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CONTENTS



## UTILISATION OF FARM WASTES *

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Recent investigations at Coimbatore on the effects of manuring a crop on the nutritive and reproductive capacity of the resulting seed, have clearly impressed the necessity for the supply of organic matter to the soil in order to produce food stuffs well supplied with nutrients for the proper nourishment of both man and animal. It is an established fact that the organic matter in the form of humus plays the most important role in the upkeep of soil fertility as well as in the maintenance of ideal texture of the soil necessary for the growth of crops. Apart from this, the demand on the soil for increasing the out-turn from crops to meet the needs of the growing population, have necessitated the augmentation of the manurial resources for crop production. The alarming rate at which the organic matter of the soil is depleted and the urgency for making good the loss, as revealed by the soil surveys conducted in India, make it all the more imperative to supply this want immediately.

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Till recently, the time-honoured farmyard manure, leaf compost, oil cakes and similar materials formed the main sources for the supply of organic matter to the soil. A survey of the amount of the available materials in conjuction with the needs of the area under cultivation, will at once impress the inadequacy of the present supply, which is about 1/20 of the demand. The available supplies of the organic manures being quite limited, means have to be found to tap other sources which can be made to yield manures as good as farmyard manure.

The need for organic manures being universally recognised, this problem of augmenting the supply has naturally attracted the attention of scientists. At Rothamsted, Richards and Hutchison sought to remedy this deficiency by finding a suitable substitute for farmyard manure. They were the pioneers in this direction who realised quite well the gravity of the situation and the demands of the future and succeeded in solving this problem. In their search, they pitched upon waste organic matter of low manurial value which could easily be worked up, by the addition of some fertilising material, to the standard and quality of farmyard manure, in its fertilising value. Wheat straw was used as the basic material with ammonium sulphate as a quick-acting nitrogen starter to hasten the decomposition of the stuff with the result that the fermented manure resembled farmyard manure in appearance, consistency and manurial value. This process was styled as the manufacture of 'synthetic farmyard manure' in contradistinction to the natural farmyard manure. Concentrated starters were put on the market with the patented names of "Adco" accelerator and "Adco" complete manure, with full directions for their use.

Simultaneously, Hutchison in India, started the study of fermentation of green manure using sunnhemp as his material and obtained an odorless product of high manurial value using copper sulphate—potassium cyanide mixture as a deodoriser. Besides, he also demonstrated the superiority of the fermented product to the unfermented. It was established that fermentation of the material was indispensable before application as manure.

Fowler working on the activated sludge system of sewage disposal, has demonstrated a process of converting night soil into an inoccuous and useful fertiliser, fit for application to crops. It was also shown that in this process nitrogen losses were greatly minimised by its conservation in the resulting product. Besides, the activated sludge was found to be one of the best inocula containing bacteria capable of attacking the most resistant materials.

At the Department of Biochemistry, Bangalore, experiments have been conducted on the utilisation of waste, in the form of municipal rubbish, into a useful manure by introducing activated sludge as the

inoculum for starting decomposition. Well-fermented organic manure has been obtained possessing high manurial value. In this process the presence of cellulose fermenters in activated sludge was availed of, to give the initial start.

Thus it will be seen that attempts have been made by numerous workers in the direction of utilisation of waste products to produce "wealth from waste" with great success.

Encouraged by the results obtained both at Rothamsted and at Pusa, a beginning was made in Madras in the year 1922, to tap the available sources of waste organic matter found in abundance, for the preparation of synthetic manure. Experiments were planned on the same lines as at Rothamsted but using 1500 lbs. of paddy straw and calcium cyanamide as basic material and starter respectively, instead of wheat straw and ammonium sulphate, proper moisture conditions being maintained for the rapid decomposition. A careful record of the temperature developed was maintained, the maximum temperature attained being 54° C, when the air temperature (in shade) was about 28° C.

It was observed that there was a quick rise in temperature within 24 hours and the heat, developed, naturally led to rapid decomposition of the material but, because of the method of heaping, there was uneven fermentation. The subsequent forking and mixing of the fermented material with the unfermented, resulted in uniform decomposition and there was a loss of 47 per cent. of organic matter and 14 per cent. of nitrogen. The manure was ready in 9 weeks.

Improvements were introduced to minimise the sudden rise of temperature and to regulate the maintenance of moisture conditions necessary for even decomposition. Experiments were started with *ragi* straw both under aerobic and semi-aerobic conditions, the latter condition being obtained by mud-plastering the exposed parts. The following results indicate clearly a reduced loss of nitrogen and organic matter under semi-aerobic conditions.

| | Per cent loss of | |
|---|---|---|
| | Nitrogen. | Organic matter. |
| Aerobic | 26·76 | 37·7 |
| Semiaerobic | 9·29 | 22·2 |

In the light of these observations, the following experiments were conducted in 1923 with *ragi* straw both in heaps and in pits and with various amounts of nitrogen. Nitrogen was added as ammonium sulphate or calcium cyanamide respectively at 0·75 per cent. and 0·5 per cent. calculated on dry matter. In the case of ammonium sulphate lime carbonate was also added to correct the acidity.

| | Ammonium sulphate series. | | | | Calcium cyanamide series. | | | |
|---|---|---|---|---|---|---|---|---|
| | Higher Nitrogen per cent of loss. | | Lower Nitrogen per cent of loss. | | Higher Nitrogen per cent of loss. | | Lower Nitrogen per cent of loss. | |
| | N. | O. M. | N. | O. M. | N. | O. M. | N. | O. M. |
| Heap | 40·09 | 43·59 | 29·02 | 46·45 | 25·68 | 36·34 | 33·46 | 38·00 |
| Pit | 34·66 | 33·30 | 26·46 | 23·85 | 22·99 | 29 63 | 15·83 | 27·00 |

(Note:— N. is Nitrogen. O. M. is Organic matter).

The loss of nitrogen from experiments in pits was less in every case than that from heaps. In pits it ranged from 16 to 34 per cent and in heaps, from 26 to 40 per cent. The high percentage of losses in all these experiments might have been due to the soaking of the liquid portion of the manure into the soil.

Apprehending the loss to be due to the exposed condition of the manure to the heat of the sun, a shelter was provided to the manure pits, but even then, the losses ranged from 44 to 55 per cent. These experiments have shown beyond doubt that the resulting loss under Indian conditions is due, chiefly to, too rapid decomposition at the initial stages and has been traced to the unsuitability to suit Indian conditions of the starters employed elsewhere. Naturally, attention was directed to the introduction of a suitable starter.

With this object in view, a detailed study of the " Adco " accelarator and " Adco " complete mixture was undertaken. These analysed with the following results :—

| | " Adco " accelarator. | " Adco " complete mixture. |
|---|---|---|
| | % | % |
| * Loss on ignition | 8·12 | 9·16 |
| Insolubles | 3·80 | 4·83 |
| @ Solubles | 88·08 | 86·01 |
| Total. | 100·00 | 100·00 |
| * Nitrogen | 2·91 | 6·63 |
| @ Iron and alumina | 11·90 | 3·92 |
| Lime (Ca0) | 42·90 | 46·50 |
| Total Phosphoric acid | 6·64 | 6·90 |
| Potash | 1·45 | 1·08 |

A bacteriological examination revealed the presence of active ammonifiers and nitrogen fixing organisms but cellulose organisms and nitrifiers were absent.

A synthetic mixture of calcium cyanamide, tricalcic phosphate and potassium sulphate were prepared resembling " Adco " and starters. This was compared with the "Adco" starters both on green and dry materials under laboratory conditions. The results are given below.—

**Average of duplicates.**

| No. | Details of experiment. | Per cent loss of Nitrogen. | Per cent loss of dry matter. |
|---|---|---|---|
| | Air-dry Ragi straw: 1 kilo in each glazed pot. | | |
| 1. | Ragi straw only | 1·28 | 69·67 |
| 2. | Ragi straw plus Adco mixture enough to supply 0·75% Nitrogen | 34·05 | 64·90 |
| 3. | Ragi straw plus Nitrolim mixture made up in laboratory enough to supply 0·75% Nitrogen | 23·60 | 64·5 |
| | Ragi green: 1 kilo in each pot and "Adco" accelarator. | | |
| 1. | Control-ragi stems and leaves | 12·16 | 54·6 |
| 2. | Green ragi straw plus Adco accelarator to supply 0·22% Nitrogen | 29·01 | 50·8 |
| 3. | Green ragi straw plus Nitrolim mixture made upto supply 0·22% Nitrogen | 26·56 | 48·57 |

Even though the fermentation was quite even in both cases, the loss of nitrogen occurred in both. But green materials do not require any nitrogen starter. The decomposition of the waste material was accelarated and this might be due to the stimulation of the organisms by the phosphate present in the starters.

Having partly succeeded to control the loss of nitrogen by the use of the quick acting starters of the nature employed so far, an attempt was made to introduce slow acting starters by using bonemeal and cattle dung in reasonable amounts so that the process might be slow and steady. Cane trash was tried in pits with these slow acting starters in suitable proportion. Results are given in the adjoining table.

| Quick acting starters. | | Slow acting starters. | |
|---|---|---|---|
| Percentage loss of | | | |
| Nitrogen | Organic matter | Nitrogen | Organic matter |
| 34·05 | 64·9 | 15·1 | 69·4 |
| 33·6 | 64·5 | 3·6 | 53·0 |
| 33·0 | 60·3 | 5·2 | 55·0 |

This led to even decomposition resulting in a minimum loss of nitrogen. Thus under our Indian conditions the use of slow-acting starters appears to be more advantageous than the quick-acting starters of the "Adco" type.

In order to popularise the preparation and use of synthetic manure for crops and to study the rate of decomposition under varying climatic conditions prevailing in the different parts of this Presidency, as also with a variety of waste materials, demonstration experiments were started on the Government Farms, private estates and tea and coffee plantations. The results are summarised in the following table.

**Results of analyses of Synthetic Farm Yard Manure obtained with different basic materials, calculated on moisture free basis.**

| Basic Material. | Nitrogen. | Phosphoric Acid. | Potash. | Remarks. |
|---|---|---|---|---|
| | % | % | % | Composition of |
| 1) Cumbu straw. | 1·25 | 0·48 | 1·09 | farmyard |
| 2) Paddy straw. | 1·60 | 0·16 | 1·93 | manure. % |
| 3) Guniea grass stubbles etc. | 1·04 | — | — | Nitrogen 1·02. |
| 4) Ragi straw. | 1·43 | — | — | Phosphoric acid 0·63. |
| 5) Dry weeds chiefly grass. | 1·90 | 0·55 | 1·09 | Potash 1·76. |
| 6) Lantana leaves and stalks. | 1·55 | 0·52 | 1·07 | Moisture in the |
| 7) Forest grass. | 2·49 | 0·51 | 2·26 | final manure |
| 8) Wild lemon grass: | 1·93 | 0·24 | 0·90 | ranged from |
| 9) Lemon grass + lantana. | 3.03 | 0·43 | 1·77 | 50 to 70 % |
| 10) Lemon grass only. | 1·06 | 0·34 | 0·16 | |
| 11) Paddy straw. | 1·59 | 1·34 | 3·37 | |
| 12) Cotton waste and groundnut husk. | 1·62 | 1·04 | 1·25 | |

It will be seen that the composition of the resulting manure varies considerably depending upon the nature of the starting material and the time of the year in which the experiment is done. The combined action of dung and bonemeal was tested on highly resistant material such as cotton—stalks, etc., with success, but the time taken to ferment was six to eight months, whereas with other waste materials it ranged from three to five months. The manure retains fairly large amounts of moisture and has the texture and colour of farmyard manure. Cactus which possesses hard spines when subjected to this treatment shows considerable softening of the spines rendering the handling of the manure easy. The slow-acting nature of the starter introduced, has the additional advantage of maintaining a steady and even fermentation in the manure pits, without the danger of loss of the most valuable manurial ingredient—nitrogen. Hence it may be said that with high temperature conditions, prevailing in India, slow-acting starters are to be preferred.

Any waste organic material like weeds, leaves, coffee pulp, husks of grains, waste straws, stems of succulent and ligneous materials can be composted. Based on numerous trials conducted all over the Presidency with various materials ranging from easily decomposable to resistant, the following technique of manufacture has been evolved.

A pit of convenient size, 12 feet by 6 feet by 3 feet should be dug on high ground. The basic material is uniformly and loosely spread to a depth of 9 to 12 inches and water is evenly sprinkled till the whole material gets moist, every part of the heap being carefully watered so that no portion remains dry. This is the most important point to be remembered in the construction of the heap. Then 1 to 2 lbs of fine bonemeal are evenly broadcasted and over this an emulsion of 10 to 20 lbs of fresh cattle dung in 5 to 10 gallons of water is applied. A second layer of basic material is placed over this and

treated similarly. The whole material is thus disposed of until a heap, about 2 feet high above the ground level is formed and then the top and the sides are mud-plastered. After the ferementation has proceeded semiaerobically for four to six weeks depending on the nature of the material, the plaster is removed to permit aerobic fermentation If the heap has sunk unevenly, which is an indication of the defective fermentation the material is reheaped after forking in and proper moistening. The raw material is ordinarily decomposed in three to four months and is fit for application as manure. This is not too long a period seeing that no fresh inoculum is added, as is done by Fowler, nor great attention paid subsequent to the starting of the compost. By this process synthetic manure of normal composition as farmyard manure may be made at a cost of Rs. 3/– to 3½ per ton. From this we can easily judge that the synthetic farmyard manure, compares favourably with that of farmyard manure as regards the cost of production.

With synthetic manure thus prepared, field trials were conducted with the results recorded in following table.

**Statement showing the yields of crops raised with organic compost as compared with Farmyard manure. Yields are for 5 cent. plots in lbs**

| Year | Crops | Grain | | | Straw | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | No manure | Organic compost | Farm-yard manure | No manure | Organic compost | Farm-yard manure | |
| 1927—28 | Chitarai Cholam | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | |
| | Yellow | 88·4 | 96 0 | 90·4 | 291·8 | 303·0 | 285·5 | Manured |
| 1928—29 | Ragi | 118 0 | 120·4 | 124·0 | 570·4 | 597·6 | 601·2 | do. |
| 1928—29 | Chitarai Cholam | 129 0 | 129 0 | 120·0 | 321·6 | 353·4 | 348·0 | do. |
| 1929—30 | Cotton | 338·1 | 369·2 | 371·3 | ... | ... | ... | Weight of kapp-as (residual effect) |
| 1930—31 | Ragi | 125·0 | 141·0 | 139·5 | 228·0 | 290·0 | 232·0 | Residual effect |
| 1931—32 | Chitarai Cholam | 137·4 | 146·4 | 142·8 | 402·0 | 379·2 | 391·2 | Manured. |

The yields from synthetic farmyard manure plots were greater than those from unmanured plots and in some years were either equal to or slightly higher than, those of farmyard manure plots. The residual effects of the organic compost were more marked in some years than those of the farmyard manure. This clearly shows that the organic compost is as good as farmyard manure. An analysis of the crop—grain and straw—further showed, that the quality of the crop was as good as that of the crop raised with farmyard manure.

Even though by this process the majority of waste materials can be turned into a most useful manure there are certain limitations with

such materials as night soil, wherein a process like this can only be applied with certain modifications. The process consists in pitting the night soil with rubbish and certain chemicals, which act as deodorisers and are non-toxic to plants when applied after fermentation. Fowler has recently recommended a method for using night soil as a starter in composting rubbish for conversion into a useful manure. This involves repeated exposure of the material with the night soil suspension on it, with the result that a manure of high value is obtained. But the sentimental objections to the handling of night soil and the cost of labour involved are two prime factors which are against the process, whereas the process developed here is without these drawbacks and the manure obtained compares favourably in composition and in cost of production with farmyard manure.

Experiments conducted here using various deodorising agents in composting night soil and the estate rubbish are sufficiently satisfactory and their results of analysis show that the process is a success as could be seen in the following table.

