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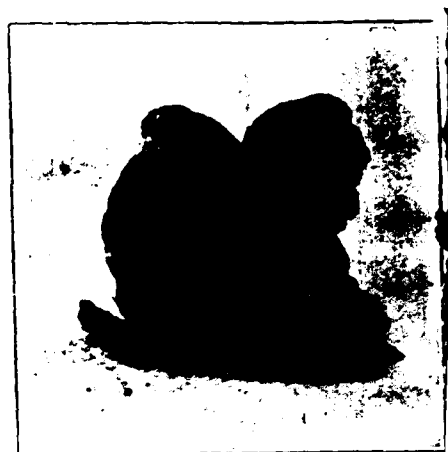
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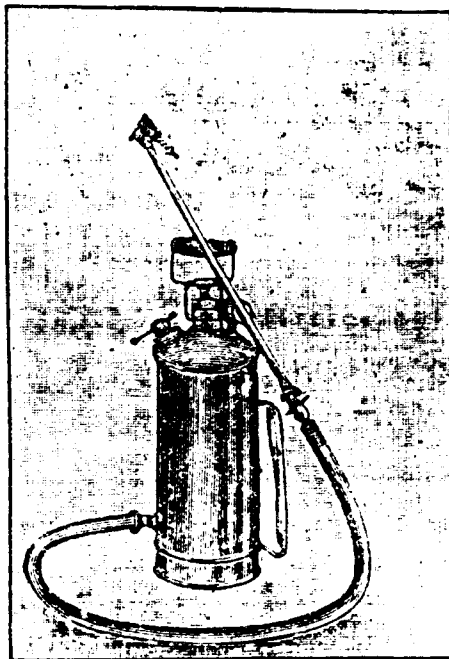
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## Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXIII]

MAY 1935

[No. 5.

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### Editorial.

**Duty on Foreign Rice.** The report of the special officer appointed last year to enquire into the rice production and trade in Madras has recently been published.

Among other things the report lays emphasis on two aspects of the question which have received considerable attention from the public in recent times namely (1) The import of large quantities of foreign rice into Madras which was one of the main causes of the reduction of the price of the commodity in the Province, and (2) The prevailing high rates of railway freight which mitigated against the development of internal trade. Action on both these matters, rested with the Government of India who decided in March this year to impose a duty of 12 annas per maund (82 lb.) on imports of broken rice.

In many quarters, the duty of 12 annas on broken rice is considered inadequate to meet the needs of the situation and the recommendation of the crop planning conference which met in Simla last June lends support to this view. The Legislative Council, Madras, expressed its dissatisfaction on the inadequacy of the relief measure, and suggested that the duty on broken as well as whole rice should be raised to Re 1-8-0 per maund.

It was the contention of many of the members that quantities of paddy, and rice raw and parboiled, were being imported into Madras in

addition to broken rice, and unless all kinds and grades were included in the levy no benefit would accrue to the cultivator. It must be remembered in this connection, that broken rice is a by-product of the rice milling industry of the exporting countries, which send out their graded produce to more fastidious countries but depend on India almost entirely for the disposal of their broken rice. Hence this commodity could afford to stand a good deal of competition with regard to prices, and a levy of duty on this may not have the desired effect of restricting its import and raising the level of the price of paddy. On the other hand, other members contended that the imposition of a duty on a staple food product would adversely affect the consumers, and especially the urban labouring classes. The famine conditions prevailing at the time, and the low output of food grains in 1934-35 due to adverse seasonal conditions, in a way justified their point of view. We would like to point out, however, that there is a fallacy attached to this argument regarding the supposed conflict of interests between the labouring and the cultivating classes. This conflict is largely illusory, since under Indian conditions the prosperity of the one is closely linked with the other, and the purchasing power of the rice cultivator, is the mainstay of the industrial labourer, and any measure which will help the former must perforce have a beneficial effect on the latter.

It is too early to consider the effect of the imposed duty on paddy prices. The major portion of the produce in the province comes to the market during the period January to March, and the percentage of rice growers who can afford to wait and take their produce to the market later in the season is relatively small; and hence any benefit which the imposition of the duty affords, is more likely to help the trader and middleman rather than the cultivator during this season. But there are signs of improvement in the price of rice and the present trend is likely to continue till the next harvest in October.

