special reference to cotton has been offered by the Indian Central Cotton Committee to Mr. S. V. Duraiswami Ayyar who, having accepted it, left the Estate on the 9th December for Madras, where he will study General Economics in the University of Madras till the end of March 1932. The studentship is tenable for two years and may be extended if necessary. It may be noted that Mr. Duraiswami has been connected with the Union as a member of the Managing Committee and the Editorial Board for several years.

The Association of Economic Biologists.—Two meetings were held by the Association in November at which four interesting papers were read and keenly discussed. On the first occasion Dr. T. V. Ramakrishna Ayyar read one on 'The Economic Importance of Entomophagous Insects' and Mr. C. S. Krishnaswami on 'The Virus Diseases of Plants.' At the second

meeting Mr. V. Ramanatha Ayyar read a paper entitled 'A study of the order of entry of pollen tubes into cotton ovules' and Rao Bahadur B. Viswanath on 'The System Soil-Solution-Plant.'

The M. A. S. U. Parliament.—At a meeting of the Parliament held on the 23rd November Mr. C. S. Krishnaswami started the discussion on 'Should Agricultural Graduates go back to Land?' Most of the students and many of the officers were present. Unusual interest was evinced by the students, for obvious reasons, and a very large number of them came forward to put forth their considered opinions on the subject under discussion. Many officers also took part giving their experiences and conclusions on this question. The consensus of opinion appeared to be in favour of the agricultural graduate not going back to the land.

The Association of the Upper Subordinate Officers.—The Association recently memorialised the Government with a view to secure the necessary exemption for the confirmation of the 1929 batch of recruits to the upper subordinate cadre, who completed their probation on August 19, 1931, a few days after the date mentioned in the G. O. passed on the 5th August. The Government have replied to the effect that they do not see any reason why an exception to the orders should be made in the case of these candidates. About 20 subordinates are involved in this. The Association also requested the Government, with reference to the recent orders on travelling allowances, to grant an exemption in the case of the assistants in the Science Sections and assistant lecturers of the Teaching Section similar to that sanctioned for the tour clerks of the Presidency Officers. It was contended that the assistants and the assistant lecturers have also to travel to different parts of the presidency and that it would be a hardship if the reduced allowances are granted to them. The tour clerks of the Presidency Officers can draw travelling allowances more or less as under the old rules. The Government have not been pleased to grant the exemption prayed for.

The Annual General Body Meeting and Tea of the Association will be held during the College Day week.

Visitors.—Dr. T. Ekambaram, Professor of Botany, Presidency College and Dr. (Miss) E. K. Janaki, M.A., Ph.D. (Michigan) visited the Research Institute, taking special interest in the Herbarium. It is understood that both of them came down on a visit to the Imperial Cane Breeding Station where they made a sojourn of over a week.

Weather Review

NOVEMBER 1931

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars ...	Gopalpore ...	0.8	- 3.3	30.4	South ...	Negapatam..	15.7	- 2.1	27.8
	Vizagapatam.	15.2	+11.4	47.3		Madura ...	10.8	+ 5.8	29.1
	Cocanada ...	8.1	+ 2.7	55.5		Pamban ...	14.5	+ 2.5	28.6
	Masulipatam	10.3	+ 4.7	47.2		Palamcottah.	2.7	- 4.7	7.7
Ceded Districts.	Kurnool ...	1.8	+ 0.6	25.7	Ceylon ...	Colombo ...	15.7	+ 3.4	88.0
	Bellary ...	1.0	- 1.2	12.3	West Coast	Trivandrum.	7.3	+ 0.7	60.1
Hyderabad.	Cuddapah ...	0.9	- 2.7	18.3		Cochin ...	3.1	- 3.5	128.8
	Raichur ...	1.9	+ 1.0	25.6		Calicut ...	3.4	- 1.9	130.2
Carnatic...	Hyderabad ...	1.5	+ 0.4	28.9		Mangalore ...	3.1	...	147.8
	Gulbarga ...	1.5	+ 0.5	26.0	Mysore and Coorg ...	Bangalore ...	1.8	- 1.2	24.4
	Nellore ...	12.1	+ 0.9	44.6		Mysore ...	4.9	+ 2.3	24.1
	Madras ...	16.7	+ 2.4	48.2		Chitaldrug...	4.9	+ 2.7	21.4
Central ...	Cuddalore ...	12.5	- 2.6	34.1		Mercara ...	3.3	+ 0.1	141.9
	Vellore ...	8.1	+ 1.2	40.2	Hills ...	Kodaikanal..	12.1	+ 3.9	55.0
	Salem ...	9.4	+ 5.7	35.7		Coonoor ...	19.9	+ 6.3	49.0
	Coimbatore Town ...	3.7	- 0.1	18.9					
	Coimbatore Res. Inst. ...	2.8	- 1.4	14.0					
	Trichinopoly.	4.6	- 0.9	34.7					