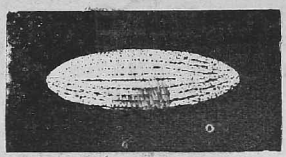
**Results of analysis of 9 samples of poudrette for moisture and nitrogen (dry basis).**

| Original materials and treatment, if any. | Moisture. % | Nitrogen. % |
|---|---|---|
| 1. 492 lbs. night soil plus 250 lbs. sweepings. | 44·88 | 1·05<br>0·80 |
| 2. 480 lbs. night soil plus 500 lbs. sweepings, treated with 0·025% solution of $CuSO_4$ | 32·82 | 1·37<br>0·64 |
| 3. 420 lbs. night soil plus 500 lbs. sweepings treated with 0·025% solution of $CuSO_4$ dissolved in excess of KCN solution. | 29·63 | 0·68<br>0·64 |
| 4. 524 lbs night soil plus 500 lbs. sweepings treated with Bordeaux mixture ($CuSO_4$ solution turned alkaline to litmus) | 40·94 | 1·53<br>0·93 |
| 5. 532 lbs night soil plus 500 lbs. sweepings plus 5 lbs. common salt. | 39·28 | 1·15<br>1·15 |
| 6. 1121 lbs. night soil alone. | 69·87 | 1·91<br>1·47 |
| 7. 562 lbs. night soil plus 1000 lbs. sweepings. | 29·66 | 0·79<br>0·55 |
| 8. 514 lbs. night soil plus 500 lbs. sweepings. | 28·77 | 0·81<br>0·53 |
| | 40·27 | 1·29 |

The observations so far recorded are so encouraging that it would be possible to produce manure out of wastes quite economically.

**Summary.** Results of experiments on the preparation of synthetic manure from organic wastes are discussed.

The losses of nitrogen and organic matter resulting from decomposition have been minimised by introducing semiaerobic conditions and slow-acting nitrogen starters such as bonemeal and cowdung-water.

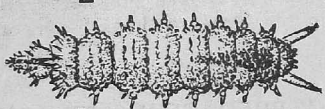


1

1. Egg

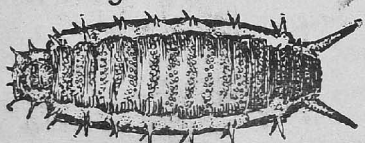
2

2. Newly hatched maggot



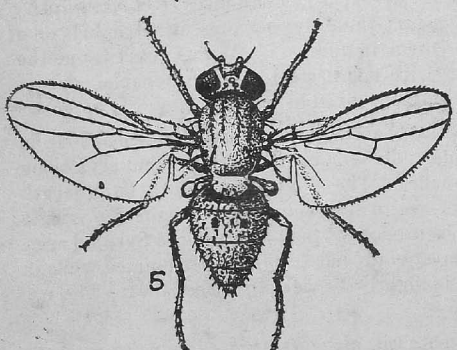
3

3. Full grown maggot.



4

4. Pupa.



5

5. Adult.

The "Adco" products are not suitable to our Indian climate and if used will result in serious loss of nitrogen. Analyses of organic compost obtained from various grades of stuffs under varying conditions are set forth and discussed. Based upon the experience gained, a working formula suitable for the production of composts under Indian conditions is described.

The effect of compost thus prepared has been compared over a series of years on crops against farmyard manure and the results of yields obtained are discussed.

The composition of the crops as regards quality compares favourably with those raised with farmyard manure.

The economics of the process are laid down and the modifications necessary in handling night soil are indicated.

The results of field trials warrant the preparation and use of organic wastes profitably in the form of organic compost on an extensive scale.

## AN AGROMYZID FLY PREDACEOUS ON APHIDS

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**Introduction.** This short note deals with the life history and habits of a beneficial insect, a fly* whose maggots are predaceous on Aphids (sucking insects)—one of the worst pests of cultivated crops. Along with Hover flies (F. *Syrphidae*), Lady-birds (F. *Coccinellidae*) and Lacewings (F. *Chrysopidae*) these fly maggots attack aphids on a large scale and destroy them in numbers. As this insect is one the farmer should be familiar with and protect as far as possible, a short description of its various stages is given below.

**Life History.** *Eggs* (Fig. 1) are laid singly by the female flies on plants infested with Aphids. These look like the Syrphid eggs being oval and white, but are smaller. These measure 0·36 m. m. in length while the Syrphid eggs are 0·8 m. m. long. Again the ridges found on the Leucopis eggs are longer than those of the Syrphid eggs. Also the Leucopis eggs have both ends more or less pointed while in the Syrphid eggs one end is slightly broader than the other. The egg period lasts two to four days.

*Larvae.* The newly hatched maggots (Fig. 2) which are about 0·45 m. m. long are pale white in colour. Unlike the young Syrphid maggots, hairs are absent on the body. Two short tubular out-growths from the dorsal aspect of the anal end directed backwards and outwards, which are the beginnings of the long larval respiratory

* *Leucopis. sp.* Sub-family—Ochthiphidinae. Family—Agromyzidae.

processes of the mature maggot are dimly visible. The maggots soon after hatching feed on the Aphids by sucking out their body contents and begin to grow in size. They moult twice before pupation. In the mature maggots (Fig. 3) the pale white colour changes to that of yellow and the anal 'horns' are longer* and more prominent, their tips being black. A detailed examination of the 'horns' under the microscope reveals the prolongation of the lateral tracheal tubes into the horn like processes which end in three-branched claw-like structures. The full grown maggots are about 2·5 m. m. long. Before pupation the maggots exude a cement-like white fluid, probably for attachment, which hardens and turns black in colour in a couple of hours. The larval period lasts four to five days.

*Pupæ.* The pupae (Fig. 4) are dark brown in colour and look similar to the mature maggots but are more stumpy. These are about 2·2 m. m. long and 1 m. m. broad. In five to seven days the adults emerge by pushing their way out at the anterior end of the pupae.

*Adults.* Adult flies (Fig. 5) are very active creatures, short and stout and measure about 2 m. m. long. The general colour of the fly is greyish dark. Antennae including arista are dark and the halteres pale yellow. The abdomen is grey with a round black spot on each side of the median line of the second tergite. Legs are light dark. Adult flies have been noted feeding on the honey dew of Aphids A fly fed with jaggery water in captivity lived 21 days. The total life cycle lasts 11 to 16 days.

**Hosts.** Fly maggots have been observed feeding on Aphids on a variety of plants such as Cholam (*Sorghum*), Cotton (*Gossypium*), Cumbu (*Pennisetum typhoideum*) and beans (*Dolychos lab-lab*).

**Parasites.** A few *Chalcids* were once collected from a Leucopis pupa but in nature the number of such parasites seems to be very few.

## GRAM WEIGHT IN RELATION TO POD AND SHOOT WEIGHTS IN BENGAL GRAM

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**Introduction.** In preliminary yield trials of crops the plant breeder has often to handle a large number of types although only a few of these can be carried forward. It is a practical consideration that the methods adopted at such a stage allow examination of as wide a range of material as possible with the minimum of labour and without loss of efficiency. Each crop sets its own problem in this connection.

* Since sending to the press a few maggots with shorter respiratory horns, probably another species of *Leucopis*, have been collected feeding on Aphids and are under study.

In Bengal gram (*Cicer arietinum*) for instance, the actual determination of the yield requires the stripping and threshing of the pods and will take time and labour when the number of plants is large. Any method which will do away with much of this labour will be an improvement. Towards this end, other more easily determinable characters indicative of yield were investigated. The results of such a study are presented in this paper, from work done at the Nandyal Agricultural Research Station during the year 1932–33.

**Material and methods.** The material of the enquiry comprised 399 different cultures of Bengal gram grown along with 201 lines of local bulk in lines 1½ feet apart in the usual arrangement of raw yields, with a control line of local bulk coming between every two selections. Plants were spaced 9 inches apart in the lines each of which allowed for 26 plants excluding out-skirts. Each line of controls, as well as the selections was harvested separately and examined for the following characters.

(1) Shoot weight, (2) Pod weight and (3) Gram weight (weight of all plants correct to ¼ oz.) The shoot weight was the portion harvested by the sickle free of the roots.

**Relations of the characters.** For purposes of this study the gram weight was taken as the ultimate basis of yield, and, the extent to which the other two characters could be relied on as a measure of it was investigated. The co-efficients of correlation expressing the relations between the characters are given below :—

**Table I.**

*Correlation of characters, pod weight, shoot weight and gram weight in Bengal gram.*

| Pairs of characters. | Local bulks (201) | | Selections (399) | |
|---|---|---|---|---|
| | Correlation coefficient. | Partial correlation coefficient. | Correlation coefficient. | Partial correlation coefficient. |
| 1 | 2 | 3 | 4 | 5 |
| Grain weight and Shoot weight | 0·938±0·006 | 0·444±0·037 | 0·926±0·005 | 0·387±0·029 |
| Grain weight and pod weight | 0·972±0·003 | 0·792±0·017 | 0·982±0·001 | 0·885±0·007 |
| Shoot weight and pod weight | 0·924±0·007 | 0·147±0·045 | 0·912±0·006 | 0·042±0·033 |

It is apparent that the characters form a very closely related group, the coefficient of correlation exceeding 0·9 in all cases. As the relationship is very high, it will be useful to evaluate the contributions of each character after eliminating the effects of the others. The partial correlation coefficients got in this way are given in columns (3) and (5). It is seen from these values that the greater part of the

relation is due to that of gram weight and pod weight, and to a less extent to gram weight and shoot weight. In order to understand more fully the significance of these relationships it will be necessary to know in what manner they are expressible.

*The regression of the other characters on the gram weight:—* If the characters, shoot weight and pod weight are sufficiently indicative of the gram weight, two conditions must be fulfilled. The first is that the relationship should be simple and definite ; secondly a large proportion of the variation in gram weight should be expressible by them. In order to determine these two points the variance in gram weight due to the other two characters was analysed into the several components. (Fisher R. A. Statistical methods 1932 P. 231). The results are given in table II.

**Table II.**

*Relation of Gram Weight to other characters.*

ANALYSIS OF VARIANCE.

| Relative | Control Bulks | | | | | | Selections. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Shoot Weight | | | Pod Weight | | | Shoot Weight | | | Pod Weight | | |
| | Freedom | Sum of Squares | % | Freedom | Sum of Squares | % | Freedom | Sum of Squares | % | Freedom | Sum of Squares | % |
| Variance in gram weight due to:– | | | | | | | | | | | | |
| Linear regression. | 1 | 1587·1 | 88·5 | 1 | 1715·1 | 95·7 | 1 | 5065·7 | 85·9 | 1 | 5666·5 | 96·1 |
| Diviation from linear regression. | 28 | 98·1 | 5·5 | 19 | 9·1 | 0·5 | 42 | 96·9 | 1·6 | 27 | 137·7 | 2·3 |
| Within arrays. | 171 | 107·5 | 6·0 | 180 | 68·5 | 3·8 | 355 | 735·6 | 12·5 | 370 | 93·0 | 1·6 |
| Total. | 200 | 1792·7 | 100 | 200 | 1792·7 | 100 | 398 | 5897·2 | 100 | 398 | 5897·2 | 100 |
| Significance of departure from straight line. | Significant P<·01 | | | Not significant. | | | Not significant. | | | Significant P<·01 | | |

It is seen that from 86 to 96% of the variation in gram weight is accounted for by the simple relation of a straight line with the other characters. Even though the departure from linear regression is significant in two cases, the percentage attributable to this cause is low, (less than 5·5%). It can therefore be concluded that the gram weight of any selection or plant is expressible to a very large extent directly from the shoot weight or pod weight. The equations giving the relations of the characters are given below all weights being in ounces:—

| | *In Bulks.* | *In Selections.* |
|---|---|---|
| Gram weight = 0·4760 | shoot weight plus 0·060. | 0.4594 shoot weight plus 0·264. |
| ,, = 0·7329 | pod weight plus 0·015. | 0·7215 pod weight ,, 0·145. |
| Gram weight = 0·139 | shoot weight plus 0·540 pod weight—0·070. | 0·091 shoot weight plus 0·601. pod weight ,, 0·060. |
| | (R = 0·9777). | (R = 9·0845). |

The very high values of the multiple correlation coefficient 'R' indicate that a remarkable accuracy (about 95%) in gram weight is got by the combined characters.

The real advantage of the relations however lies in their applicability. From practical consideration even the determination of pod weight appears unnecessary. The labour of stripping the pods can be avoided and the preliminary selection made on the basis of shoot weight only with a fair degree of accuracy (nearly 90%). If, for example, we require to choose plants or selections with 20% increase over control in gram weight, the error involved by choosing those with 20% and over increase in shoot weight will be negligible, the only condition necessary being that the harvest of the plants should be done when they are in a thoroughly and uniformly dry condition as in plants of the present study.

**Summary.** The pod weight, shoot weight and gram weight form a very closely related group of characters the coefficient of correlation exceeding 0·9 in all cases. When the effects of the different characters are independently evaluated the relation of gram weight and pod weight is most pronounced ($r_{pg.s.} = 0·8$), while that of gram weight and shoot weight is next in importance ($r_{gs.p.} = 0·4$).

The gram weight can be expressed directly as a simple function of either pod weight or shoot weight. The equations expressing these relationships are similar in bulks as well as selections and give an accuracy ranging from 86 to 95%.

For purposes of preliminary yield trials it is not even necessary to determine pod weight. Selections made on the basis of shoot weight will hold good for gram weight without any appreciable loss of accuracy.

# STUDIES IN POULTRY-KEEPING

## Part III. NATURAL INCUBATION OF POULTRY

By R. W. LITTLEWOOD, *Deputy Director of Agriculture, Live Stock.*
and H. NARAHARI RAO, *Poultry Manager, Hosur.*

*(Continued from the July 1933 issue of the M. A. J.)*

**Natural Incubation.** The natural method of hatching i.e. by the employment of broody hens is right and proper for those who intend keeping fowls in a small way, say up to 100 chicks.

**Signs of Broodyness.** Broodyness is a maternal instinct in all female species of birds. It is an irresistable tendency to sit on the eggs until the chicks hatch out, which nature has provided for reproducing the species. A country hen ordinarily lays 10 to 15 eggs in three or four batches and after each such lot, she goes broody. Broody hens can be recognised by:

(1) Ceasing to lay eggs,
(2) A partiality towards a dark corner where she would like to make a nest and sit undisturbed
(3) The feathers stand out when a person approaches it and the hen clucks.
(4) A general lack of appetite.
(5) A reduction in the size of the comb, wattles and the reproductive organs.
(6) A rise of temperature.
(7) A general lack of lustre throughout the face.

The average time for a hen to incubate her eggs is 21 days although this period may either be lengthened or shortened by the influence of the temperature to which the eggs are subjected. She can also be employed to incubate the eggs of other species of domestic fowls.

The following are the approximate periods of incubation of eggs for the different species of fowls.

| | |
|---|---|
| Hen ... ... ... | 21 days. |
| Duck and Turkey ... | 28 days. |
| Goose ... ... ... | 30 days. |

**Sitting hen.** Care should be exercised to see that the hen is properly broody before setting. Very often it so happens that, when a hen shows the signs of broodyness, the eggs are set and the hen after a few days of sitting deserts the nest, which is a source of great disappointment, and loss.

To test that a hen is properly broody, one or two eggs or an artificial egg can be placed under her and tried for 2 or 3 days. If the hen settles to sit on the eggs properly, it can be taken for granted that the hen is properly broody.

**Selection of a hen.** A medium sized hen which is docile and in sound health should be selected; she must be perfectly clean with no lice or mites on her body; those with scaly legs should strictly be avoided for the reason that unless the hen is perfectly clean, she will pass on all the complaints to the chicks that she hatches. Some hens are clumsy, awkward and excitable and are apt to break the eggs every time they are let out and resettle. It is therefore necessary to watch the sitters carefully and if a hen proves unreliable, it will be a

good thing not to use her for the purpose. Long-legged hens are generally clumsy and the breakages of eggs are more, although some of them happen to be good mothers. Short-legged variety of hens is more reliable and as such preference should be given to it.

**Number of eggs to a hen.** A good average size hen of imported strain can take from 10 to 12 eggs and a country hen 8 to 10 according to the size of eggs. Care should be taken to see that the hen is able to cover all the eggs properly. When the hen shuffles her eggs it is quite possible that one or two eggs might be left outside and consequently chilled. So it is always safe just to give her the number of eggs which she can conveniently cover and have the others removed.

The number of eggs that a hen can sit on depends on the breed and size of the bird as follows :—

| | *Hen of imported breeds.* | *Country hens.* |
|---|---|---|
| Hens' eggs. | 10 to 12 eggs. | 8 to 10 eggs. |
| Ducks' eggs. | 7 to 8 „ | 6 „ |
| Geese's eggs. | 5 to 6 „ | 4 to 5 „ |
| Turkeys' eggs. | 5 to 7 „ | 4 to 5 „ |

**The Nest.** It is a simple matter to make the nest, but special attention is required. A dealwood case about 18" square with a trapdoor in front can be taken and the nest made out of hay or straw, over a layer of moist sand. On top of the hay or straw place some wood ashes; this helps to prevent lice etc.