We hope that the Government of India will reopen the question before then and consider the advisability of increasing the duty and extending it to imported paddy and whole rice.

**New Crops and Old.** This is the heading given to the leader in the Madras Mail on 30th April. It arose out of an interview given by Mr. S. V. Ramamurthy, Director of Agriculture, Madras to the special correspondent of the paper indicating the natural advantages which Madras possessed for growing special crops like sugarcane and fruits. The Director's view that Madras should take early action to extend its sugar manufacture rapidly up to the extent of at least of supplying its needs has been criticised as 'bad economics'. We hardly agree with this criticism. If Madras were to rest content with getting its sugar needs from outside, it is obvious that there must be some

product which she can produce and profitably exchange it with sugar. But as things stand she has not got such a commodity. The question is therefore mainly one as to what she can produce more economically than other Provinces with the existing resources. As pointed out by Mr. Ramamurthy in a later communication, Madras can manufacture sugar cheaper than North India by growing Coimbatore canes like Co. 213. Recent work in sugarcane breeding has also shown that Co. 213 can be replaced by certain varieties of thick canes suitable to Madras for irrigated conditions. With the introduction of these types into general cultivation the necessity to grow thin canes chiefly to economise in cost of cultivation should disappear.

We believe Mr. Ramamurthy was right in his statement that Madras failed to take advantage of the favourable conditions early enough. A considerable time has probably been wasted in trying to evolve a particular type of sugar mill suitable to the small producer and in improving the methods of manufacturing jaggery. A number of sugar companies have been floated recently in Madras but very few of them have yet made any headway. On the other hand we hear of sugar companies in North India which have been able to realise half their capital outlay in two years after start.

More than the competition from the north, Madras has a serious rival in the adjacent State of Mysore. Here thick canes are grown under irrigated conditions as in Madras and the factory started in Mandya two years ago is already producing more sugar than what could be consumed within the State and it is increasing the output from this June.

Even if Madras does not produce sugar to the extent of competing with North India or Mysore, the growing of sugarcane in place of other crops that are less paying should be welcomed in places where facilities exist. Such possibilities appear to exist to the greatest extent in the central districts of Chittoor, North and South Arcots, Salem and Trichinopoly. The area under sugarcane in these districts has increased from 19,956 acres in 1928-29 to 54,129 acres in 1932-33 and this is a happy augury.

There is however one important consideration in the manufacture of sugar, the neglect of which is likely to hinder further development i. e., the existence of a healthy co-operation between the grower and the miller. While the grower should undertake to supply the mills with his canes, the price offered by the miller should allow a reasonable margin of profit to the grower to encourage him to grow canes in preference to other crops. Co-operative undertaking in which the grower has some interest will probably be the best way of meeting the problem. We do hope that this will be kept in view when new factories are brought into existence.

## ANTHESIS AND POLLINATION IN BENGAL GRAM (*CICER ARIETINUM*)

By V. RAMANATHA AYYAR, L. Ag.,

Cotton Specialist, Coimbatore.

R. BALASUBRAHMANYAN, B.A., B.Sc. (Ag.),

Assistant to the Cotton Specialist, Coimbatore.

A study of the time of flower opening and anther dehiscence is a necessary pre-requisite in any scheme of plant breeding where artificial hybridisation is contemplated. As the mechanism controlling these phases of floral development are influenced by latitude and season, it is essential that separate data are collected on this aspect at each place of investigation. In Bengal gram (*Cicer arietinum*) Howards and Khan (1915) have recorded their observations under the conditions obtaining at Pusa. Since no information under South Indian conditions was available, detailed studies were undertaken at Coimbatore during 1931-32.

Bengal gram is usually sown in the Coimbatore District about the middle of November, and is in flowers between the second week of January and the first week of February. A pattern of its flowering curve is given in Chart I. It may be mentioned here that this crop belongs to the category of plants, the flowers of which open and close for two successive days.