Summary of general weather conditions :—

The storm which crossed the coast between Nellore and Masulipatam on the 31st of the last month moved in some westerly direction and lay over the South Deccan on the 2nd and passing into the Arabian Sea on 2nd persisted there till the 4th when it became unimportant. Again on the 5th a wave of low pressure crossed the south of Madras and moving into the Arabian Sea lay centred in the neighbourhood of Lat. 9°N and Long. 65° E on the 7th when it weakened and disappeared. These two disturbances caused two fairly widespread rainfall over the peninsula as far north as Bombay Deccan and the Circars. Thereafter weather was fine over the greater part of the area with a general excess of pressure.

During the period 1st to 8th rainfall was general over the presidency and extended to the Circars south of Calingapatam, and into Hyderabad and Bombay Deccan, and was very heavy in places on the East Coast. From the 21st onwards rainfall reappeared on the south Madras coast and Ceylon.

Rainfall was in very large excess locally in the Circars, and within 20 per cent of normal nearly elsewhere. Other climatic elements were not far from normal.

The chief falls were Vizagapatam 7.4 inches and Cocanada 4.3 inches (and Madras 6.5 inches) on the 1st and Coonoor a fall of 5.6 inches on the 21st.

Weather Report for the Research Institute Observatory:—

Absolute Maximum in shade	...	...	89.0°
Absolute Minimum in shade	...	...	63.0°
Mean Maximum in shade	...	...	85.9°
Mean Minimum in shade	...	...	69.1°
Total rainfall	...	...	2.78"
Mean rainfall for November	...	...	4.15"
Departure from Normal	...	...	1.37"
Heaviest fall in 24 hours	...	...	0.63"
Number of rainy days	...	...	6
Mean Daily wind velocity	...	...	1.4 m.p.h.
Mean 8 hours wind velocity	...	...	1.6 "
Mean humidity at 8 hours	...	...	80.5%
Total hours of bright sunshine	...	...	186.1
Mean daily hours of bright sunshine	...	...	6.2

Summary of weather conditions:—

Rainfall was slightly below normal and the greater part of the total rainfall fell during the first two weeks of the month. For the second two weeks weather was fine and during the period 15th to 21st was dry and cool with rather low nought temperatures for the time of the year. The general conditions were not typical for November as the North-east Monsoon was feeble.

Rainfall totalled 2.78 inches and was 1.37 inches below normal. The heaviest fall occurred on the 26th when 0.63 inch was recorded.

P.V.R.

B.S.N.

Departmental Notifications

Gazette Notifications.—Mr. M. U. Vellodi, D. A. O., Salem, l. a. p. for 3 months from 4-1-32 prefixing Xmas holidays. Dr. J. S. Patel, Oilseeds Specialist, l. a. p. for 3 days from 21-12-31 prefixing and suffixing holidays. Mr. S. V. Ramamurti, I.C.S., to be Director of Agriculture for 3 years from the date of taking over charge.