It is necessary to put some ventilation holes in the sides of the box to enable free circulation of air. During the process of incubation if dry weather is experienced a little water should be sprinkled all round the nest to increase the humidity and also on the sand at the bottom of the nest. The nest proper should be made circular with a slight hollow in the centre covered with a layer of wood ashes as mentioned before. It should not be too deep as there is the possibility of the eggs rolling to the centre and consequently some breakages occurring amongst the eggs.

The box and the nest should be dusted with some disinfectant powder to keep off vermin. Powdered sulphur mixed with wood ashes, Sodium fluoride and tobacco dust, answer the purpose very well. A good powder can be made from a cigarette tin full of equal quantities of petrol and carbolic acids poured over one lb. of plaster of Paris and allowed to dry.

The nest must be examined for vermin carefully once a week and action taken; if it is not attended to the hen becomes restless and does not sit properly and when the chicks are hatched out, they will be found to be covered with lice or fleas and so their growth suffers. The nest should be scrupulously clean and should never be fouled. Any broken egg or droppings should be removed and any source of contamination should strictly be avoided. If however, the nest is fouled

either by a broken egg or the hen's droppings, another clean nest can be made and the remaining eggs so contaminated should be washed in warm water about 100° F. and the hen immediately returned, to the nest.

**Setting eggs.** Fresh eggs of uniform good oval shape and size should be selected. Too small or abnormally big sized ones should be rejected. The shell of the egg must be of sound texture, free from ridges and encrustations. While selecting eggs preference should be given to those laid by vigorous and well matured hens.

**Storing and holding eggs.** When collecting eggs for setting, they should be kept in a dry, cool, airy place. In plains they should not be kept too long. Under the best conditions, to get the best results, eggs should not be older than 4 to 6 days. In hill stations there is no harm in using eggs 10 days old. As the eggs absorb odour very easily it is not good to store them near smelly substances like onions, kerosine oil etc.

**The hen and its treatment.** After having arranged the nest as described above, the nest box should be placed in a partially dark, quiet place, where there is no disturbance.

The hen should be set preferably in the evening and should not be disturbed until the following evening. She must get plenty of grain food and drink before setting. From that day onwards she must be let out once a day at a stated regular time for feeding, exercise etc. This guarantees the cooling and turning of eggs at regular intervals.

**Dust-bath.** The fowls' natural method of cleansing themselves so as to be free from vermin and parasites is to take dust bath. So, the hen should be provided with a place for this which should contain sand mixed with wood ashes.

**Feeding.** Sitting hens should be given hard grain like maize, wheat, cholam, cumbu, paddy etc. The whole grains take a longer time for digestion and so the hen can sit comfortably on the eggs. Soft food like cooked rice and wet mash made of bran is not good for sitting hens. It is a bad practice to place either mash, grain or water in the nest itself for the hen to eat whilst sitting.

Good sitters generally do not come off the nest when required and so it will necessitate the removal of the hen by hand. While so doing it is quite possible that some eggs are concealed in her wings and dropped and consequently broken. This fact should be borne in mind while handling the bird. Usually good sitters go back to their nests after 15 to 20 minutes when they have finished their feed, drink, dust-bath etc.

This daily routine should continue with occasional dressing of disinfectant powder on the bird and the nest.

**Testing of eggs.** The eggs are tested on the tenth day of incubation. The simple method of doing is by means of a tube made out

of a stiff paper, and holding each egg between the thumb and fore-finger and middle finger exposed to the sun light and examining it through the tube. All eggs that appear clear can be taken as infertile and those that have spider-like structure inside with radiating lines which are the blood vessels, can be taken as "fertile" ones.

**End of incubation.** The 19th. day evening will be the final day for the hen to be allowed out of her nest. On the 20th. day the hen sits tight and the chicks start their active life. They pip on one side of the shell with their beak-horn and break open the shell and struggle. The whole hatch finishes on the 21st. day. It is not good to help the chicks to come out as such chicks will invariably be weaklings and hand assistance will cause injuries and damage.

**Conclusion.** Another clean hen coup should be kept ready for transferring the newly hatched chicks with the mother-hen. The hen can be given her food but the chicks should not be fed for at least 48 hours. The chick just before hatching takes in all the yolk material in the system and this serves as reserve food for a number of days. Such being the case, they should not be over-fed, as it is likely that they may get indigestion, diarrhoea, and in fact all sorts of complications. The first food for the chicks may be some finely broken grain eg. Wheat, maize, cholam and broken rice. Oat meal is the best food for young chicks. The mother hen will teach them to pick up grain and drink water and all we have to do is to house them properly and keep them free from lice, mites etc.

The essential factors for a successful hatching are moisture, heat and air. When a hen goes broody, the normal temperature of her body increases due to the accelerated flow of the blood in the system. This heat aids towards the maintenance of the eggs at a temperature of about 103° to 104° F.

An egg when placed in its normal position, the impregnated or the fertilized germ comes topmost. The yolk which contains the germ is of less specific gravity than the albumen and so it floats on it. It is the object in nature's purpose to bring the fertilized germ topmost, as near to the source of heat as possible. When a hen is let out for daily exercise (generally this occupies 10 to 15 minutes per day) she returns to her nest afterwards. Before she settles down on the eggs she shuffles the egg by which the object of turning is accomplished. If the eggs remain in the same position, there is the possibility of the developing germ sticking to one side of the egg and consequent death of the embryonic chick.

It may be mentioned here that the incubators are made so as to subject the eggs almost to the same conditions as they would be under a hen during the process of incubation.

# MAIN POINTS OF SOME OF THE IMPROVED SUGARCANE VARIETIES FROM THE CULTIVATORS' VIEW POINT

BY T. G. MENON, B.A., B.Sc., Ag.,

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The sugarcane station at Coimbatore has evolved a number of new cane varieties which are rapidly ousting the indigenous ones in all the provinces. The thin and the medium thick canes are specially evolved to suit the demands of the North Indian cane cultivators who supply their canes to the mills. With a severe summer, when the temperature goes up to 110-112°F. for several days. and with an indifferent system of cultivation as is practised by most of the ryots in North Bihar under non-irrigated conditions, the only possibility of improving the cane supply for a successful cane industry is to evolve drought resistant varieties which give a fairly high tonnage and sucrose content.

The Agricultural Section at Pusa which has been the central agency for the distribution and spread of improved canes in the sugarcane tract, chiefly parts of the United Provinces, has been testing all canes sent out by the Imperial Sugarcane Station as to the suitability of growing them under the North Indian cultivators' conditions. The canes distributed by this section are spreading rapidly and all over the tract the improved varieties have come to stay. For instance, the 1931–32 estimates of the area under improved canes for the United Provinces and Bihar and Orissa (1930-31) would reveal the popularity of these canes.

| | 1931-32<br>Total Estimates | 1930–31<br>Area under improved canes |
|---|---|---|
| United Provinces | 1,554,000 | over 70% of total area |
| Bihar and Orissa | 279,000 | 70,484 |

For these two provinces especially, sugarcane cultivation has been the sheet anchor for the agriculturists and the indigenous varieties are being displaced rapidly. This will again be evident from the fact that in 1930–31 season, 66,748 lbs. of sugarcane setts were distributed by the Imperial Department of Agriculture (1930-31). It will not be too much to say that today, the sugarcane industry in this tract is entirely dependent on the improved canes and in no respect has the readiness of the cultivator to accept an improvement been clearer, than in his adoption of the improved canes distributed by the Agricultural Section, Pusa.

In view of the added impetus to the sugarcane industry by way of sugar tariff of Rs. 7—4—0 per cwt. on foreign sugar, and the consequent increase of the area under sugarcane, it is but fitting that an attempt should be made to make a comparative study of the improved canes which are now, or shortly will be, available to the cultivator.

The more important canes which have so far been distributed by the agricultural section, or are being tried on an extensive scale under normal conditions, are the following :—

Co. 210, Co. 213, Co. 214, Co. 281, Co. 285, Co. 299, Co. 312, Co. 316, Co. 331 and Co. 205.

*Co. 210* is of comparatively shorter growth than Co. 331. Canes are zig-zag, joints purple, internodes of medium length (four to five inches); canes are round, purple, with abundant foliage of light green colour, leaves long, of medium width, and of spreading curvature. Tillers good and five to six ; the variety is a drought-resistant. It is now the standard cane and grown all over North Bihar. Yield six to seven hundred maunds per acre on good land ; Sucrose 16 per cent. This is suitable to lighter lands, but grows on any type of soil.

*Co. 213* has an erect habit, with canes usually straight, joints purple. Foliage is dark green and abundant ; long, wide lamina. Canes straight, medium thick (thin upward) round, internodes of medium length (three to four inches), pink : buds prominent and round. Tillers 5—6. Length of cane is four to five feet. It has aerial roots. It is less drought resistant than Co. 210. This is fairly resistant to water logging. Yield is 650 maunds per acre on good land. Sucrose 16 per cent. It needs better land, and optimum conditions as regards manuring and cultivation. It withstands lodging.

*Co. 214*:— This shows a lodging habit especially in rich land. It is very much like Co. 299 with sub-erect habits ; crooked cane, leaf-sheath not easily separated, abundant but dark green foliage, long narrow lamina ; nodes even with joints, fair tillering ; internodes of medium length ; prominent round bud. Length of nodes three to five inches, height four to five feet. Yield about 400 maunds per acre. It is fairly resistant to water logging. The earliest cane not a heavy yielder (400 mds. per acre) but contains high percentage of sucrose. A premium is paid for these canes. It has more than 18 per cent. sucrose. Though this lodges, there is less deterioration in the juice than in other varieties. Its germination is good and uniform. During monsoons its growth is slow.

*Co. 281* is an optimum cane. It yields about 600 maunds per acre and has a high sucrose content which goes up to 18 per cent. It is an early cane, ripening in November ; does not lodge ; but, under ordinary cultivation the variety does not come up well. Its foliage also dies up early and besides is susceptible to the attack of white ant at all stages and of jackals if allowed to remain after December.

*Co. 285* has an erect habit, with erect canes, greyish white joints ; with leaf-sheaths not easily separated. It has dark green abundant foliage ; leaves with long narrow lamina ; thin hard canes with nodes a bit thicker than joints, round, and internodes of medium length.

Buds are not so prominent. Tillers well (eight), rich in sugar content. It lodges to a slight extent. If allowed to stand the buds begin to sprout. It is attacked by jackals.

It grows on any land but better on low land which is particularly suitable to it and grows on conditions similar to Co. 205, to which it is preferred, being less fibrous. It yields about 700 to 800 maunds per acre and the sucrose content is 15 per cent. This germinates quicker than most other varieties and grows very quickly in hot weather. The cane formation is quite early. It stands water logging.

*Co. 299* seems to do better than Co. 214 and has no tendency to lodge; the canes are zig-zag, yellow jointed, with leaf-sheaths not easily separated. It has a light green abundant foliage. Leaves have long narrow lamina, with erect curvature. Canes are medium thick, the base being thicker; nodes are even with joints; tillering is rather poor. Buds are not prominent. After passing through a rather severe summer with temperature going up to 110 to 112° for over a week, this cane has done better than Co. 214 in tonnage. It promises to be an early cane and may replace Co. 214. In comparison it is a heavy yielder and possesses good agricultural habits. The sucrose content is 17 per cent. The yield is 600 maunds, although it is a little lower on poor lands. It is not a fast grower, but stands drought well. Germination is not uniform, and is slow and late.

*Co. 312* is a fast growing variety with pale green leaves. Its germination is good and uniform; tillering good; stands bad weather better than other varieties. This is a soft medium cane and has many good agricultural points except for its tendency to lodge in rich land. Canes are thin, internodes of medium (3—4″) length. Sucrose content varies from 13·26 to 16·59 per cent. The yield is 600 maunds.

*Co. 316* canes are crooked and have a tendency to lodge; Joints are brown, leaf-sheaths are easily separated, leaves are long and broad, canes are medium thick, with internodes of medium length, 3-4 inches. Tillers fairly well on good land. Its yield is about 350 maunds per acre. It is being tried on light soils. It stands water logging. Sucrose content varies from 14·65 per cent on low land to 18·81 per cent on high land. This is not good as a drought-resister and cracks badly. It is a juicy medium-thick cane.

*Co. 331* is a promising variety and has excellent agricultural habits. It is a tall strong erect growing variety, with medium thick purple canes, with fairly long nodes (6—8″). Leaves are long, erect and tough. It tillers fairly well (eight). It resists droughts well and gives a good tonnage but matures late; sucrose content is 15 per cent. Yield is 720 maunds as calculated from a small area.

*Co. 205* is, from the point of the mill not a desirable variety as it contains over 20 per cent. of fibre. But it is specially suited to water

logged situation, where it grows vigourously with bushy growth. It tillers fairly well. People in the Punjab prefer this because the *gur* (jaggery) made from this is of superior quality and the variety is less liable to damage by men and animals than other varieties it. Further it grows on poor land with less manuring. These and a few more are still under experiment. The sucrose content is 14 per cent. and the yield 400 maunds

***Yield, sucrose percentage and main points at a glance.***

| Variety | Average yield. | Sucrose % | Remarks. |
|---|---|---|---|
| 205 | 400 | 14 | Late cane. Fibre over 15 per cent |
| 210 | 600–700 | 16 | Standard cane. Drought resistant. Grown on light lands. |
| 213 | 650 on good land | 16 | Needs better land. Stands water logging to a certain extent. |
| 214 | 400 | 18 | Earliest cane. Premium offered by mills. Fairly resistant to water logging. |
| 285 | 700 | 15 | Suitable for low lands. Less fibrous than Co. 205. Grows on similar conditions. To be preferred to Co. 205. |
| 331 | 720 1931 trial | 15 (1931 analysis) | Excellent agricultural habits but late variety. Resists drought well. |
| 312 | 600 | 15·5 (1931 analysis) | ..... |
| 316 | 400 | 16 (1931 analysis) | Being grown on light lands. |
| 281 | 600 | 18 | Optimum cane. An early cane ripening in November. |
| 299 | 600 | 17 | Seems to be better than Co. 214 in tonnage Has good agricultural habits. Promises to be an early cane and may replace Co. 214. |

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## "CHROMOSOMES AND PLANT BREEDING"*

The lecture dealt with the study of chromosomes in relation to sterility. Sterility could be classified under three heads. (1) Relational sterility, where the pollen grains of one plant are not able to grow on the styles of the same plant. This is due to self incompatibility which is governed by the interaction of certain genes; (2) Morphological sterility where malformation of sexual organs enters into the causation of sterility and this is also genetically determined and is governed by a single gene; and (3) Generational sterility, which is by far the most important, is due to the segregation of chromosomes at meiosis.

* Abstract of a lecture delivered by Dr. C. D. Darlington Ph. D., D.Sc. Cytologist, John Innes Horticultural Institution, London, under the auspices of the Association of Economic Biologists, Coimbatore on 13th August 1933.

This kind of sterility is most often met with in interspecific or intergeneric hybrids and are due to particular behaviour of chromosomes at meiosis. The different types of chromosome behaviour contributing to the causation of sterility may be classified as under:—(a) *Raphanus* × *Brassica* hybrids. These are completely sterile. Cytological examination of the meiosis of these plants reveal non-pairing of the two haploid parental chromosome sets with the result, that the univalents are assorted at random to the poles as in the case of haploids. By this chance and irregular distribution of chromosomes it is hardly possible to get gametes with viable sets of chromosomes and the result is almost complete sterility. (b) *Primula kewensis.* In this type, the haploid chromosomes of *Primula sinensis* and *Primula floribunda* pair together and simulate normal meiosis but still we meet with complete sterility. This could be explained by the segmental interchange of chromosomes taking place at meiosis, being brought about by the crossing over and chiasma formation in them. This segmental interchange brings on unbalance of chromosomes in the gametes and the result is the occurrence of sterility. (c) Triploidy as a cause of sterility is known in many plants. In triploids, instead of the two normal sets of chromosomes present in diploids, there are three homologous sets and at meiosis the extra odd set is left without its partners and the result is irregular distribution of chromosomes to the poles and consequent formation of a large percentage of non-viable gametes. While triploidy among cereals, where seed production is all important, is of no advantage, among horticultural varieties, triploids have been found to be of great use. Many of the ornamental plants of Japan like the hyacinths and tulips are triploids. (d) Tetraploidy has also been a source of generational sterility. While tetraploids derived from diploid hybrids by duplication of the chromosomes, have been found to be mostly fertile, those arising in homozygous diploids by duplication of chromosomes are found to exhibit marked sterility. The reason is that in such tetraploids, there are four homologous sets of chromosomes and these by interchange of segments owing to crossing over and chiasma formation at meiosis, bring about unbalance in the gametes with the result that only a small percentage of the gametes are viable and hence there is reduced fertility.