**Anthesis.** Groups of flower buds were marked a day prior to their opening on 4 days in 1931, and 3 days in 1932 in a bulk rainfed crop grown on the black soil during the cold weather, and the time of their opening and closing were observed carefully every half an hour on two consecutive days during each period except on 9-1-1931 when the second opening and closing was not observed. Apart from these, two sets of flower buds were studied at hourly intervals in a crop raised for another purpose on red loamy soil under irrigated conditions during the summer of 1932. The data obtained on all these days are tabulated into hourly class intervals and given in Table I-(a) and (b).

When the figures relating to the time of opening of flowers are examined it is seen that:—

1. Some of the buds under observation did not open at all (even for the first time) and the proportion of such (cleistogamous) flowers was greater in summer crop. For instance in January 1932 the percentage of cleistogamous flowers ranged from 8 to 12, while it was between 32 to 42 in June and July.

2. Among the buds that bloomed on the first day some did not open on the second day. The ratio of such flowers increased with the

Table I-(a). Flower opening and closing in B. Gram in 1931.

| Hours.                               | First opening and closing.           |                                      |                                      | Second opening and closing.          |                                      |                                      |
|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
|                                      | 9-1-1931                             | 15-1-1931                            | 31-1-1931                            | 16-1-1931                            | 1-2-1931                             | 28-2-1931                            |
|                                      | Percentage of flowers Opened Closed. | Percentage of flowers Opened Closed. | Percentage of flowers Opened Closed. | Percentage of flowers Opened Closed. | Percentage of flowers Opened Closed. | Percentage of flowers Opened Closed. |
| 9 A. M.                              | 22                                   | 42                                   | 27                                   | 16                                   | 4                                    | ...                                  |
| 10 "                                 | 36                                   | 22                                   | 31                                   | 6                                    | 1                                    | ...                                  |
| 11 "                                 | 8                                    | 7                                    | 9                                    | ...                                  | ...                                  | ...                                  |
| 12 Noon.                             | 5                                    | 3                                    | 9                                    | 2                                    | ...                                  | ...                                  |
| 1 P. M.                              | 6                                    | 5                                    | 8                                    | 9                                    | ...                                  | ...                                  |
| 2 "                                  | ...                                  | ...                                  | ...                                  | 5                                    | ...                                  | ...                                  |
| 3 "                                  | ...                                  | ...                                  | ...                                  | 5                                    | ...                                  | ...                                  |
| 4 "                                  | ...                                  | ...                                  | ...                                  | 1                                    | ...                                  | ...                                  |
| 5 "                                  | 64                                   | ...                                  | ...                                  | ...                                  | ...                                  | ...                                  |
| 6 "                                  | 12                                   | ...                                  | ...                                  | ...                                  | ...                                  | ...                                  |
| 7 "                                  | ...                                  | 1                                    | ...                                  | ...                                  | ...                                  | ...                                  |
| Total.                               | 77                                   | 79                                   | 84                                   | 22                                   | 5                                    | 2                                    |
| Percentage of Cleistogamous flowers. | 23                                   | 21                                   | 16                                   |                                      |                                      |                                      |

\* One damaged.

Table I-(b). Flower Opening and Closing in B. Gram 1932.

| Hours.                               | First opening and closing.       |                                  |                                  |                                  |                                  |                                  | Second opening and closing.      |                                  |                                  |                                  |      |        |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|------|--------|
|                                      | 4-1-1932                         | 11-1-1932                        | 22-1-1932                        | 23-6-1932                        | 2-7-1932                         | 5-1-1932                         | 12-1-1932                        | 23-1-1932                        | 24-6-1932                        | 3-7-1932                         |      |        |
|                                      | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Percentage of flowers of flowers | Open | Closed |
| 9 A.M.                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 10 "                                 | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 11 "                                 | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 12 Noon                              | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 1 P.M.                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 2 "                                  | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 3 "                                  | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 4 "                                  | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 5 "                                  | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 6 "                                  | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| 7 "                                  | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |
| Total.                               | 88                               | 90                               | 92                               | 88*                              | 58                               | 27                               | 7                                | 6                                | 2                                | ..                               | 27   | ..     |
| Percentage of Cleistogamous flowers. | 12                               | ..                               | 8                                | 32                               | ..                               | 42                               | ..                               | ..                               | ..                               | ..                               | ..   | ..     |

\* One damaged. \*\* 4 damaged.

advance in season. In 1931 the percentage of flowers that did not open for the second time on the 16th January, on the 1st February and on the 28th February were 72, 94, 97 respectively.