I Circle.—M. Gopal Rao, A.D., Berhampur, l.a.p. for 3 weeks from 4-1-32, with permission to prefix holidays. V. Tirumala Rao, Asst. to G.E., extension of l.a.p. for 15 days. M. V. Konadal Rao, A.A.D., Ellore, extension of leave on average pay on medical certificate for 30 days in continuation of the leave already granted. *Transfer.*—V. Buchi Raju, A. D., Vizianagaram, transfer to Ramachandrapuram and G. Sitarama Sastri, A.D., Ramachandrapuram to Vizianagaram. *II Circle.*—S. Sithapathi Rao, A.A.D., Nellore, extension of l.a.p. till 28-11-31. M. P. Narasimha Rao, A.D., Kaikalur, l.a.p. for 2 days suffixing holidays. *III Circle.*—M. Krishnasami Ayengar, A.A.D., Allagadda, l.a.p. on m. c. for 1 month and eight days from 16-11-31 with permission to prefix Sunday 15-11-31 and suffix the Christmas and New Year holidays. K. Ramanatha Iyer, A.D., extension of l.a.p. for 1 month and 2 days with permission to affix the Christmas and New Year holidays. A. Venkatachari, A.A.D., Gooty, l.a.p. for four days from 23-11-31. S. Varadarajulu Naidu, A.A.D., Guntakal, l.a.p. for 15 days from 13-11-31. *Transfer.*—P. Nagadhar Naidu, A.A.D., Bellary to Adoni. K. Sanjiva Shetty, A.D., to

Bellary. *IV Circle.*—B. Shiva Rao, A.D., Madanapalle, to be in charge of the Motor Exhibition van in North Arcot and Chittoor districts. M. A. Balakrishna Ayyar, A.D., Gudiyattam, will be in charge of Motor Exhibition vans from the 11th December, 1931. M. Narayana Ayyar, A.D. on leave, posted to Tindivanam. V. Suryanarayana, Headmaster, Kalahasty, l.a.p. for 3 months prefixing holidays. P. K. Venkatasubramaniam, A. D., Cuddalore, posted to Kalahasty Farm. K. S. Krishnamurthi Iyer to be A.D., Cuddalore. K. V. Natesa Ayyar, F.M. Palur, posted to Kallakuruchi as A.D., K. B. Vydeeswara Ayyar, A.D., Kallakuruchi to Palur Farm. *V Circle.*—K. Sitarama Ayyar, A.D., Turaiyur, l.a.p. for 2 months from 1-12-31. *VIII Circle.*—C. S. Namasivayam Pillai, A.D., Omalur, extension of l.a.p. for one month on m. c. *Curator's Section.*—K. Krishna Hegde, A.F.M., Government Botanical Gardens, Ootacamund, in place of M. Arokiasami Pillai, from 1-12-31. *Cotton Section.*—P. K. Natesa Iyer, Koilpatti, l.a.p. for 1 month from 4-1-1932 with permission to prefix Christmas and New Year holidays. A Ramados, Probationer A.D., will work as F.M. *G. M.'s Section.*—P. Vishnusomayajulu, Asst., l.a.p. for 23 days from 1-12-31, with permission to suffix Christmas and New Year holidays. *G. E.'s Section.*—E. R. Gopala Menon relieved on 30-11-31, to work under Cotton Specialist. K. R. Ramamurti, Artist, l. a. p. for 1 month from 24-11-31 with permission to affix Christmas and New Year holidays. *Millet Section.*—K. Narayana Nair, Asst., l. a. p. for 1 month from 16-11-31. *Paddy Section.*—S. Venkataraman, A. F. M., Aduturai, extension of l. a. p. for 1 month and three days with permission to suffix Christmas and New Year holidays. K. Kunnikannan Nambiar, l. a. p. for 3 days prefixing and suffixing holidays. K. Kunhikannan Nambiar, Asst., l. a. p. for 3 days from 21-12-31, with permission to avail Sunday the 20th and Christmas and New Year holidays. *D. A.'s Office Orders.* *Appointments.* The following are appointed as assistants in the Madras Pemppheres and Physiological Scheme. Mr. Kondapalli Dharmarayalu, B.Sc., Asst. Botanist, Mr. E. R. Gopala Menon, M.A., Asst. Entomologist, Mr. Suryanarayana, B.Sc., Asst. Chemist. *Reversions.* A. Yesudasan, Agricultural Instructor, Borstal School, Tanjore, to revert to his permanent appointment. C. Rangasami Iyengar, Upper Subordinate Vth grade, to revert to lower division IVth grade. K. E. Visvam Iyer, Lower Subordinate IVth grade to revert to Vth grade. *Appointments.* The following officiating appointments of Upper Subordinate Science Section, Vth grade in the scale of Rs. 85—5—120 are ordered. P. Kunhiraman Menon, B.A. as Assistant in Chemistry vice M. Suryanarayana on other duty. Mohamed Moinuddin, B.Sc., as Assistant in Entomology vice E. R. Gopala Menon. C. V. Dhakshnamurthi, B.A. (Hons.), as Assistant to Soil Physicist in the temporary post. D. S. Rajabooshanam, M.A., as Assistant in Millet vice T. R. Narayana Iyer. D. V. Krishna Rao, B.Sc. (Ag.) as Assistant in Chemistry vice S. Kasinatha Iyer on leave. K. Virabhadra Rao, B.Sc. (Ag.) as Assistant in Chemistry vice M. Sanyasi Raju on leave. *Reappointment.* R. Anantapadmanabhan, B.Sc. (Ag.) whose probation was terminated as a measure of retrenchment is reappointed Offg. Upper Subordinate, Agricultural Section in the Scale of Rs. 85—5—120. His previous service will count towards his probation. *Transfers.* P. A. Narayana Nambiar, A.A.D., Tellichery, to VIIIth circle to be A. A. D. Annur. P. Narayana Nair, A. D., Annur to the College, to officiate as Assistant Lecturer in Agriculture vice S. V. Doraisami.