The lecture at the end touched upon the definition of hybrids, which differs from the points of view of the taxonomist and the cytologist, as instanced in the case of *Oenothera*.

## ABSTRACTS

**Disintegration of Bones.** D. L. Sahasrabudhe (*Agri. and Live-stock in India, 1933, vol. 3, pp. 264—271*). The present paper reports a comparison of some simple methods which can be adopted by the farmer to render bones friable and easily powdered. Bones cost about Rs. 7 to 8 per ton in the village, but the factories sell bone-meal at Rs. 70 to 90 per ton or even more, a major part of the difference being due to high transport charges, and the price could be easily brought down to about Rs. 30/- to Rs. 35/- per ton. if small scale plants be started in village centers, adopting simple methods for the preparation of bone-meal. Experiments carried out with a Simplex Crusher, worked by hand, showed that a preliminary treatment of bones with water for 2 months reduced the time required for crushing from 95 minutes to 45 minutes; bones treated with 2 per cent hydrochloric acid for one month required 45 minutes; those treated with 2 per cent sulphuric acid required 60 minutes. Treatment with alkalies was better; soaking in 5 per cent caustic soda for 8 days reducing the time of crushing from 95 minutes to 10·5 minutes. 5 per cent washing soda (8 days soaking) reduced the time required to 32 minutes only and was not so effective. Treatment with bulky materials by storing the bones mixed with soil, farmyard manure, cattle-dung or urine

required a long period (4 months) for the time of crushing to be brought down to 25 minutes and is not considered useful for the purpose in view. Heating the bones in an autoclave, under steam pressure at 140°C for two hours rendered the bones easily crushable by hand, but dry heating between iron plates was not so effective, 5 hours heating at 150°C reducing the period of crushing to 13 minutes. Charring and half charring the bones using dry leaves and farm refuse as fuel, at the rate of 16 lbs. fuel per 100 lbs. bones for full charring and 10—12 lbs. fuel for half-charring, was found to be very effective. The fully charred bones could easily be crushed by the fingers, while the half-charred bones were easily crushed in the mill (10 minutes). A comparison of the economics of the different methods showed that the cost of a ton of the bone-meal prepared was as follows :—(a) by 5 per cent caustic soda Rs. 57/–, (b) by 5 per cent washing soda Rs. 35·7 ; (c) by half charring Rs. 16 5 ; (d) roasting Rs. 13·5. The last two methods are recommended for adoption at village centres. (C. N.)

**The effect of the contact of Chemical fertilisers with seeds on their germination.** V. G Gokhale and P. M. Gaywala (*Agri. and Live-stock in India, 1933, vol. 3, pp. 256—263*). Sometimes the practice has been recommended of sowing the fertilisers along with the seed, as one securing economy in cost of application besides giving greater yields than later applications of fertilisers ; but the practice has one draw back, namely, the harmful effect on germination exerted by the concentrated fertilisers coming into contact with the seed sown The authors have examined the conditions under which such a harmful effect is observed and arrive at the following conclusions :—(1) The effect on germination is most injurious when the mixture of cotton, *jowar* (*Sorghum vulgare*) or *bajri* (*Pennisetum typhoideum*) and sulphate of ammonia at the rate of 100 lbs. per acre is dibbled in pinches, thus bringing about direct and concentrated effect. Cotton seeds were found to suffer comparatively more than *bajri* or *jowar*. (2) Drilling of the above mixture seems to lessen this contact and concentration and thus to effect a marked improvement in germination over (1), due to intervention of soil between the seed and the fertiliser. (3) The injury to germination is practically nil when the contact and the concentration of the fertiliser with the seed are still further lessened as by drilling the fertiliser 3 to 4 feet behind the dropping of the seed in the same furrow, or by applying the fertiliser separately either before or after sowing. (4) The contact of the fertiliser (sulphate of ammonia at the rate of 6 oz per two tolas of *bajri* and cotton seed or eight tolas of *jowar* per plot of 4 ft × 40 ft.), with the seed up to 2 days in the dry condition of both did not effect any appreciable difference in germination. (5) The failure of germination occurred only when the fertiliser comes in concentrated and direct contact with the seed under the soil conditions favourable for germination, i. e. moist soil etc. (C. N.)

**Live Weight of cattle by measurement.** S. G Singh (*Agri. and Live Stock in India, 1933, vol. 3, part 2, pp. 144—151.*) Several formulae have been used in Western countries to estimate the weight of animals from certain body measurements, but the author found that these were not applicable to cattle in India. He finds a formula recently devised by Capt. G. E. Macguckin (*Ind Jour. Vet. Sci. and Animal Husbandry 1931, vol. 1, part 3*) to be better than others, viz :—

$(\text{Girth})^2 \times \text{length} \times 5{\cdot}5 = \text{Live weight of the animal in pounds.}$ The girth is measured just behind the shoulders to represent the circumference of the body, and the length as the distance between the square of the buttock and the square of the shoulder. The readings for length were taken from both sides and averaged to eliminate the effect of different postures assumed by the animals at the time of measuring. Girth and lengths are expressed in feet. In actual practice this formula was found to work fairly well in the case of large animals, but it did

not give satisfactory results for small cows of the Montgomery breed, for which the author devised the following modified formula :—

$G \times L/X$ = Live weight of the animal in seers, where G is the girth of the animal in seers, L the length of the animal in inches and X was a variable factor whose value was found by experiment to vary with the size of the animal as follows :— X equals 9 or 8·5 or 8 according as the girth of the animal is below 65 inches, between 65 and 80 inches and above 80 inches respectively. The new formula was found to give better results than that of Capt. Macguckin for all cows, including the small ones of the Montgomery breed. (C. N.)

**Studies on germination and growth in groundnut** (*Arachis Hypogaea, Linn*)—Ali Mohammad, Zafar Alam, and K. L. Khanna. (*Agriculture and Live Stock in India, 1933, vol. 3, part 2, pp. 91—115*). (1) In groundnut, earliness in maturity appears to be associated with the erect habit, and lateness with the spreading habit of growth. The spreading varieties show a greater power of disease resistance than the erect growing varieties. (2) Germination tests carried out in the field showed that :— (a) Best germination is obtained by sowing seeds instead of pods. (b) Pods soaked in water for 24 hours before sowing give 16 to 20 per cent. more germination than unsoaked pods. (c) Seeds soaked in water for 12 hours before sowing give quicker and more uniform germination than unsoaked seeds. (d) Seeds with their testas partly or wholly removed fail to send up their seedlings above ground; this inability is traced to fungus attack on the seeds after sowing. (e) Seeds with portions of cotyledons removed gave less germination than entire seeds, and the root and shoot development of their progeny was also very poor. (3) A comparison of three varieties at different stages of growth showed that the "Burmese" exhibited a much more vigorous root and shoot growth than the other two varieties viz., "Small Japan" and "Small Spanish", of which the latter appeared to be better suited to withstand drought. (4) The formation of leaves and flowers in groundnut has been shown to proceed simultaneously. The period of maximum vegetative growth and flower production lasts from 56 to 97 days and from 70 to 125 days after sowing, respectively in the case of erect and spreading varieties. This is a critical period of growth and importance of a plentiful water supply during this period has been pointed out. (5) A close correspondence has been found to exist between the root and shoot development in the different varieties studied. (6) The groundnut plants grown in sand or clay showed a very poor development The addition of *Kankar* to clay proved beneficial. The application of lime to soil encouraged both root and shoot development in the early stages of plant growth atleast and induced early flowering. The application of ammonium sulphate retarded the growth of plants and delayed flowering. Lime promoted the formation and development of nodules on roots to a great extent and ammonium sulphate inhibited their formation. (Author's summary)

**Relative merits of High and Low Silage Feeding to Cows in Milk.** K Gupta and R. S. Gupta. (*Agri. and Live Stock in India, 1933 vol. 3 part, 2 pp. 116—124*). Two groups A and B, each consisting of 20 freshly calved cows (Sindhi and cross bred) were fed, A with 41·25 lbs. of silage and B with 24·75 lbs. of silage per 1000 lb body weight (average live weight 600 to 700 lbs). Ragi straw was given *ad lib* to both the groups as the supplementary roughage, and in addition, a concentrate mixture of wheat bran, brewery grain and groundnut cake at the rate half a pound of the mixture per pound of milk produced; also 1·426 lb. of groundnut cake per 1000 lb. live-weight to ensure an ample supply of protein for maintenance. The experiment which ran over four weeks, showed that: (1) the cows getting less silage consumed more *ragi* straw, and thus the total food consumed by the two groups A and B were almost equal (about 32—33 lbs. dry matter per day for 1000 lb. body weight) (2) There was a greater increase in live weight in group A which

was getting more silage, but the quantity and quality of the milk obtained from the two groups was almost identical. (3) Since silage is costlier than *ragi* straw, the authors conclude that feeding of lower silage as in group B, (24 lb. per 1000 lb. live weight) is economical, especially as it does not decrease either the quantity or quality of milk. (C. N.)

**The composition and Fertilising value of Sewage Sludge.** G S. Fraps. (*Bulleti . No. 445 of the Texas Agri. Expt. Station, U. S. A., 1932*). Sewage sludge obtained as a by-product from the purification of sewage, is of two varieties, viz. the *Digested Sludge*, produced in the Imhoff process where the raw sludge is kept in closed tanks and undergoes an extensive decomposition by the action of Bacteria and other organisms whereby the less resistant portions of the organic matter is destroyed and the more resistant portions settle down, and secondly, the *Activated Sludge*, obtained by seeding the sewage with activated sludge and pumping air through the mixture, whereby an extensive growth of protozea and other organisms is produced which adhere to the suspended solids and cause them to settle. While the digested sludge consists of the resistant parts of sewage organic matter, the activated sludge contains, besides the organic material of the sewage, bodies of the organisms which produce clarification, and hence contains more nitrogen than digested sludge and is more easily nitrified in the soil. Analyses of dried *digested sludge* showed that it contained on an average about 1·9 per cent nitrogen, 1·6 per cent total phosphoric acid, of which about 1 1 per cent is available, and 0·2 per cent potash. *Activated sludge* when dried usually contains over 5 per cent of nitrogen and 2 per cent of available phosphoric acid, and about 0·2 per cent of potash. It has about 70 per cent of the fertilising constituents of cotton-seed meal. Both the dried sludges contain 33 to 76 per cent of ash chiefly insoluble in acid; grease, pentosans and crude fibre are also present. Pot experiments to determine the availability of nitrogen and the rate of nitrification showed that the availability of the nitrogen of digested sludge was variable and averaged about one half of that of cotton seed meal. The availability of the nitrogen of activated sludge was about equal to that of cotton seed meal, and it nitrified more easily Dried *di ested sludge* contains somewhat more plant food than farmyard manure, but is a poorer source of humus. Dried *activated sludge* is a nitrogenous fertiliser similar to cotton-seed meal and has about seven-tenths its value. It can be used alone or in the preparation of mixed fertilisers. (C. N.)

**Studies in South Indian Pastures I Seasonal, variation in the mineral and nitrogen content of spear Grass (Andropogen contortus)**—P. V. Ramiah (*Indian Jour. Vet. Sci. and Animal Husbandry, 1933, vol. 3, part 1, pp. 65—84*). The investigation reported here consisted of a study of the mineral matter and protein of the herbage (the main flora being *spear grass*) of four paddocks at Hosur during two seasons in 1929 and 1930 The results obtained which are similar to those reported from England and other countries, show that the main factor determining composition of herbage is the stage of growth, though seasonal conditions and incidence of rainfall exert a subsidiary influence. Nitrogen and phosphoric acid curves followed a parallel course, while the calcium curve varied inversely as the other two. The deficiency of the soil in calcium and phosphoric acid was reflected in a deficiency of these too essential constituents in the herbage. The author opines that the posture would just meet the maintenance requirements of an adult working animal, while growing animals and milch cows are both in danger of a deficiency if grazing on the herbage alone without the supply of a concentrate. A mineral supplement is recommended for use as a prophylactic in such cases The best period for mowing for silage or hay making was found to be that when the grass had flowered and before the seeds had set. (C. N.)

**Disintegration of bones by Alkali method and their use as fertilizers.** M. A. Hossain (*Agri. and Live-stock in India, 1933. vol. 3, part 2, pp. 152—165*). This

is a continuation of previous work by Sen and Hossain (Agri. and Live-stock in India, 1931, vol. 1, p. 151) wherein it was found that caustic alkali plus common-salt gave good disintegration of bones. The present paper gives details of the optimum conditions under which the disintegration could be brought about. The raw bones are kept dipped in a solution containing 1·5 per cent caustic soda and 1·0 per cent common-salt for about 2 months in air tight vessels. The ratio of bones to solution recommended is 1:4. The used up liquid can be re-used for two more subsequent treatments, renewing the alkali only. Details of a simple and convenient process are given which can be adopted by the cultivator himself, using kerosine tins, commercial caustic soda and common salt. The cost of preparation of the alkali treated bones is very low; it is about Rs. 1—14—0 per maund, excluding labour charges, as compared with about Rs. 5—8—0 per maund which is the price of bone-meal and bone super-phosphate. The alkali treated bones were found to be superior to bone-meal or bone-super in respect of phosphoric acid content. Pot culture experiments with Dacca soil which was extremely poor in total and available phosphoric acid, showed that the bone fertilisers prepared by the alkali process gave as good yields as superphosphate (C. N.)

**Russian methods of artificial Insemination** Water Landauer. (*Journal of Heredity, vol. 24, No. 3*). The article describes the methods adopted in Russia for artificial insemination of sheep. In Russia, a country of great distances, the economic programme calling for rapid improvement of existing livestock made it imperative to use the expensive purebred sires which had been imported from foreign countries to the greatest possible extent in grading up local herds. This naturally gave new impetus to attempt at perfecting the methods of artificial insemination. It seems probable that artificial insemination will play an important role in the future of livestock breeding in general, since it will enable breeders to make much more rapid progress towards reaching the goal of their breeding programme. Although the methods described have been specially worked out for sheep, very similar ones are used in Russia for house cattle and pigs. During 1931 in Russia one of the methods was used for the insemination of several hundred thousand sheep and of about 187,000 cows; it has also been used for horses and donkeys. Essentially all the methods consist in collecting the sperm from the vagina of the animal after it had been served and injecting the same into the vaginas of other animals. During 1930, it was found that the sperm of a single can when fully utilised was sufficient to inseminate from 300 to 400 ewes during one season. One service of the ram on the average gave enough sperm to inseminate six ewes. About 90 per cent. of all ewes inseminated, became pregnant which is as high as can be expected under normal breeding conditions. As many as 400 cows can be inseminated from a single service of a bull, and as many as 1250 cows have been actually inseminated from one bull in the course of a year. Ordinarily, the possibilities of utilising the sperm will be limited by the available number of animals which are in heat. Experiments have been made, however, concerning the possibility of keeping the sperm. With a special glucose phosphate dilution fluid, and at a temperature of from 10 to 15°C it was found that raw sperm could be stored for 18 days and still be used for successful insemination. Studies are also being made in Russia concerning the possibility of inducing heat periods experimentally. (K. R.)

# Gleanings

**Jute cloth for road surfacing.** An interesting experiment involving the use of jute cloth in road surfacing has recently been tried in Calcutta by the Indian Jute Mills Association. The work was carried out by Messrs. McLeod & Co., with the co-operation of the Public Works Department of the Government of Bengal, on a

stretch of the Strand Road one of the most important thoroughfares in Calcutta. After being scraped and cleaned, the road surface was coated with bitumen and then laid with Jute fabric. The fabric was then again coated with bitumen, covered with a layer of fine stone metal and rolled so that the upper coating of bitumen penetrated the cloth and formed a solid mass with the bitumen underneath; at the same time the stone chips adhered to the bitumen and fibre, producing the wearing surface. The stretch of road so treated is behaving exceptionally well and has retained a better appearance than another stretch of road which was built at the same time without the Jute cloth. (*Chemistry and Industry, April, 28, 1933*).