3. Though a few commenced opening on the first days at about 9 A. M., the time of most active blooming was between 9 to 10 A. M. The laggards however kept on till 3 P. M. The buds developing in summer under irrigated conditions started opening at the same time as in cold months, but the rate of opening in the course of the day was very much slower, reaching its peak at 2 P. M.

4. On the second day, the opening was much earlier and less drawn out in distribution. Anthesis started at 8 A. M. and by 11 A. M. it was complete.

When these observations were compared with those recorded at Pusa, it is noticed that no mention of cleistogamy is made at the latter place except a small note made in the body of the Table IV, on page 220-(4) to the effect that two flowers (out of the sixteen under observation) did not open. Very probably this feature is not very much pronounced there. The difference in behaviour if present, may be due to varietal differences. At Coimbatore most of the North Indian types dry up when they are in flowers, while the local types complete their life cycle rapidly.

The occurrence of higher percentage of cleistogamous flowers in the summer crop needs an explanation. Henslow (1838), and Coulter, Barnes, and Cowles (1932), mention that fall or rise of temperature and illumination, poor nutrition, changes in turgor pressure, and parasites may induce cleistogamy which might also involve changes in structure, form and setting. The data on the setting of pods show that it was as good as in chasmogamous group. (Table II).

Table II.  
Percentages of setting.

| Date of observation. | Open flowers. |          |                     | Cleistogamous flowers |          |                     |
|----------------------|---------------|----------|---------------------|-----------------------|----------|---------------------|
|                      | No. observed. | No. set. | Percent of setting. | No. observed.         | No. set. | Percent of setting. |
| 9-1-1931             | 70            | 44       | 63                  | 20                    | 16       | 80                  |
| 15-1-1931            | 70            | 50       | 71                  | 19                    | 13       | 68                  |
| 27-2-1931            | 61            | 37       | 61                  | 14                    | 7        | 50                  |
| 4-1-1932             | 80            | 69       | 86                  | 11                    | 9        | 82                  |
| Total.               | 251           | 200      | 71                  | 64                    | 45       | 70                  |

A scrutiny of the hourly figures relating to temperature, humidity, number of hours of sunshine, and total atmometric evaporation on these days, point out that they bear no relation to the phenomenon observed, Table III.

Table III. Air Temperature °F.

| Date.     | Hours. |      |      |      |      |      |    |      |      |      |      |      |      |  |
|-----------|--------|------|------|------|------|------|----|------|------|------|------|------|------|--|
|           | 6      | 7    | 8    | 9    | 10   | 11   | 12 | 1    | 2    | 3    | 4    | 5    | 6    |  |
|           | A.M.   | A.M. | A.M. | A.M. | A.M. | A.M. | N. | P.M. | P.M. | P.M. | P.M. | P.M. | P.M. |  |
| 9-1-1931  | 67     | 67   | 68   | 69   | 74   | 78   | 79 | 80   | 81   | 82   | 82   | 82   | 79   |  |
| 15-1-1931 | 71     | 71   | 71   | 72   | 73   | 75   | 76 | 77   | 78   | 80   | 80   | 80   | 80   |  |
| 31-1-1931 | 72     | 72   | 72   | 72   | 72   | 74   | 75 | 79   | 80   | 81   | 81   | 81   | 81   |  |
| 27-2-1931 | 69     | 69   | 70   | 76   | 80   | 83   | 85 | 87   | 87   | 88   | 88   | 88   | 88   |  |
| 4-1-1932  | 68     | 69   | 70   | 74   | 76   | 78   | 80 | 80   | 82   | 81   | 80   | 79   | 76   |  |
| 11-1-1932 | 62     | 68   | 70   | 74   | 77   | 80   | 81 | 82   | 83   | 83   | 82   | 80   | 78   |  |
| 22-1-1932 | 70     | 70   | 70   | 72   | 74   | 75   | 80 | 82   | 83   | 83   | 84   | 83   | 82   |  |
| 23-6-1932 | 73     | 76   | 79   | 81   | 83   | 84   | 84 | 84   | 84   | 84   | 80   | 78   | 77   |  |
| 2-7-1932  | 68     | 72   | 74   | 78   | 80   | 83   | 85 | 87   | 87   | 87   | 83   | 80   | 77   |  |