APPENDIX

ADDITIONS TO THE LIBRARY DURING OCTOBER, 1931

A. BOOKS

1. <i>Agricultural Marketing</i> ...	By B. N. Bhargava	...	1930
2. <i>A Hand-book of Practical and written work in Economics.</i>	„ E. C. Bhaty	...	„
3. <i>Note book of Agricultural Facts and Figures for Farmers and Farm Students.</i>	„ P. McConnel	...	„
4. <i>Climate—A Treatise on the Principles of Weather and Climate.</i>	„ W. G. Kindrew	...	„
5. <i>Climatology</i> ...	„ A. A. Miller	...	1931
6. <i>Land Drainage and Flood Protection.</i>	„ B. A. Etchevery	...	„

7. *The Physical Properties of Soil* ... By B. A. Keen ... 1931
8. *Crop Production and Management* ... „ J. F. Cox ... „
9. *Proceedings of the 4th World's Poultry Congress.* „
10. *Mineralogy* ... „ F. H. Hatch ...
11. *A Text Book of Geology Parts I and II.* 1929
12. *Electric Motor Management* ... „ A. A. Avery ... 1931
13. *Electricity for Everybody* ... „ R. B. Matthews ... „
14. *The Fitting and Erecting of Engines.* „ C. L. Browne ... 1918
15. *The Elementary Theory of the Internal Combustion Engine.* „ F. W. Ludlam ... 1931
16. *Butter fat (Ghee) its Nutritive Value, Adulteration, Detection and Estimation.* „ N. N. Gidbole and Sadgopal. ... 1930
17. *Modern Methods of Testing Milk and Milk Products.* „ L. L. Vanslyke ...
18. *The Chemical Investigation of Plants.* „ L. Rosenthaler ... 1930
19. *Recent Advances in Analytical Chemistry, Vol. I Organic, Vol. II Inorganic.* „ C. A. Mitchell ... „
20. *A Text Book on Plant Physiology* ... „ N. A. Maximov ... „
21. *The Survival of the Unfittest* ... „ C. W. Armstrong ... 1931
22. *Bibliographia Genetica, Vol. VIII* ... „ J. P. Lotsy and W. A. Goddijn. ... „
23. *Tropical Forests of the Caribbean* ... „ T. Gill ... „
24. *Fauna of British India Series, Vols. I and II (Cestoda).* „ T. Southwell ... 1930
25. *Coleoptera—Staphylinidae* do. ... „ M. Camaron ... „
26. *Recent Advances in Entomology* ... „ A. D. Imms ... 1931
27. *Animals in Wild and Captivity* ... „ E. G. Boulenger ... 1930
28. *Biology in Human Affairs* ... „ E. M. East ... 1931
29. *Histological and Illustrative Methods for Entomologists.* „ H. Eltringham ... 1930
30. *Locusts and Grass-hoppers* ... „ B. P. Uvarov ... 1928
31. *Report on the 3rd Imperial Entomological Conference.* 1930
32. *A Summary of Data Relating to Economic Entomology.* „ S. A. Neave ... „
33. *A Text Book of Entomology* ... „ K. M. Smith ... 1931
34. *Calcutta University Calendars and Regulations, 1931.* „
35. *The Year Book of the Universities of the Empire, 1931.* „ H. F. Heath ... „