**Russian Research on Plants of Waste Land.** The *March, 1933* number of *Revue de Botanique Appliquee d'Agriculture tropical* contains a summary of recent Russian work which might prove of considerable value under Indian conditions. Although the intensity of cultivation differs greatly between the thinly populated South Western Steppes and the typical village lands of India, there is much waste-land in both areas which is only occasionally cultivated and left to lie fallow for long intervals. It is in such places that this research work aims at finding more or less perennial crops which need little tending and which will not exhaust the soil, but which will yield some revenue. Those mentioned include several common Indian genera or very similar plants, the chief classes of which are gutta-percha-yielding *compositae*, tawnin-yielding plants, grasses containing ethereal and scented oils, grasses for paper and pulp, and several common herbs, which yield a mucilage substituted for mineral paraffin oils as laxatives, eg., *Salvia aegyptica*, *Plantago, amplexicaulis* and *Lallamantra royleana*. (*Indian Forester, August 1933*).

# Notes & Comments.

**Advisory Board Meeting of the Imperial Council of Agricultural Research.** Several schemes have been discussed at the recent meeting of the advisory board, the most important of them being the question of the improvement of the standard of Veterinary education in India and the consideration of the draft curriculum framed by the Committee of experts appointed for the purpose. After considerable discussion it has been agreed that there should be a minimum course of three years which should be raised to four in each College as soon as local conditions permitted. During the discussion it appears to have been suggested that because there were many unemployed veterinarians, there was no necessity to train more young men as veterinarians. It cannot be said that the existing facilities for the ryots to protect their cattle againt diseases are yet adequate, and it will not be wise for Governments to cut down expenditure on veterinary education on the score that there are several unemployed qualified veterinarians. The suggestion, however, thrown in the discussion that a multiplicity of Colleges might be avoided, deserves attention. A few colleges with the standard of education as high as would be necessary would certainly be far better than a large number where the quality of training was indifferent. It has been rightly pointed out that the existing rate of pay for the veterinary surgeons was

rather low considering the huge amount of disease prevailing in the country and the importance of the study of Animal Husbandry to India. We should suggest that the standard of training in the Veterinary Colleges must be improved and the pay and prospects of the qualified men brought on a par with those of the Agricultural graduates. We are glad to note in this connection that there is a proposal to affiliate the local Veterinary College to the Madras University and this when it meterialises should be a move in the right direction as it must indirectly improve the standard of education imparted there.

Among the other subjects that were discussed by the Council may be mentioned (1) The scheme for the investigation and cultivation of medicinal plants of the Punjab; (2) The scheme for combating the *Koleroga* disease of areca palm in Kanara. Bombay; (3) Grant for research into malting and brewing tests of improved barley; (4) Investigation into Johne's disease among animals in Mysore; (5) Scheme for the biological study of the alkali soils in the Punjab.; (6) Continuation and extension of the grant for satistical studies relating to Agricultural work in India under the Professor of Physics, University of Calcutta; (7) Scheme of poultry breeding research in Western India and (8) Sugarcane Research in N. W. Frontier Provinces.

It is well that regarding item No 2 there has been differences of opinions expressed at the Council meeting. The question is whether the grant applied for by Bombay is for the purpose of conducting research or for applying the lessons of research. The Council, we believe, can entertain schemes only for conducting research while the practical application of results obtained from research must be the business of the provinces concerned. Provinces like Madras and Mysore have already extensively adopted the latter and successfully carried out practical demonstrations about combating the disease. We hope the application of Bombay for the grant was for the purpose of doing more intensive research on the disease itself.

**Fruit Farming and Canning of Fruits.** We understand that as a result of successful experiments in canning and colouring of certain classes of fruits conducted under Government auspices, the Ceylon Department of Agriculture is contemplating the formation of a separate branch of the Department which will be in charge of fruit culture in the island. Extensive experiments are being carried out in fruit farming. They are also intending to provide the Agricultural Chemist with a plant to enable him to continue his experiments in fruit colouring and fruit canning. Experiments on artificial colouring of locally grown oranges and mangoes are reported to have been successful with the result there are now produced in Ceylon oranges having the same colour as the Australian, Jaffa and Californian species. In the meantime the Ministry of Agriculture and Lands is engaged in studying the question of finding markets abroad and problems of shipping and cold

storage. In this connection we are glad to note that the proposal to open a fruit farm in Madras with the funds provided by the Imperial Council of Agricultural Research is materialising. A suitable site for the station has been selected at Rajampet in the Cuddappah district and the acquisition proceedings are awaiting the acceptance by Government of the Director's proposals. That the production and consumption of more fruits in the country is necessary for the maintenance of good health is now being increasingly recognised. That the people in parts of Kistna and Guntur are devoting more and more of their dryland for planting oranges and limes is a hopeful sign. The opening of a fruit farm by the Department is expected to be of great help to the fruit growers in teaching them what fruits to grow and how to grow them. The question of canning fruits is not a problem to be worried about for the present in as much as we do not produce enough fruits even for local consumption. As a corrollary to the opening of the fruit farm we would urge the Government for their earnest consideration the necessity for making a comprehensive study of the existing markets and to evolve a scheme for regulating and organising them. The control of the fruit markets has already engaged the attention of Bombay and without similar impetus from the local Government, the scheme is not likely to result in the maximum benefit for the cultivators.

**Rice Trade in Madras.** We have reviewed elsewhere in this issue, the world rice situation for 1932–33. Burma as usual, practically monopolises the foreign export trade of India in rice. For 1931–32 Burma contributes 87·8% of the whole export, Bengal 5·4% Madras 2·7% and all the other provinces put together the balance. To check the existing adverse effects of a big import of cheap Burma rice into Madras it is necessary that Madras should at least maintain if not improve the small share of export which she is now having. The two chief obstacles standing against its maintaing this export trade are (1) the absence of organised marketing agencies and (2) the high freight charges. The agitation and representation of the rice growers in Tanjore district (which contributes mostly to this small export trade), to the Railway and getting them to reduce the freight charges have had a very desirable effect, in that exports of rices to Ceylon during the last two months have appreciably increased. We should like to point out that Madras contributes nothing to the export of rice, raw, par-boiled and broken to the United Kingdom, the monopoly almost exclusively resting with Burma. The London prices of the American and Spanish rices which are the ones chiefly consumed in the United Kingdom are found to be 2·3 and 1·4 times respectively that of the Burma rice. The samples of these three rices as sold in London have been obtained, and it is found that the quality of some of our rices, particularly the variety *Nellore Samba* grown on a commercial scale all over Madras is as good as the Spanish and distinctly better than the

Burma rice. Taking advantage of Ottawa pact, we understand, that even Australia is trying to find a market for her rice in Great Britain but it is believed she will never be able to compete with India because of her higher cost of production. It appears to be a feasible proposition for even Madras to send some of her rices to England. While the export of Burma rice is well organised and there are agencies in England to exhibit the products of that country there is no such agency for Madras. It is up to the Tanjore Rice Syndicate which is newly formed to try and explore the posibilities in this line. It must be remembered, however, that greater attention must be paid to the milling and cleaning processes in the country so that the finished product—cleaned rice—will have the same attractive appearance as the American and Spanish products and thus catch the attention of the consumers there.

**A Lecture by Dr. C. D. Darlington.** The usefulness of the existence of a scientific association like the Association of Economic Biologists, at the Research Institute was apparent in that it was able to get Dr. C. D. Darlington, Cytologist, John Innes Horticultural Institution, London, who had come on a casual visit to Coimbatore to see the famous sorghum—sugarcane hybrids, to address the association on "Chromosomes and Plant Breeding". He is one of the greatest cytologists of England at present and is the author of an important book "Recent Advances in Cytology" published recently. The importance of Cytology to Genetics and Plant Breeding is now well recognised and every plant breeder has to keep himself in touch with the latest developments in this branch of science which is progressing by leaps and bounds in recent times. Dr. Darlington has in his book formulated his own hypothesis about nuclear structure and phenomenon of crossing over in chromosomes, and it is a matter we have to congratulate ourselves upon in that we were able to hear an exposition of this new hypothesis from the author himself. In spite of the fact that his stay in Coimbatore was so short, hardly 36 hours, he found time to visit the laboratories and stations of all the Plant Breeding Sections, and go through critically the cytological work that has been going on in each of these sections. The plant breeding sections must be deeply indebted to him for the many helpful and highly instructive suggestions he gave about further cytological work. The subject matter of his lecture is abstracted elsewhere in this issue.

# Crop & Trade Reports.

**Cotton Crop Report, Madras, 1933-34, First Report.** The average of the areas under cotton in the Madras Presidency during the five years ending 1931—'32 has represented 9·0 per cent. of the total area under cotton in India. 2. The area under cotton up to the 25th July 1933 is estimated at 176,500 acres. As compared with the area of 210,000 acres estimated for the corresponding period of last year, there has been a decrease of 16 per cent. 3. *Central Districts and South—mainly*

*Cambodia tract.* The area in the Central districts and the South represents the last year's crop left on the ground for second-pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts fell from 137,100 acres to 115,500 acres *i. e.*, by about 16 per cent. The yield is expected to be below normal due to the want of sufficient showers in June. 4. *Deccan or Northerns and Westerns tract.* In Bellary, where the early crop is sown in June, the area rose from 22,500 to 28,000 acres owing to the good rains received in May. In the other districts the area has fallen owing to the inadequacy of timely rains. 5. *Cocanadas tract.* There has been a decrease in the area in Guntur and Nellore due to the insufficiency of timely rains. 6. The wholesale price of cotton lint per Imperial maund of 82—2/7 lb., as reported from important markets towards the close of July 1933, was about Rs. 18—10—0 for Cocanadas, Rs. 16—14—0 for red northerns, Rs. 18—2—0 for white northerns, Rs. 16—7—0 for (early crop) Westerns, Rs. 25—4—0 for Cambodia, Rs. 23—2—0 for Coimbatore karunganni, Rs. 24—11—0 for Tinnevelly karunganni and Rs. 20—13—0 for Nadam. (*From the Board of Revenue, Madras.*)

**All India Preliminary Forecast of the Jute Crop, 1933.** The total area under Jute in Bengal, Bihar and Orissa and Assam, for 1932, has been revised to 2,143,000 acres and yield to 5,845,000 bales, as against 1,899,300 acres given in the final forecast in 1932. The estimated area of jute in the above three provinces for 1933, is 2,479,800 acres, an increase of 336,700 acres, or about 15·7 % as compared with the revised total for 1932. (*India's Trade Journal, July 13, 1933.*)

**The World Sugar Situation. Production.** The estimated world production of cane and beet-sugar during the year 1932—33 sugar season is placed at 26,821,000 short tons, according to the latest estimates received from official sources, the International Institute of Agriculture and trade estimates. The current figure, 9 % below that of the preceding season, is the lowest world crop reported since 1926—27 when 26,624,000 short tons were produced. The world beet sugar crop, estimated at 8,670,000 short tons is 874,000 short tons less than last year, while the cane sugar production placed at 18,151,000 short tons, shows a reduction of 1,741,00 short tons from last season's total of 19,892,000 short tons. Cane sugar producing countries showing the most noticeable changes from production in 1931—32 are Java, Cuba, India, Formosa and Porto Rico. Java and Cuba alone account for a total reduction of 2,008,000 short tons. Production in Java, according to a preliminary estimate is placed at 1,488,000 short tons as compared with 2,821,000 short tons reported for last season's production, while Cuba's sugar crop has been fixed at 2,240,000 short tons as compared with 2,915,000 short tons produced in 1931—32. Both these countries are Members of the International Sugar Plan.

India expects to produce a record crop of 5,209,000 short tons during the current season. This shows an increase of 7,63,000 short tons over the previous record crop of 4,446,000 tons produced last season. This places India foremost among world sugar producing countries, a position which was held by Cuba prior to the restrictions imposed on production in connection with the International Sugar Plan. While India's sugar crop has exceeded Cuba in out-put, India has not entered the world Sugar Trade to the extent Cuba has. The sugar produced is of a low grade mostly consumed in an unrefined state within the country and does not enter into exports. In addition, India imports considerable quantities of sugar annually. With the increase in production, imports have fallen off considerably. India is gradually establishing modern factories for manufacturing refined sugar, which will probably tend to curtail imports in the future.

The world sugar production has shown a steady increase during the post-war period up until 1930—31 when a record crop of 31,820,000 short tons was produced. In the following year, production dropped to 29,436,000 short tons to be followed

by a further decline to 26,821,000 short tons during the present season. The decrease in production during the last two years is the direct result of the efforts in crop control put forth by the countries which are members of the International Sugar Plan.

**Consumption.** The total world sugar consumption in 1931—32 is estimated at 29,674,000 short tons, compared with 30,394,000 short tons in 1930—31, and 29,592,000 short tons in the preceding season; this indicates a decrease of 720,000 short tons from 1930—31. Most of the decrease in consumption occured in European countries where total consumption dropped from 11,590,000 short tons in 1930—31 to 11,012,000 in 1932. Asia and Africa are the only continents which show increased consumption in 1931—32. In the case of Asia, there has been a steady increase in sugar consumption since 1924—25. At that time 6,403,000 short tons were consumed; the total consumption for 1931—32 is placed at 8,243,000. In recent years India has accounted for most of this increase in consumption.

**Prices.** Sugar prices continued their downward trend through 1932, but during the first few months of 1933, there has been a slight upward tendency. Sugar prices dropped steadily from 1927 to 1932. The decline during this period in the price of raw sugar at New York, was from 4·7 cents per pound, the average for 1927, to the low level of 2·9 cents for 1932, which is the lowest average annual raw sugar price on record. The low for the year and the lowest on record was in March and April 1932, when the average monthly price was 2·6 cents per pound. Raw sugar prices at *Havana*, Cuba, have shown a similar trend. The average annual price for 1932 was 0·72 cents per pound. This is the first time on record that the average annual raw sugar price has fallen below one cent. per pound.

(*From Foreign Crops and Markets, U. S. A., June 5, 1933*)

**Estimates of area and yield of principal crops in India—1931-32.** The following are extracts from the report of the Director General of Statistics for 1931-32.

**Character of the season.** The monsoon of 1931 was, on the whole, well distributed but at a few places heavy rains resulted in floods causing damages to crops. Averaged over the plains of India, the total rainfall during the period was only 4% above the normal. During the retreating period, the rainfall was normal or nearly so in Burma, Assam, the North West Frontier Province, Mysore and the Punjab, but excessive elsewhere. Taking the year, as a whole, the total rainfall was within 25% of the normal except in Sind where it was in large defect and in Berar, Bombay and West Rajputana where it was in moderate excess.

**Rice.** Rice is generally regarded as a winter crop, being mainly harvested in December and January. It is sown in the months of May to August. There are two other varieties, comparatively of small importance, namely autumn rice and summer rice. Autumn rice is sown in May and June and harvested in September and summer rice is sown in January and February and harvested in May and June. In Madras, the seasons vary greatly, the first crop being sown in April to October and harvested between September and March and the second crop sown in September to March and harvested between January and May. The total area under rice in 1931-32 for which returns has been received (which represent 97% of the total rice area of India) was 84,353,000 acres, a record area, as compared with 82,846,000 acres in the preceding year. The condition of the crop was good except in Burma, where the crop suffered considerably owing to failure of late rains. The total yield was estimated at 33,052,000 tons, as against 32,193,000 tons in 1930-31. To this figure should be added about 1,071,000 tons in respect of tracts for which no forecasts are made.

**Wheat.** Wheat which is a *rabi* (spring) crop in India is sown from October to December and is harvested from March to May. The total area under wheat in

1931–32 was reported to be 33,749,000 acres, which is greater than the area of the preceding year by 5%. The condition of the crop was reported to be fairly good. The total estimated yield was 9,026,000 tons which is 3% less than the yield of 1930–31. An addition of some 147,000 tons should be made to this estimated yield in respect of some other tracts (having an area of about 551,000 acres) for which no reports are made.