Further if alterations in temperature are responsible for the higher percentage of cleistogamous flowers observed in the summer crop, one would expect a consistently higher or lower proportion in the latter part of the flowering period when the days get warmer. But a study of distribution of unopened flowers during the entire flowering period (vide chart I) shows that it is not so. The peaks noted on the 7th, 13th, 16th, 17th, 20th and 23rd January are not associated with any rise or fall in atmospheric temperature prevailing on these days. The only possible explanation left is the difference in the nutrition between the two crops studied. The soil on which the off-seasonal crop was grown and the water used for irrigation were slightly alkaline, while the seasonal crop was raised on more or less neutral soil under rainfed conditions. The summer crop was very much poorer in growth than that raised in the cold weather. The tardiness observed in the opening of the chasmogamous flowers produced in summer plots (Table I-b) tends to support this possibility. It is stated by Coulter, Barnes and Cowles that want of available food in the embryonic regions might bring about alterations in the time of opening and closing of flowers in spite of favourable temperature and illumination.

If the figures of the closing of the flowers are compared, (Tables I-(a) and (b) it is seen that:—

1. The march of closing is more gradual and less rapid. Although flowers in 1932 commenced the first closing earlier than in 1931, largest number closed nearly at the same time in both years viz., between 4 and 5 P. M.

2. The second closing starts very much earlier than the first. In 1931 the latter did not begin before 4 P. M. while in the former flowers closed as early as 11 A. M.

3. The daily scheme of closing in the summer crop is however similar to that obtaining in the crop grown in the normal season. This feature forms a direct contrast with its behaviour during opening.

The data collected at Pusa on this point show that the closing occurs at about the same time on both the days.

The results of the duration of flowering point out (Table IV) that the flowers remain open for a shorter time during the hot months

and also on the second day, and that the duration of flowering on the second day is not influenced by its performance on the first day.

Table IV. Duration of flower opening. Frequency distribution.

| Duration<br>in hours. | First Opening. |         |         |         |        |         |         |         |        | Second Opening. |        |         |        |         |         |         |        |  |
|-----------------------|----------------|---------|---------|---------|--------|---------|---------|---------|--------|-----------------|--------|---------|--------|---------|---------|---------|--------|--|
|                       | 9-1-31         | 15-1-31 | 31-1-31 | 27-2-31 | 4-1-32 | 11-1-32 | 22-1-32 | 23-6-32 | 2-7-32 | 16-1-31         | 1-2-31 | 28-2-31 | 5-1-32 | 12-1-32 | 23-1-32 | 24-6-32 | 3-7-32 |  |
| 1                     | ..             | ..      | ..      | ..      | ..     | ..      | ..      | 6       | 2      | ..              | ..     | ..      | ..     | ..      | ..      | ..      | ..     |  |
| 2                     | ..             | ..      | 1       | 4       | 2      | 2       | ..      | 32      | 14     | 5               | 1      | 1       | 3      | 1       | ..      | ..      | ..     |  |
| 3                     | 2              | 1       | 12      | 4       | 4      | 2       | ..      | 12      | 22     | 6               | 1      | ..      | 3      | 1       | ..      | ..      | ..     |  |
| 4                     | 7              | 6       | 5       | 4       | 6      | 7       | 4       | 8       | 6      | 5               | ..     | ..      | 4      | 4       | ..      | ..      | ..     |  |
| 5                     | 7              | 2       | 7       | 13      | 13     | 9       | 12      | 6       | 6      | 5               | 2      | ..      | 5      | ..      | 6       | 2       | ..     |  |
| 6                     | 27             | 11      | 28      | 27      | 16     | 31      | 12      | 4       | 8      | 1               | 1      | 1       | 7      | ..      | ..      | ..      | ..     |  |
| 7                     | 28             | 36      | 14      | 10      | 21     | 19      | 26      | ..      | ..     | ..              | ..     | ..      | 3      | ..      | ..      | ..      | ..     |  |
| 8                     | 6              | 23      | 16      | 11      | 19     | 11      | 20      | ..      | ..     | ..              | ..     | ..      | 2      | ..      | ..      | ..      | ..     |  |
| 9                     | ..             | ..      | ..      | ..      | 6      | 8       | 8       | ..      | ..     | ..              | ..     | ..      | ..     | 1       | ..      | ..      | ..     |  |
| 10                    | ..             | ..      | ..      | ..      | ..     | 1       | 6       | ..      | ..     | ..              | ..     | ..      | ..     | ..      | ..      | ..      | ..     |  |
| Average<br>hours.     | 6.2            | 6.8     | 5.9     | 5.8     | 6.4    | 6.4     | 7.1     | 2.8     | 3.5    | 3.6             | 4.2    | 4.0     | 5.0    | 4.3     | 5.0     | 5.0     | ..     |  |