B. REPORTS.

1. Agricultural Statistics of India ... Vol. II, 1928-29
2. Report of the St. Lucia Agricultural Department for 1930.
3. Do. Fiji Agricultural Department for 1930.

4. Report of the Experimental Stations of the Empire Cotton Growing Corporation up to 1925.
5. Do. do. 1925-26
6. Do. do. 1927-28
7. Do. do. 1928-29
8. Do. do. 1929-30
9. Annual Administration Report of the Madras Industries Department for 1930-31.
10. Engineering College Calendar for 1931-32
11. United States Department of Agriculture Year Book 1931.
12. U.S.A. Monthly Weather Review. (50 Years Average).

C. BULLETINS.

13. Experiments in Electro-Farming U.P. Agricultural Department Bulletin No. 53
14. A Brochure on School Gardens „ 55
15. Tractor Trials near Brakpan Union of South Africa Bulletin No. 91
16. The Preserving of Fruits and Vegetables „ 92
17. Prickly-pear and its Eradication... .. „ 93
18. Report on Cotton Insects and Disease Investigations, Part I. „ 94
19. Life History of the Codling Moth in the Rouge River Valley of Oregon. U.S.A. Agricultural Department Technical Bulletin No. 255
20. Wheat Growing in the South Eastern States „ Farmer's Bulletin No. 885
21. Christmas Trees as a Cash Crop for the Farm „ „ 1664
22. Rural Community Fire Departments „ „ 1667
23. Emergency Forage Crops Cornell University Agricultural Department External Bulletin No. 209

D. LEAFLETS, MISCELLANEOUS PUBLICATIONS, Etc.

24. Sprayers and Spraying Madras Agricultural Department Leaflet No. 34
25. Useful Information obtained from 10 years Work (1920-29) in the Agricultural Research Station, Samalkot. „ Pamphlet No. 4
26. Some Common Insecticides... .. „ „ 5
27. Report on the Imperial Sugar Cane Research Conference by M. W. Sayer and other enclosures. Special Report.
28. The Peasant's Account Book Gujarat Vidyapith Publication.
29. Blossom Wilts of Apples England Ministry of Agriculture Advisory Leaflet No. 63

30. The Magpie Moth	...	...	England Ministry of Agriculture Advisory Leaflet	65
31. The Raspberry Moths	...	...	"	66
32. The Cultivation of Lucerne	...	...	"	67
33. The Carrot Fly	...	...	"	68
34. Rapid Methods of Determining the percentages of Fertility and Sterility in seeds of the Jerns Betula.	...	...	Canadian Scientific Agriculture—June 1931	
35. The Experimental Modification of Heredity in Crop Plants.	...	...	"	
36. Modern Methods of Field Experiments...	...	...	"	
37. Ploughing as a control Measure for the European Corn Borer in Western New York.	...	...	U.S. Agricultural Depart- ment Circular No. 165	
38. Experiments for the control of the San Jose Scale with Lubricating oil Emulsions in the Pacific North West.	...	...	U.S.A. Agricultural Circular No. 175	
39. Observations on the Satin Moth and its Natural enemies in Central Europe.	...	...	"	176
40. Cooking Cured Pork	...	...	U.S. Agricultural Department Leaflet No. 81	
41. Motion Pictures of the United States Agricultural Department, 1931.	...	...	"	111
42. List of Technical Workers in the U.S. Agricultural Department, 1931.	...	...	"	123
43. Protect White Pine from Blister rust	...	...	Bureau of Plant Industry No. 22	
44. Cyprus Wheat and Flour milling	...	...	Crop Gazette No. 2161 Supplement—39.	