**Sugarcane.** The sugarcane crop is usually planted from February to May and is harvested from November to January. In Madras, the crop is harvested between December and May. The total area reported under sugarcane in 1931–32 was 2,885,000 acres as compared with 2,801,000 acres in the preceeding year. The condition of the crop was reported to be good. The estimated yield amounted to 3,886,000 tons of raw sugar (*gur*) a record production, which is 20% above the final figure (3,228,000 tons) of the preceding year. To this figure should be added approximately 141,000 tons in respect of tracts (having an area of 105,000 acres) for which no estimates have been received.

**Tea.** The seeds are sown between November and March and the seedlings are transplanted when they are atleast six months old. The crop is plucked from May to December in Northern India, and from January to December in Southern India. The Provinces where tea is grown are Assam, Bengal, Bihar and Orissa, the United Provinces, Punjab, Madras, Coorg, and the States of Tripura (Bengal), Travancore, Cochin and Mysore. In Burma, tea is grown principally for comsumption as pickles. The total area under tea in 1931 was reported to be 807,400 acres as compared with 803,500 acres in the preceding year. The total production of manufactured tea (black and green) was calculated at 394,083,500 lbs. as against 391,080,800 lbs. in the preceding year.

**Cotton.** Cotton is grown in all the Provinces. There are two crops, namely, the early and the late; early cotton grows mainly in Central and Northern India, and late cotton in Southern and Western India. Taking both the crops together, the sowing season extends from March to August and the harvesting season from October to April. In parts of Southern India, sowings continue till December and harvesting till July. The total reported area under cotton was 23,495,000 acres in 1931—32, as against 23,812,000 acres in 1930—31. The condition of the crop was reported to be only fair. The total estimated out-turn was 4,060,000 bales of 400 lbs. each, as compared with 5,224,000 bales in 1930—31, or a decrease of 22% owing to damage caused by excessive rains.

| | 1930—31. 1000 bales. | 1929—30. 1000 bales. |
|---|---|---|
| Exports ... ... | 3279 | 3868 |
| Mill consumption ... ... | 2271 | 2373 |
| Extra factory consumption (conjectual) | 750 | 750 |
| Approximate crop ... ... | 6750 | 6991 |
| Estimated in forecast ... | 5224 | 5243 |

Of the total yield in 1931—32, Oomras represented 33%, Bengal-Sind 19%, Dholleras 14%, Broach 7%, Americans 6%, Coompta-Dharwars 6%. Westerns and Northerns 5%, Tinnevellies and Cambodias 3% each Comillas, Burmas, and other sorts 2%, Cocanadas and Salems 1% each.

**Jute,** is an autumn crop being sown from March to May and harvested in August and September. The provinces where it is grown are Bengal, Bihar and Orissa and Assam. It is also grown to a small extent in the Nepal State, but no reliable information is available from that State except the figures for export. As a result of restricted cultivation, the total area under Jute in 1931 was 1,862,000 acres which is nearly 47% less than that of the preceding year, and the estimated yield 5,542,000 bales (of 400 lbs. each), being about 51% below that of 1930. The

area and yield of Jute in 1932 are estimated to be 1,899,000 acres and 5,820,000 bales, an increase of 2 and 5% respectively as compared with 1931. **Linseed**, is a *rabi* (spring) crop, being sown from August to October and harvested from January to April. The total area under linseed in all the reporting tracts in 1931–32, was 3,241,000 acres which is 8% above the final figure of the preceding year. The condition of the crop was reported to be fairly good. The total estimated yield was 411,000 tons as against 377,000 tons last year. To this figure should be added some 38,000 tons for tracts (having an area of 303,000 acres), for which no reports are made. **Rape and Mustard**, are also *rabi* (spring) oilseeds, being sown from August to October and harvested from January to April. The total area in 1931–32 was 6,131,000 acres as against 6 632,000 acres in the preceding year. The condition of the crops was reported to be fairly good. The total estimated yield (1,026,000 tons) was 4% above the final figure of the preceding year. To this figure should be added some 44,000 tons in respect of tracts (having an area of 260,000 acres) for which no reports are made.

**Sesamum** is mainly a *Kharif* (autumn) crop being generally sown from May to July and harvested from October to December; a *rabi* or summer variety is also grown in certain tracts. This is sown in January and February and is harvested in May to July. The total area reported under sesamum in 1931–32 was 5,481,000 acres, as against 5,618,000 acres in the preceding year. The condition of the crop was fair. The total estimated yield was 464,000 tons as against 526,000 tons in 1930–31. An addition of approximately 58,000 tons should be made to this figure in respect of tracts (containing an area of about 680,000 acres) for which no reports are made. **Castor seed**, is sown from May to July and harvested from January to February; a late variety is also grown which is generally sown in September and harvested in March and April. The total area sown in 1931–32 was estimated at 1,569,000 acres and the yield at 144,000 tons as against 1,457,000 acres with an estimated yield of 120,000 tons last year. The condition of the crop was good. **Groundnut**, is sown from May to August and is harvested from November to January. A summer variety is also grown in Madras forming about 5% of the total area under the crop; this variety is sown in February—March and harvested in July—August. The total area under groundnut in 1931–32 was reported to be 5,490,000 acres, which was 17 per cent less than that of the preceding year. The estimated yield (2,673,000 tons of nuts in stall) was also 15 per cent less than that of the preceding year. The condition of the crop was reported to be fair.

**Indigo.** The Indigo crop is sown from February to July and is harvested from August to November. In Madras, about 20% of the area under the crop is irrigated, being grown as a second crop on wet lands after paddy; this irrigated crop is sown in December—January and harvested in March—April. The provinces to which estimates for Indigo relate are Madras, the Punjab, Bihar and Orissa, the United Provinces and Bombay. The total reported area (52,500 acres) in 1931–32 was 18% below the final figure of the preceding year. The total estimated yield of dye was 9,900 cwts., which was 25% less than the yield of the preceding year. **Coffee** is sown and transplanted in the rainy season. The harvesting period is from October to January. The crop is practically confined to Southern India, comprising the Madras Presidency, Coorg and the States of Mysore, Travancore and Cochin. The total reported area under Coffee in 1930—31 was 160,900 acres, the yield of cured coffee therefrom being estimated at 32,973,000 lbs. The figures are, however, defective in as much as plantations of less than 10 acres are not taken into account. **Rubber.** The provinces where rubber is cultivated to an appreciable extent are Burma, Madras, Coorg and the States of Mysore, Travancore and Cochin. The total area under rubber in 1931 was 183,000 acres, as against 192,500 acres in the preceding year. The total yield of dry rubber was 20,117,100 lbs. as against 24,351,500 lbs. in 1930.

# Correspondence.

**Insect Pests of Pomegranate and Coconut and Dwarf Varieties of Coconut.**

*Mr. K. R Subramania Ayyar* writes from Salem: Please be kind enough to get me expert opinion on the following:— 1. In a pomegranate garden, what remedies are to be applied against worms entering the ripe fruits? I have tried potters ashes, tied cloths with no good results. 2. What remedies are to be applied to young coconut plants against beetles entering into the new stem? 3. Wherefrom I can get good quality coconut plants which may yield crop in 5 years and what would be the cost?

*We publish below answers to the above queries, kindly supplied by the Government Entomologist and the Oil Seeds Specialist.* 1. The damage is due to the young of a buish brown butterfly. This butterfly lays eggs on ripening fruits and the young ones hatching from the egg burrow into the fruits and damage the same. To prevent egg laying covering the growing fruits *at a very early stage* with loose muslin or paper covers so as to prevent the butterfly reaching the fruit to lay eggs has been found very effective in most places. The young fruits can also be sprayed with a deterrent mixture like Bordeau-mixture or crude oil emulsion. Further details re. this may be had from the articles on garden insects in the current Villager's Calendar. 2. The article on 'Coconut beetles' contains the current necessary information. 3. The dwarf types of coconuts will yield in about 5 years if they are regularly and sufficiently watered. They cannot be successfully grown where plenty of water is not available for the palms. The nuts of these dwarf plants can be obtained from Chowghat Taluk, Malabar District. The seed nuts would cost about Rs. 5 per 100. It may be possible to get seedlings at a rate of about Rs. 10 per 100 through the help of Deputy Director of Agriculture, VII Circle, Tellicherry.

These palms may yield 100—200 nuts per year if properly cared for. The nuts will be small and the copra from these nuts would be of low quality. The life of the palm would be between 30 to 40 years.

# Review.

**World Rice Situation.** Reprints from Foreign Crops and Markets. Issued by the Foreign Agricultural Service Bureau of Agricultural Economics, United States Department of Agriculture, Washington June 19, 1933.

The estimated world production of cleaned rice in 1932-33, exclusive of Russia and China shows a reduction of a little less than 2 per cent from 1931-32 but is about 1·5 per cent above the previous 10 years average. India's production, 668·667 million pounds, nearly half the world's production, has been the smallest since 1927, but this has been partially offset by increases in Japan and Phillipines. Production in European countries is little different from that of 1931-32 season. There are indications of the expansion of rice industry in Brazil, which has become a competitor with United States in the Latin-American rice markets. There is a great increase in area and production in Java, due to the restriction in sugarcane industry. Despite the increased outputs, imports of cheaper rices from southern area increased, and this brought about official intervention in the form of restricted imports.

Among the chief rice-producing countries of the East, India shows a little decrease in the area covered than the previous year, while there is an increase in countries like Siam and Phillipines. Otherwise there is very little change in the average in these countries; but Japan, Korea and Formosa have increased their production by nearly 8 per cent of the production in 1931-32. In spite of this, Japanese imports of rice, mostly from Siam and United States, increased because of the anticipated smaller rice crop in the next season. Imports from the United

States consists mostly of broken rice used for flour making and distilling. In the principal South-Asiatic exporting countries like Burma, Siam, and Indo-China, the trade reports indicate continued exportable surplus of 9 per cent more than the actual exports of 1932. The large share of these rices goes to non-European countries. The latest government estimate of Burma rice available for export for 1933 is placed at 3,S64,000 short tons as against the actual exports of 3,399,000 short tons last year. The movement of rice from Burma to India proper, is on the increase during the past five years. Next to India proper, Ceylon and Strait Settlements are the leading countries of destination in the Indian rice export trade The greater part of the Indian export rice originates in Burma with relatively insignificant quantities from Bengal, Madras and other provinces. The trade with China comes next in importance, followed by Germany and Netherlands. A considerable volume of Burma rice reaches Cuba annually, while Java also has a fairly prominent position in the trade. Exports from Siam are mostly to Australia, Straits and China, while those from French Indo China show an increased movement to Europe, as a result of official efforts to increase the consumption of colonial rice in France.

Among the European countries, there was a decline in the sales of American rice in foreign countries which has been brought about by the specially low purchasing power of the principal rice importing countries. Supplies in the exporting countries of Asia have been large and prices of rice in these countries have been at low levels. This situation accounts for the fact that many of the large rice-importing countries have increased their total imports of rice, while at the same time they were decreasing their purchases of American rices. Imports of American rice in the United Kingdom declined about 60 per cent, compared with the corresponding period last year, while during the same period, imports from British India, chiefly from Burma increased about 30 per cent over those of last year, and were about 40 per cent compared with average. (N. P.)

## ASSOCIATION OF ECONOMIC BIOLOGISTS, COIMBATORE

A meeting of the association was held in the Freeman Hall on the 20th July afternoon when the following two papers were presented. (1) Some introduced weeds of South India by Messrs. C. Tadulingam and G, V. Narayana; (2) A Haploid plant in rice by Messrs. K. Ramiah, N. Parthasarathi, and S. Ramanujam.

The first paper gave a short account including observations on their habit, habitat and propagation of 20 species of foreign weeds, mostly natives of tropical America introduced into S. India either wilfully, or unintentionally, during the past 150 years, and stressed the necessity of detecting these in the early years of their introduction, and taking effective steps for their eradication, as otherwise they would get beyond control and prove a great menace. The systematist with his intimate knowledge of the native flora could spot out the new comers and render a great help in suggesting control measures to keep them down. All the weeds described were illustrated with lantern slides. At the end of the paper a lively discussion ensued in the course of which it was suggested that in determining the original home of the species attention should be paid to localities, where, a diversity of species nearly related to the one in question, exists.

The second paper dealt with the morphology and cytology of a haploid plant in rice that arose spontaneously in association with a diploid from one of the seeds of a pure culture, which exhibits the phenomenon of polyembryony among its population, roughly in the proportion of 1 : 1000. The plant was described as dwarfed in stature, with considerable reduction of floral organs, and was marked by absence of anthesis and hence complete sterility. The various irregularities met with in its microsporogenesis, which was followed from diakinesis to tetrad formation were described and compared with those in haploids of other plants that have been recorded. The origin of the haploid was discussed to the effect.

that, it is perhaps due to the development of one of the reduced cells in the embryo sac, other than the egg cell. The paper was illustrated with lantern slides and evoked a small discussion at the end when a few questions were asked and answered.

# College News & Notes.

**Welcome to Freshers.** On the 11th. inst. the students of the ii and iii B.Sc. classes welcomed the students of B. Sc. i and the newly instituted short course. The function began with tea, which was followed by amateur music, after which the representatives of classes ii and iii and a number of lecturers, tutors, games coachers and the Secretary, M. A. S. U. made speeches welcoming the new students and initiating them into the life of the College. The representative of the new batch suitably responded and with a few words of advice to the students by Rao Bahadur C. Tadulingam, the Principal, the pleasant function came to a close.

**Games. Football.** The College entered for the Abraham Memorial Tournament run under the auspices of the Coimbatore Athletic Association. In the opening game we were pitted against the London Mission High School who eventually won the tournament. Though we lost the match by three goals to two, our boys gave a very good account of themselves.

**Cricket.** The College has entered for the Y. M. C. A. Cricket Tournament and as holders of the Rondy shield, are defending the title this year. Our opening game was against the Government College who winning the toss elected to field. We made 238 runs for 5 wickets and declared. Shiva Rao 50 (not out) Thomas 45, Suryanarayanamurti 43, Ananda 38, and Ramanatha Rao (not out) were the chief rungetters. The Government College were dismissed cheaply for 93 runs of which Chockalingam contributed 36, and Krishnaswami 25. In their second venture they were again dismissed for 50 runs, (Krishnaswami 18), so that we won the match by an innings and 95 runs.

**Hockey.** Our hockey team is gradually getting into strides. In a friendly match played against a strong local combination we lost the game by 3 goals to 1 but in a return match we showed better form and drew at 1 all. It is hoped that with strenous practice, our team will show all-round improvement by October, when we shall compete for the Coimbatore Hockey Tournament.

**College Day.** Owing to the inability of Sir T. Vijayaraghavachariar to come down to Coimbatore early in September, the College Day and Conference have been postponed to October. Preliminary arrangements are however in progress and the entertainment committee is busy with rehearsals of the dramas to be staged on the occasion.

**Visitors.** Rao Bahadur D. Ananda Rao the Headquarters Deputy Director of Agriculture, visited Coimbatore towards the end of August to inspect the work of field investigators employed by the Imperial Council of Agricultural Research in the district of Coimbatore. Dr. J. D. Darlington, Cytologist, John Innes Horticultural Institution, London, and Dr. E. K. Janaki Ammal, Professor of Botany, at the Maharaja's College, Trivandrum, visited the Imperial Sugarcane Breeding Station and the Research Institute during the middle of August. The Association of Economic Biologists was "At Home" to the distinguished guests on the 13th August. After tea Dr. Darlington gave a very interesting lecture on "Chromosomes and Plant breeding" which was largely attended.

**Personal.** Dr. J. R. Seshadri, soil physicist who was appointed as Assistant Professor in the Andhra University left for Bezwada on the 2nd of August. Information has been received that Mr. S. Kasinathan who was deputed for higher studies in England by the Indian Central Cotton Committee, has taken the degree of Ph. D. in Chemistry at the London University. Dr Kasinathan will be returning to Coimbatore by the end of August. Mr. T. R. Narayanan who was deputed by the same organisation for training in Plant Physiology has taken

his B. A. (tripos) at the Cambridge University, and will be spending another year there. Mr. M. Sanyasi Raju who was on leave out of India for purposes of higher study, is understood to have taken the M. Sc. degree in Bacteriology at the University of Iowa (U. S. A.) and will be returning to India soon. It is a matter of great satisfaction that a good number of the subordinate staff of the Research Institute are going out of India for higher studies which will benefit them and their country.

**Promotions.**. At long last, the long-expected grade promotions in the Subordinate Services have been ordered and the announcement has considerably relieved the strain imposed by long stagnation in several grades on the one hand and the cuts in salary on the other.