**Anther dehiscence and pollination.** It has been observed that on the day of flower opening the pollination is complete by the time flowers unfurl their petals. Examinations of buds one day previous to the anthesis have shown that the process had already started by 8 A.M. A large number of buds due to open two days hence were then labelled and examined in lots of fifteen or more, at intervals of two hours from 2 P. M. onwards, on the 20th January 1931 for anther dehiscence, and on the 4th, 13th, and 23rd January 1932 for both anther dehiscence and for pollination. The data obtained are furnished in Table V.

Table V. Dehiscence of anthers in Bengal Gram.

| Hours of observation. | 20-1-1931                         | 4-1-1932                          |                                   | 13-1-1932                         |                                   | 23-1-1932                         |                                   |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                       | % of buds with dehiscent anthers. | % of buds with dehiscent anthers. | % of buds with pollinated stigma. | % of buds with dehiscent anthers. | % of buds with pollinated stigma. | % of buds with dehiscent anthers. | % of buds with pollinated stigma. |
| 4 P.M.                | 8                                 | ...                               | ...                               | ...                               | ...                               | ...                               | ...                               |
| 6 "                   | 23                                | ...                               | ...                               | ...                               | ...                               | 4                                 | ...                               |
| 8 "                   | 31                                | 13                                | ...                               | 8                                 | ...                               | 25                                | ...                               |
| 10 "                  | 36                                | 28                                | ...                               | 25                                | ...                               | 38                                | 10                                |
| 12 "                  | 45                                | 39                                | 4                                 | 32                                | 12                                | 65                                | 12                                |
| 2 A.M.                | 48                                | 42                                | 4                                 | 34                                | 14                                | 86                                | 13                                |
| 4 "                   | 80                                | 42                                | 4                                 | 40                                | 23                                | 91                                | 20                                |
| 6 "                   | 100                               | 46                                | 21                                | 61                                | 44                                | 92                                | 32                                |
| 8 "                   | 100                               | 69                                | 35                                | 65                                | 52                                | 98                                | 42                                |
| 10 "                  | ...                               | 84                                | 43                                | 72                                | 70                                | 100                               | 52                                |
| 12 Noon               | ...                               | 100                               | 76                                | 100                               | 92                                | 100                               | 67                                |
| 2 P.M.                | ...                               | 100                               | 96                                | 100                               | 100                               | ...                               | 100                               |
| 4 "                   | ...                               | ...                               | 100                               | ...                               | ...                               | ...                               | ...                               |

It is seen that the anthers commenced to dehisce more than 40 hours prior to the flower opening. In 1931, they started at 4 P. M. and by 6 A. M. on the next day all had liberated their pollen, while in 1932 the first anther opened between 4 and 6 P. M. only, and the last did not do so till 12 noon of the next day. The active period of opening was between 2 A. M. and 12 noon according to the variations in the phenological conditions.