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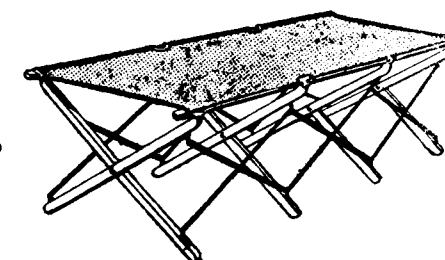
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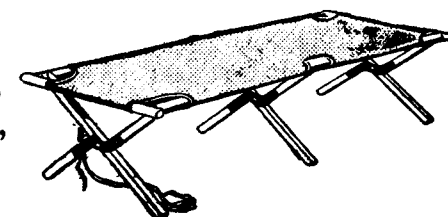
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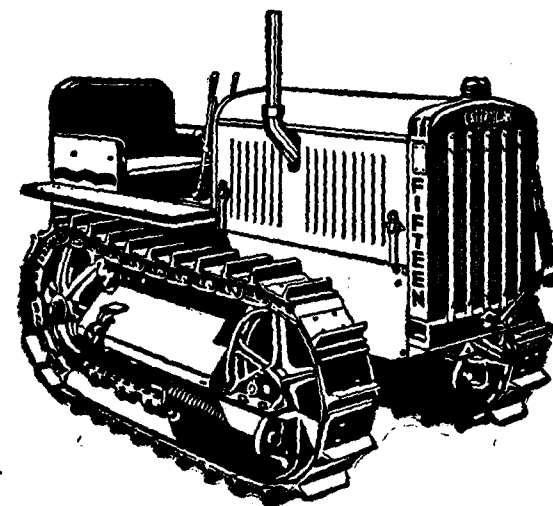
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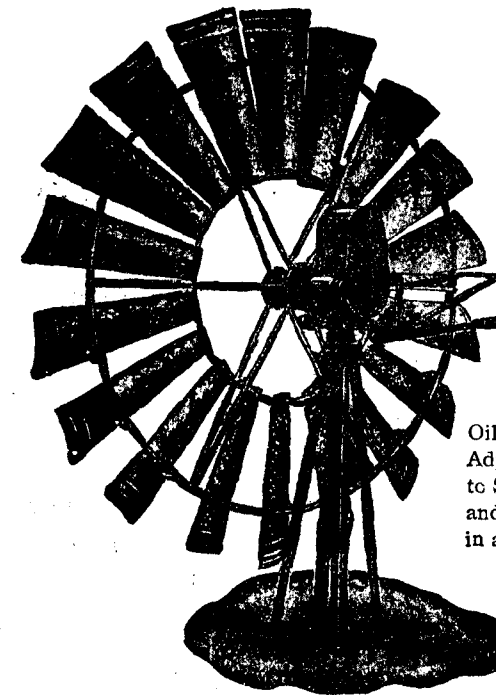
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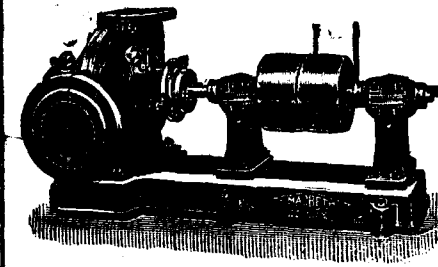
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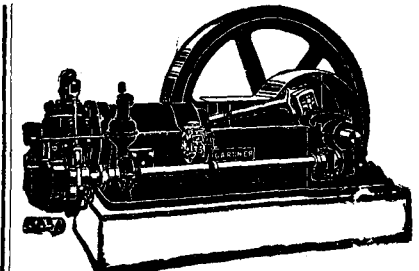
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