**Weather.** Despite the heavy monsoon experienced on the West Coast and the floods in the Circars, Coimbatore had only about 2 5 inches of rain since June 1st. Though the monsoon breeze was stronger than usual and our tanks are all full from rains received on the ghauts, the fate of the dry crops on the plateau is still in the balance. Cholam usually sown in July, is in most places still in the seed store and the few enterprising farmers who have sown their seed in anticipation of rain are providing food for the population.

# Weather Review (JULY—1933)

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 | 6·2 | +0·1 | 17·2 | South | Negapatam | 0·8 | −1·1 | 9·7 |
| | Berhampore * | 10·3 | +3·0 | 25·0 | | Aduthurai * | 0·4 | −1·1 | 8·8 |
| | Calingapatam | 13·6 | +8 0 | 21.2 | | Madura | 2·3 | +0·4 | 10·9 |
| | Vizagapatam | 4·8 | +0·5 | 8·7 | | Pamban | 0·2 | −0·7 | 4·2 |
| | Anakapalli * | 7·4 | +2·4 | 19·6 | | Koilpatti * | 1·0 | +0·2 | 6·5 |
| | Samalkota * | 5·0 | −2·4 | 1 ·5 | | Palamkottah | 1·9 | +1·6 | 13·6 |
| | Cocanada | 7·4 | +1·4 | 11·6 | | | | | |
| | Maruteru * | 12·3 | +4·9 | 19·6 | | | | | |
| | Masulipatam | 10·2 | +4·0 | 16·9 | | Trivandrum | 11·5 | +4·1 | 81·3 |
| | Guntur * | ... | ... | ... | West | Cochin | 21·3 | −1·0 | 103·1 |
| Ceded | Kurnool | 2·3 | −2·5 | 9·1 | Coast | Pattambi * | 29·7 | +4·8 | 94·3 |
| Dists. | Nandyal * | ... | ... | ... | | Calicut | 29·6 | −0·1 | 117·4 |
| | Hagari * | 2·2 | +1·2 | 5·4 | | Taliparamba * | 59·4 | +11·4 | 127·5 |
| | Bellary | 2·3 | +0·6 | 10·6 | | Kasargode * | 50·5 | +13·9 | 121·6 |
| | Cuddapah | 4·4 | +0·4 | 8·2 | | Nileshwar * | 52·2 | +17·7 | 124·0 |
| | Anantapur | 2·9 | +0·7 | 8·8 | | Mangalore | 63·8 | +25·8 | 116·1 |
| Carnatic | Nellore | 1·6 | −1·0 | 3·5 | | | | | |
| | Madras | 1·1 | −2·7 | 4·8 | | Chitaldrug | 3·2 | +0·1 | 11·7 |
| | Palakuppam * | 0 3 | −1·2 | 12·4 | Mysore | Bangalore | 5·7 | +1·6 | 16·5 |
| | Palur * | 2·8 | ··0·2 | 20·8 | and | Mysore | 5·5 | +3·0 | 18·6 |
| | Cuddalore | 3·2 | +0·1 | 17·4 | Coorg | Mercara | 40·5 | −1·2 | 95·4 |
| Central | Vellore | 1·6 | −3·1 | 4·7 | | | | | |
| | Salem | 2·9 | −0·6 | 12·9 | | Kodaikanal | 4·8 | +0·5. | 29·9 |
| | Coimbatore | 1·2 | −0·2 | 8·1 | Hills. | Coonoor * | 2·4 | −1·3 | 21·0 |
| | Coimbatore Res. Inst. * | 1·1 | −1·9 | 10·1 | | Kallar * | ... | ... | ... |
| | Trichinopoly | 1·2 | −0·3 | 8·1 | | Ootacamund * | 4·6 | −0·7 | 25·0 |
| | | | | | | Nanjanad * | 5·2 | −7·1 | 24·9 |

* Stations of the Agricultural Dept.

**Summary of general weather conditions:** The monsoon was active on the west coast almost throughout the month, and in the Circars during the latter half of the month, it was weak over the rest of the peninsula. Between the 21st and the 23rd owing to an abnormal pressure distribution over the Bay and the adjoining regions, widespread thunderstorms occurred over the south of the peninsula.

The weather in the Bay was disturbed off the Orissa-Circars coast on the 14th. The disturbed conditions passed inland as a low-pressure wave and developed into a depression over South Bengal and moved westwards. Another depression formed at the head of the Bay on the 24th and moving in a westerly direction crossed the Orissa coast on the 26th and merged with the seasonal trough of low pressure by the next day. A third depression formed off the Orissa-Circars coast on the 30th and lay centred near 17½° N and 87° E. It moved in a northwesterly direction and on the 31st lay 100 miles to the south east of Gopalpore. The three disturbances gave rise to widespread and locally heavy rain over the region extending from the Konkan to the Circars coast.

Rainfall was in large excess in the Circars, South Kanara and North Malabar, in slight to moderate excess in the Deccan and Mysore, and was in defect elsewhere, being markedly so in the Carnatic and central districts. The chief falls reported being: Mangalore 7·7″, 8·3″, 6·1″ and 8·7″ on the first four days of the month, Peermade 9·4″, Calicut 6·5″ and Ankamali (Travancore) 7·5″ on the 1st.

Day temperature was generally above normal on the coromandel except during the last week, Nellore recording a maximum of 103° on the 23rd, and maxima of 100° and above on 12 days. Temperature was markedly below normal on the Circars coast during the last week when rainfall was general.

**Weather Report for the Research Institute Observatory:** Report No. 7/33.

| | |
|---|---|
| Absolute maximum in shade | 93·0° |
| Absolute minimum in shade | 70·0° |
| Mean maximum in shade | 87·0° |
| Departure from normal | + 0·8° |
| Mean minimum in shade | 72·6° |
| Departure from normal | + 0·6° |
| Total rainfall | 1·05″ |
| Departure from normal | − 1·94″ |
| No. of rainy days | 4 |
| Heaviest fall in 24 hrs. | 0·28″ |
| Mean daily wind velocity | 7·2 M.P.H |
| Departure from normal | − 2·2 M.P.H |
| Mean humidity at 8 hrs. | 70·8% |
| Departure from normal | − 2·0% |
| Total hours of bright sunshine | 166·0 |
| Mean daily hours of bright sunshine | 5·4 |

**General weather conditions:** The monsoon was active at the beginning of the month, but was weak thereafter till the 25th. Thunderstorms occurred in the vicinity of the observatory between the 22nd and the 26th but rainfall was light. Day temperatures were markedly above normal between the 9th and the 25th with the weak monsoon, but slightly above normal for the whole month. Skies were generally heavily clouded and humidity about normal.

P. V. R. and T. S. L.

# Departmental Notifications.

**I Circle.** T. V. Krishnaswami Rao, A. D. Sompeta the period of absence from the 20th to 30th June treated as l. a p. H. Narahari Rao, A. D., extension of l. a. p for fortnight in continuation of leave already granted. D. Bappaya A. D., Tadepalligudem, l. a. p. for 15 days from 25—6—'33. D. Hanumantha Rao, A. D., Kothapeta, extension of l. a p. for 4 days from 19—7—'33. P. Lakshminarayana, A. A. D., Narasapur, l. a p on m. c. for one month from 13—7—'33. M. Satyanarayana, A. D. l. a. p. on m. c. for one month from 14—7—'33. T. V. Krishnaswami Rao A. D. Sompeta, l. a. p. on m. c for 2 months. T. Natarajan F. M. Samalkota, l. a. p. for 10 days from 4—6—'33 **II Circle.** V. Ratnaji Rao A. D. Naidupet, l. a. p. for 16 days from 15—8—'33. M. Krishnaswami, A. A. D. Kudligi, l. a. p. on m. c. for 6 months from the date of relief. **IV Circle.** T. V. Srinivasacharlu, A. A. D. Conjeevaram, l. a. p. for 10 days from 10—7—'33. S. Rama Rao, A. D. Chittoor, l. a p. for 15 days from 25—7—'33. M. Gopalan Unnithan A. D. transferred to Vellore Division. S. Kuppuswami Iyengar from Vellore to Saidapet. P. S. Vengasami Iyer A. D. Marudandagam will hand over charge of Saidapet sub-circle to S. Kuppuswami Iyengar. T. V. Srinivasacharlu A. A. D. Conjeevaram extension of l. a. p. for 12 days from 20—7—33. **VI Circle.** M. C. Menon A. D. Ambasamudram, l. a. p, for 11 days from 5—7—33 **VII Circle.** P. Kesavaunni Nambiar A. D. Calicut, l. a. p. for 2 months from 18—7—33. K. Soopi Haji, A. A. D. Kasargode, extension of l. a. p, for 5 days from 22—7—33. **VIII Circle.** P. K. Kameswara Menon, A. D. Erode, l. a. p. on m. c. for 18 days from 21—7—33. **Principal's Office.** V. T. Subbiah Mudaliar, l. a. p. for 13 days from 26—6—33. S. Ramaswami Raju, Sub Assistant, l. a. p. for 15 days from 19—6—33. **Paddy Section.** M. K. Venkatasubrahmaniam, Assistant, l. a. p. for 26 days from 24—7—33. S. Dharmalingam Mudaliar Assistant, l. a. p. for 10 days from 24—6—33. V. M. Ramunni Kidavu. F. M. Pattambi, l. a. p. for 11 days from 25—7—33. M. P. Sankara Nambiar, F. M. Pattambi, l. a. p. for 12 days from 19—6—33. **Cotton Section.** P. Abraham, Assistant, l. a. p. for 10 days from 29—6—33. and extension of l. a. p. for 15 days in continuation. S. M. Kalyanaraman, l. a. p. for 15 days from 7—7—33. and extension of l. a. p. for three weeks in continuation. **Mycology Section.** C. S. Krishnaswami, Assistant, l. a. p. for 8 days from 23—6—33 and again for one month from 10—7—33. **Chemistry Section.** T. Varahalu, Assistant l. a. p. for 6 days from 12—6—33. **Entomology Section.** Dr. C. J. George, l. a. p. for 4 days and half average pay for 8 days in continuation. **D. A's office orders.** P. Kunhiraman Menon will be considered to have been officiating as assistant in the Chemistry Section from 13th April, 1933; E. R. Gopala Menon, Temporary Assistant, Entomologist, will be considered to have reverted to his permanent appointment as Assistant in the Entomology Section from 16th May 1933 and to have availed the leave granted to him for 2 months and 15 days from that date. V. Margabhandu should be relieved in the Entomology Section to report himself for duty to the Cotton Specialist. The appointment of Muhamad Moinuddin as officiating assistant in the Entomology Section will commence from the date of E. R. Gopala Menon availing the leave till 19—6—33. John A. Muliyil granted leave for two years from 1—8—33. There are 34 Permanent vacancies in the Madras Agricultural Subordinate Service, Class I, V grade as detailed below:— 1. Posts sanctioned in G. P. No. 642 Micc Development, dated 2nd April 1928. Agricultural Section (11). 2. G. O. No. 937 Development dated 25th May 1929. Science Section (7) G. O. No. 1041 M. S. Development dated 20th June 1929.2 (Millets) 3. G. O. No. 775 Mis. Development dated 5th April, 1930. 1 (Cotton Section) 4. G. O. No. 747 Ms. Development dated 4th April 1930; with effect from 1st August 1930; (Agricultural Section) 1. 5. Due to retirement of Mr. Raman from 20th September 1931. (Vacancy in the III grade) (Agricultural Section.) 1. 6. Due to retirement of Arogyaswami Pillai f. m. Vacancy

from 1st April 1932 in the III grade (Agricultural Section.) 1. 7. Due to retirement of P. A. Raghunathaswami Iyengar from 1st September 1932, Vacancy in the III grade 1 (Chemistry.) 8. Due to the death of late Mr. M. K. Nambiar 1 grade vacancy from 7th December 1932. Vacancy in the III grade. 1. 9. Posts sanctioned in G. O. No. 937 Ms, Development dated 25th May 1929 in the Oil Seeds Section from 1st April 1933·1. These 34 posts were declared temporary with reference to G. O. No. 542 Public (Services) dated the 8th April 1932 in G. O. No. 311 Public (Services) dated 13th April 1933. The following transfers of upper subordinates in the V grade are ordered to take effect from 13th April 1933. N. K. Thomas, Assistant, Millet Section, to Agricultural Section. M. Royappa Pillai, Assistant, from Agricultural Section to Science section as assistant in Millet—permanent, but to continue in the Paddy Section. K. Narayana Nair, Offg. Assistant, Millet Section, to continue in the same section. S. Madhava Rao Assistant, Oil Seeds Specialist's Section, to Agricultural Section. C. R. Seshadri, from Chemistry Section to Oil Seeds Specialist Section. T. S. Lakshmanan from Agricultural Section to Science Section as Assistant in the Chemistry. R. Krishnamurti, Assistant in Oil Seeds to continue to officiate as Assistant in Cotton. K. Kumaraswami Chetty, Offg. Assistant, Oil Seeds Specialists Section to officiciate in the same section. L. Neelakantan, Assistant in Paddy to be Assistant in Cotton. P. N. Krishnaswami, Assistant in Cotton to be Assistant in Paddy but to continue in Cotton Section. M. Narasimham Assistant in Cotton to continue to Officiate in Paddy. M. C. Menon F. M. Hosur to Vi Circle. V. Karunakaran Nair, A. D. Ambasamudram to Live Stock, Hosur. M. Satyanarayana, Assistant Lecturer in Agriculture to I Circle for District Work. P. A. Venkateswara Iyer, A. D. Palghat to Agricultural College, as Assistant Lecturer in Agriculture. A. Chinnathambi Pillai, Offg. Assistant Director of Agriculture, Guntur, on reversion to the Madras Agricultural Subordinate service on the 28th June 1933 is posted to II Circle. P. Vishnu Somayajulu, Assistant, I Circle, l. a. p for 4 months from the date of relief. P. Panduranga Rao, Millet Section, Coimbatore, is temporarily transferred to A. R. S. Hagari. L. Krishnan, whose Offg. appointment terminates on the 2nd July 1933 will continue to officiate from 3rd July 1933 to 19th August 1933. T. K. Mukundan whose Offg. appointment terminates on the 6th July will continue to officiate from 7th July 1933 to 5th October 1933. The resignation tendered by Dr. C. J. George of his appointment as Assistant is accepted with effect from 22nd June 1933. S. Madhava Rao, A. D. is temporarily transfered to Science section to officiate as Assistant in the Millet Section. H. Narahari Rao, poultry trained assistant, Live Stock Research Station, Hosur will proceed to Tiruvellore, Chingleput District. He will arrange for the survey of area and examine the possibilities of introducing the poultry keeping in the area. He should arrange for supply of poultry and eggs. He should make arrangements for construction of sheds fencing etc. through the agency of local Agricultural Association. A class may be held in the area at a suitable time when students are arranged to attend. M. J. David, whose Offg. appointment as Assistant terminates on 15th July 1933 is appointed to officiate as upper Subordinate, Agricultural Section, with effect from 16th July 1933 till further orders. He should report himself for duty to the Dy. Director of Agriculture V Circle, Trichinopoly. The Indian Central Cotton Committee have sanctioned training grants to the following members of the Madras Agricultural Service. S. N. Venkatarama Iyer, Assistant Cotton Section, Nandyal, for training in Cotton Statistics for one year under Prof. P. C. Mahalanobis M. A. of Presidency College, Calcutta. C. Jaganatha Rao, Assistant, Cotton Section, Nandyal, for a period of one year for training in the Cotton Physiology under Dr. T. Ekambaram, Lecturer, Teachers' College, Saidapet. The training will commence from 10th August 1933. M. P. Sankaran Nambiar, F. M. Pattambi transferred to Calicut as A. D. P. Kesavanunni Nambiar,

A. D. Calicut, as F. M. Pattambi. E. R. Gopala Menon, Assistant, on return from leave is posted to work in the VII Circle, Tellicherry. The Central Cotton Committee have sanctioned a scheme for carrying out selection work on Nandan Cotton grown in the Coimbatore and Salem Districts, for 5 years. K. L. Rama Krishna Rao permanent Upper Subordinate and Offg. Assistant in the Cotton Section is posted to work on the scheme. He will work under the orders of Cotton Specialist. M. Subbiah Pillai, Offg. Assistant Paddy Section is confirmed as Assistant in the V grade in the Entomology Section with effect from 22nd June 1933. Mohammad Moinuddin whose Offg. appointment as Assistant in the Entomology Section terminates on 30th July 1933 will continue to officiate as Assistant in the Entomology Section. L. Neelakantan, Assistant, Cotton Section, Coimbatore transferred to Nandyal. The following promotions are ordered in the Upper Subordinate Service, Science section with effect from 13th April, 1933. **From II grade to I grade.** T. R. Ramasubrahmania Iyer, Assistant in Chemistry. C. V. Ramaswami Iyer, Assistant in Chemistry. P. N. Krishna Iyer, Assistant Lecturer in Entomology. **From IV grade to III grade.** D. Marudaraja Pillai, Assistant in Mycology. Samuel Jobitharaj. Assistant in Paddy. **From V grade to IV grade.** V. K. Subrahmania Mudaliar, Assistant in Cotton. M. Suryanarayana, Assistant in Chemistry. S. N. Venkataraman, Assistant in Cotton. **Agricultural Section. From II grade to I grade.** V. S. Narayanaswami Iyer, S. Narayana Ayya. L. Narasimha Charya. **From IV grade to III grade.** A. Gopalakrishna Ayya Naidu, A. Gopalan Nair. **From V grade to IV grade.** S. Kuppuswami Iyangar, P. Abisheganathan Pillai, T. G. Muthuswami Iyer, S. R. Srinivasa Iyangar, M. Subrahmania Pillai, A. Venkatarangam, K. K. Raghavan, A. Chidambaram Pillai, M. P. Sankaran Nambiar, K. G. Sankappa Bhandari, K. L. Ramakrishna Rao, V. Atchyutha Rammaya, N. Subrahmania Iyer, N. Ramadoss Pantulu, K. Jagannatha Rao, E. K. Govinda Nambiar, R. Vasudeva Rao Naidu, S. Krishna Nayak, N. Srinivasa Rao, G Sakharama Rao, C. S. Seshagiri Iyer, V. K. Kunhunni Nambiar, K. Rama Rao, K. Srinivasa Acharya, K. S. Krishnamurti Iyer, K. Gurumurti, K. S. Ramanna Rai and M. Chinnaswami Naidu.