The stigma, however, got pollinated for the first time at 12 P. M. in the night but the majority showed abundance of pollen grains between 8 A. M. and 2 P. M. on the succeeding day (i. e.) a day previous to the opening of the flower. It may be mentioned here that Pusa types 6 and 8 dehisced their anthers 12 hours later than the local varieties, while Type 1 showed very low percentage of dehisced anthers.

It is reported at Pusa that bees visit flowers in large numbers and a certain percentage of cross pollination occurs in nature. As far as the observations made at Coimbatore go, self pollination seems to be the invariable rule. Few insects are found visiting the flowers. Besides, no hybrid plant has ever been found so far in the several populations raised. The small number of aberrant plants found in them proved to be mutants. These indicate definitely that cross pollination is practically absent at Coimbatore. A few experiments conducted on this aspect fully confirmed the above inference. In one case 50 flowers were emasculated and left unpollinated. No pods resulted from any of these. In another set, 46 flowers were emasculated two days previously and pollinated on the day of flowering with the pollen secured from flowers opening on that day. Only one pod developed. This result might point out that conditions were not favourable for natural cross pollination on the day of flower opening. It could not be said that the pollen grains used in the second experiments would have lost their viability as they were more than 24 hours old by the time the anthesis occurred. For, germination tests made in vitro in culture media made up of 2% agar and 20% of cane sugar showed that on the first day of flower opening 96% of pollen grains were yet viable (Table VI) and it was only at the time of second day opening, the germination capacity fell down to 13%.

Table VI. Pollen Germination. Average of 6 counts in plates.

| Date of observation. | First day flowers. |                           |                   | Second day flowers. |                           |                   | Remarks.          |
|----------------------|--------------------|---------------------------|-------------------|---------------------|---------------------------|-------------------|-------------------|
|                      | Total grains.      | No. of grains germinated. | % of germination. | Total grains.       | No. of grains germinated. | % of germination. |                   |
| 23-7-1932            | 66                 | 63                        | 95                | 71                  | 10                        | 14                | * 4 readings only |
| 24-7-1932            | 73                 | 68                        | 93                | 81                  | 9                         | 11                |                   |
| 25-7-1932            | 83                 | 79                        | 95                | 78                  | 11                        | 14                |                   |
| 26-7-1932            | 85                 | 83                        | 98                | 51                  | 6                         | 12*               |                   |
| 30-7-1932            | 96                 | 94                        | 98                | 75                  | 9                         | 12                |                   |
| Total.               | 403                | 387                       | 96                | 356                 | 45                        | 13                |                   |

It is clear from the foregoing data that in Bengal gram the flowers are protandrous in nature and the pollination is complete in bud stage itself.

**Technique of Crossing.** Artificial crossing in this crop has been found to be very difficult on account of the smallness of buds and their sensitivity to manipulation. In spite of the great care taken during the process as well as in the selection for fertile parents, only 15 to 19% flowers managed to set (Table VII).

Table VII.

Percentage of setting in Crosses.

| Date of crossing.      | No of flowers crossed. | No of flowers set. | Percentage of setting. |
|------------------------|------------------------|--------------------|------------------------|
| 30-12-1932 to 9-1-1933 | 570                    | 108                | 19                     |
| 10-1-1933 to 19-1-1933 | 435                    | 84                 | 19                     |
| 20-1-1933 to 29-1-1933 | 242                    | 37                 | 15                     |
| 30-1-1933 to 11-2-1933 | 283                    | 48                 | 17                     |

The following method has been found to give very successful results at Coimbatore. Flower buds due to open two days later are selected and labelled. Such buds can be easily identified by their size after a little experience. In the evening between 2 and 6 P. M. the keel is gently pushed apart with a blunt needle and the anthers are carefully removed with a light upward jerk given at the point of attachment with filament, without pricking the anthers. A large number of flowers could be operated quite easily in this manner when one gets familiar with the work. It may, however, be pointed out that care has to be taken to see that the pedicels are handled least, and a few of the tagged flowers are left undisturbed for use as pollen parent later on. On the next morning pollen grains from these buds are removed and dusted between 9 and 11 A.M. on the stigmas of the buds emasculated on the previous evening. It has been found that emasculated buds left exposed overnight without any covering kept fresh on the next day. As insects are seldom found visiting the flowers, there is hardly any risk of cross pollination. Freshness of the pedicel on the subsequent days will indicate the success of crossing. Pods will be seen from these 5 or 6 days hence.