## ADDITIONS TO THE LIBRARY DURING MAY 1933.

### A. Books.

1. *Van Harreveld (C. H.) tr. by Pendleton* (1932) Properties of Sugarcane Soils of Java. 2. *G. D. Clyde* (1929) Measurement of Irrigation Water (Utah Agri, Expt. Stn. Bull. 77). 3. *Parshall (R. C.)* (1932) Measuring Water in Irrigation Channels (U. S. Agri. Dept. Far. Bull. 1683). 4. *Fred (E B.) and others* (1932) Root Nodule Bacteria and Leguminous Plants. 5. (1933) Sir Profulla Chandra Ray—70th Birth day Commemoration Volume. 6. *Williams (C)* (1928) The Story of the Hive: A Bee Lover's Book 7. *Kropotkin (P)* (1907) Fields, Factories and Workshops. 8. (1932) Index to the Publications of the United States Department of Agriculture—1901-1925. (For reference in the Library).

### B. Reports.

1. Third Annual Report of the Executive Council of Imperial Agricultural Bureau—1931-1932. 2 Report of the Imperial Bureau of Soil Science for the year ending March 31st, 1933. 3. Twenty-seventh Annual Report—31st December 1931 of the British Cotton Growing Association. 4. Annual Report of the Department of Agriculture of the Province of Ontario—1931. 5. Annual Report on the Agricultural Conditions of the Colony and the work of the Department of Agriculture for 1931 of the Colony of Mauritius. 6. Experimental Station Reports of the Institute of International D'Agriculture—1931. 7. Report on the

Agricultural Experiment Stations—1931 of the United States Department of Agriculture. 8. Annual Report of the Department of Water Supplies and Sewage Disposal—July 1, 1930—June 30, 1931 of New Jersey Agri. Expt. Station. 9. Review of the Sugar Industry of India during the official year 1931–32. (Supp. to Ind. Trade Jrl.). 10. Tour: Iraq to the Sudan—1932 by Sir William H Himbury. (British Cotton Growing Association Pub). 11. Tour in India by Sir William H. Himbury. (British Cotton Growing Association Pub.)

## C. Bulletins, Memoirs Etc.

12. The Use of the Antimony Electrode for Determining Soil Reaction. *Punjab Irr. Res. Inst. Memoirs, Vol. IV. No. 4.* 13. The Planting and Early Care of Young Fruit Trees. *United Provinces Agri. Dept. Bull. 1, Fruit Ser.* 14. The Dispersion of Soils in Mechanical Analysis. *Imp. Bur. Soil Sci. Tech. Com. No. 26.* 15. Recent Research on Forage Crop Cultivation, Fodder Conservation and Utilization, at the Animal Breeding Institute of the University, Konigsberg. *Imp. Bur. of Plant Gene. Herbage Plants Bull. 8.* 16. Vernalization or Lyssenko's Method for the Pre-treatment of Seed. *Imp. Bur. Plant Genetics Herb. Plant Bull. 9–1933.* 17. The Bursate Lungworms of Domesticated Animals. *Imp. Bur. Agri. Paras. Pub. 1933.* 18. Table Poultry Production with a Section on Battery Brooding. *Enf. Min. Agri. and Fish. Bull. 64.* 19. The Production, Care and Handling of Milk and Cream. *Union S. Afr. Dairy Res. Ins. Bull. No. 113.* 20. Panama Disease of Bananas in Jamaica. *Jamaica Dept. Sci. and Agri. Microbio Bull. No. 1.* 21. Field Experiments with Sugar Cane, 1931–32. *British Guiana Agri. Dept. Sugar Bull. No. 1.* 22. The Control of Asterolecanium (The Fringed Scale of Coffee). *Kenya Dept. Agri. Bull. No. 23 of 1932.* 23. Banding for Coffee Mealy Bug Control. *No. 24.* 24. Stills for the Production of Essential Oils. *No. 25.* 25. Silos, Ensilage and Silage, (The Importance of Silage as a Stock-feed. *No. 26.* 26. Report on the Economic Results of the Commercial Side of the Farm during 1931. *No. 27.* 27. Observations on Some Pasture Plants in Kenya (with suggestions for the extended trial of certain grasses. (Grassland No. 1). *Kenya Dept. Agri. Bull. No. 1 of 1933.* 28. Trials of Cash Crops and Green Manure Crops in the Nakuru and Kitale Areas during 1932. *No. 2.* 29. Maize Yields and Green Manuring, 1932. *No. 3.* 30. The Control of Antestia in Wetter Districts (Notes on a Paraffin-Pyrethrum-Soap Emulsion Spray). *No. 4.* 31. Transactions of the Texas Academy of Science 1930 to 1931 together with the Proceedings for the same time. Chlorophyil deficiencies induced in cotton (Gossypium hirsutum) by radiations. *Texas Pub. Vol. XV 1932.* 32. Rural Electrification in Oklahoma. *Oklahoma A. E. S. Bull No. 207.* 33. Red Oxide of Copper as a Dust Fungicide for combating Damping-off by Seed Treatment. *New York State A. E. S. Bull. No. 615.* 34. Twenty-five Years of Supplemental Irrigation Investigations in Willamette Valley. *Oregon State A.E S. Station Bull. No. 302.* 35. Observations and Experiments with Blueberries in Western Washington. *Pullman A. E. S. Station Bull. No. 276.* 36. Trends in the Apple Industry. *No. 277.* 37. The Production and Utilization of Corn Grown under Irrigation in Washington (Irrigation Branch Experiment Station Division of Agronomy). *No. 278.* 38. Report on Control of Floods and Drainage of Wet Lands in the Valley of the Passaic River and its Tributaries. *New Jersey Dept. of Conser. and Develop. Pub.* 39. Organic Compounds Associated with Base Exchange Reactions in Soils. *Arizona A. E. S. Tech. Bull. No, 31.* 40. Electrodialysis as a Measure of Phosphate Availability in Soils and the Relation of Soil Reaction and Ionization of Phosphates, to Phosphate Assimilation. *No. 38.* 41. Truck Crop Investigations: The Effect of Heavy Applications of Phosphorus on the Inter-Relation of Soil Reaction, Growth and Partial Chemical Composition of Lettuce, Beets, Carrots, and Snap Beans. *Virginia Truck Expt. Station Bull. No. 73.* 42 The Story of Field A of the Massachusetts Agri. Expt. Stn.: A Review of Experiments with Nitrogen Fertilizers, *Massachusetts A. E. S. Bull. No. 290.* 43.

Two Systems of Feeding Dairy Cows: High Roughage and Low Grain versus Low Roughage and High Grain *No. 291.* 44. Carbon Disulfide Emulsion for the Control of the Root-Knot Nematode. *No. 292.* 45. Water Holding Capacity of Irrigated Soils. *Utah A. E. S. Bull. No. 183.* 46. Cost Reduction in Dry-Farming in Utah. *No. 215.* 47. Twenty-eight Years of Irrigation Experiments near Logan, Utah 1902–29, Inclusive *No. 219.* 48. A Quarter Century of Dry-Farm Experiments at Nephi, Utah, *No. 222.* 49. Twenty Years of Rotation and Manuring Experiments at Logan, Utah. *No. 228.* 50. Factors Related to Income and Costs of Production on Farms in Marshall and Dekalb Countries, Alabama 1927—1929. *Alabama Polytech. Inst. A. E. S. Bull. No, 236.* 51. Morphological, Greenhouse, and Chemical Studies of the Black Belt Soils of Alabama. *No. 237.* 52. Experiments with Commercial Nitrogenous Fertilizers. *No. 238.* 53. Swine: Series on California Crops and Prices. *California A. E. S. Bull. No 523.* 54. Marketing Globe Artichokes. *No. 524.* 55 Spacing Studies with Asparagus. *No. 525.* 56. Planting Season for Sugar Beets in Central California. *No. 526.* 57. The Tank-Mixture Method of Using Oil Spray. *No. 527.* 58. The Puncture Vine (Tribulus Terrestris, L) in California. *No. 528.* 59. Verticillium Wilt of Straeberries. *No. 530.* 60. Breeding Plants of the Cabbage Group. *No. 532.* 61. The Harvesting and Handling of Fall and Winter Pears. *No. 533.* 62. Effect of Extending the Cutting Season on the Yield of Asparagus. *No. 535.* 63. The Smokiness of Oil-Burning Orchard Heaters. *No. 536.* 64. Sales Methods and Policies of the Calavo Growers of California *No. 539.* 64(a). Effect of Partial Cutting in the Virgin Stand upon the Growth and Taper of Western Yellowpine. *No. 540.* 65. Physical and Chemical Characteristics of the Soils from the Erosion Experiment Stations. *U. S. A. Agri. Dept. Tech. Bull. No. 316.* 66. Biology and Morphology of the Spindle Worm, or Elder Borer. *No. 345.* 67. Practical Information for Beginners in Irrigation. *U. S. A. Agri. Dept. Far. Bull. No. 864* 68. Breeds of Light Horses. *No. 952.* 69. Strawberry Culture: Western United Stages. *No. 1027.* 70. Beef-Cattle Production in the Range Area. *No. 1395.* 71. Currants and Gooseberries: Their Culture and Relation to White-Pine Blister Rust. *No. 1398.* 72. Bean Diseases and their Control. *No. 1692.* 73. Growing Christmas Holly on the Farm. *No 1693.* 74. Dressing and Packing Turkeys for Market. *No. 1694.* 75. Using Soil-Binding Plants to Reclaim Gullies in the South. *No. 1697.* 76. Growing Root Crops for Livestock. *No. 1699.* 77. Bacterial Diseases of Plants occurring in Formosa I. *Japan Taihoku Imp. Univ. Phytopath Lab. Contri,* No. *13.* 78. Studies on the White Pocket Rot or "Renkonkusare" of Chamaecyparis Formosensis Mats. No. *14.* 79. Early Diagnosis of Plant Diseases. No. *15.* 80. Bacterial Diseases of Plants occurring in Formosa II. No. *16.* 81. Immunological Studies of Mosaic Diseases III. Further Studies on the Distribution of Antigenic Substance of Tobacco Mosaic in different Parts of Host Plants. No. *17.*

## D. Circulars, Leaflets Etc.

82. The Indian Central Cotton Committee: Its Objects, Activities and Achievements. *Ind. Cent. Cott. Comm. Pub. Pamph.* No. *1.* 83. Physiology of the Cotton Plant in Sind with special reference to Perrennial Irrigation. No. *2.* 84. The Khandesh Cotton Breeding Scheme. No. *3.* 85. Green Stained Sind-American Cotton. 86. Madras Herbaceum Scheme. 87. Tackling the Impurity in Indian Cottons. 88. Campaign against Cotton Wilt Disease in C. P. Two High Yielding and Resistant Strains evolved. 89. Some Problems of Cotton Growing and its Rotation Crops in the Central Provinces and Berar. 90. War on Boll-Worm in Broach District. 91. Publications on Soil Science issued from the Empire Overseas during 1932. *Imp. Bur. of Soil. Sci. Pub.* 92. Operation of Egg Packing Stations: I. A Farmers' Co-operative Station. II. A Private Station. *Wales Agri. Dep. Econ. Pub.* 93. Wool Intelligence Notes: World Wool Situation.

1933. *E. M. B.—(Statistics and Intelligence Branch Pub.).* 94. Bark Beetles and Shot Borers. *Mini., Agri. and Fish. Adv. Leaf.* No. *159.* 95. Rabbits for Fur and Flesh. No. *161.* 96. Angora Rabbit Wool Production. No. *162.* 97. The Onion Fly. No. *163.* 98. The Wood Pigeon. No. *165.* 99. Selection of Dairy Cattle and Milk Recording. No. *166,* 100. Hand and Machine Milking. No. *167.* 101. The House-Sparrow. No. *169.* 102. Pea and Bean Thrips. No. *170.* 103. The Cultivation of Flax for Fibre. No. *171.* 104. Earcockles of Wheat No. *172.* 105. The Gout Fly. No. *174.* 106. Current and Gooseberry Aphides. No, *176,* 107, Notes on the Cultivation of the Pineapple (Ananas Sativus), *Mauritius Agri. Dept, Leaf, Ser, Leaflet 33.* 108. Notes on Vanilla Cultivation, *Leaflet 34,* 109. Preparing Wool for Market. *U. S. A. Agri. Dept. Leaflet 92.* 110. Lamb Feeding, N. *Dakota Agri. Ext. Dvn. Cir. 114.* 111. An Inexpensive Machine for filling the Trench Silo. *Alabama A. E. S. (Poly Tech. Inst.) Cir 61.* 112. The Use of Ice in Curing Pork on the Farm. *Cir. 62.* 113. Idle Farm in Hunterdon County New Jersey. *New Jersey Agri, Dep. Cir. 227.* 114. Records of Rice Yields in Japan. *Japan Bettar Farming Assocn. Pub.*

## E. Reprints.

115. Empire Fibres for Marine Cordage: Tests of Cordage Manufactured from Manila and Sisal Hemps. 116. Methods of Pasture Analysis. 117. Cotton Fibres—1. Origin and Early Stages of Elongation. 118. Differences in the Amino Acid content of the Chief Protein (Glycinin) from Seeds of Several Varieties of Soybean. Oil Content of Nine Varieties of Soybean and the characteristics of the Extracted Oils. 119. A Method for Determining the Quantity of Mineral Oil Retained by Leaf Surfaces After Spraying.

## F. Translations.

120. The Present State of Investigations on Virus Diseases. 121. Sugar Formation and the Process of Ripening of Sugar Cane 2nd Contribution—On the Formation of Starch in the leaves of Sugar Cane. 122, Pennisetum Americanum, L. (X, Schum), Breeding Technique, 123, Sorghum:— The History and Distribution of Sorghum, Andropogon Sorghum. L, The Breeding Work—Pure Breeding, Hybrid Vigor in Sorghum, 124, Millets-Breeding: The Effect on Yield of the Duration of the Vegetative Period in Varieties of Millet, On the Glume Colour of Panicum Miliaceum, Investigation on Pollination in Millet, Contribution to the Study of Panicum Miliaceum Breeding Work, Panicum Italicum (L), 1, Maximum—Breeding Technique—Pure Breeding, Panicum Italicum, L, 2, Moharium (P, Germanica [Røth]), Breeding Technique,