The above method differs from the one described by Khan and Akhtar (1934) in the non-removal of petals and in dispensing with the muslin bags. In fact tissue bags were used at first to cover the emasculated flowers, but they were abandoned when they were found to accelerate shedding. It has been experienced that crossing is more

successful if the earlier formed buds are selected for crossing. They are also easier to manipulate on account of their size and capacity to keep fresh for a longer time.

Pusa types differ among themselves with regard to their sensitiveness to crossing. T-6 and T-8 stand handling better. Types 11 and 13 give higher percentage of setting if they are used as pollen parents. Shaw and Khan (1931), Khan and Akhtar (1934), experienced the same drawback at Pusa in the last two types.

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**Summary.** Observations made at Coimbatore on the time of opening and closing of flowers in Bengal gram (*Cicer arietinum*) disclosed that :—

- (a) Cleistogamy was present and its proportion seemed to be altered by differences in nutritional conditions in the soil.
- (b) All the flowers that opened on the first day did not open on the second day.
- (c) The time of active blooming was between 9 and 10 A. M. on the first day. In a summer crop, most of the flowers opened at 2 P. M.
- (d) The march of closing was more gradual and less rapid than that of opening.
- (e) The petals opened and closed much earlier on the second day of their opening.
- (f) The total period during which a flower remained open was less on the second day of opening and during hot months.

2. It was also found that the anther dehiscence and pollination occurred one day before the opening of the flowers, and there was hardly any cross pollination notwithstanding the fact that the pollen grains were viable at the time of flower opening.

3. The method of crossing that has been found successful is described.

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## GERMINATION TESTS ON SORGHUM SEEDS PRESERVED IN EARHEAD

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&

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To a plant breeder with whom seed material especially of single plants, accumulates rapidly, the whole of which cannot be worked off each succeeding year, the question of how long and in what way this seed could best be preserved with unimpaired viability is a matter of primary importance. In a previous article (Rangaswami Ayyangar and Vijayaraghavan)\* the result of the germination tests of loose sorghum seed stored in tin screw top bottles has been reported, and it was recorded that the seeds retain full vitality for about 2½ years and when four years old deteriorated to a germination capacity of only about 10 per cent. It was also recorded that preserving the seed in naphthaline, which keeps the seed free from damage from pests of stored grain, does not affect its germination capacity.

In breeding work in sorghum the individual head is usually the seed unit and it has been the practice at the Millets Breeding Station to keep the seed material from single plant selections as earheads and to thresh them only just prior to sowing. As the earheads are compact and the seeds safely clipped up in the glumes, it has been found that it was enough to scissor off portions of the earhead for sowing purposes and have the rest of it as a sample for future reference, so that the general configuration of the earhead and the seeds on it is, in a measure, preserved for future use. Leaving the seeds in the glumes is an added advantage.

The sample heads thus preserved accumulated through years and in 1933, after ten years of seed accumulation, it was decided to discard superfluous earheads; and before they were rejected the seeds in them were tested for their viability. One to ten years old earheads of the same variety were used in these tests. Two to four heads in each of different important varieties representative of typical tracts were chosen, and 200 grains from each head were germinated. Germination tests were made by keeping the seeds on wet blotting paper or germination trays in an incubator.

The first indications of germination are usually observed from 12 hours onwards and in the case of fresh (½ to 1 year old) seeds germination will be completed in 3 days. In these tests the ungerminated seeds were retained up to a week, and then rejected as having

\* Madras Agri. Dept. Year Book, 1926, p. 14.

no vitality. The results of the germination percentages obtained in the different varieties tested are given below.

**Viability of Sorghum Seeds Preserved in the Earheads.**

| Local Name.             | Botanical group.               | Percentage of germination. |              |              |              |              |              |              |                         |
|-------------------------|--------------------------------|----------------------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------------------|
|                         |                                | 1 year old.                | 2 years old. | 3 years old. | 4 years old. | 5 years old. | 6 years old. | 7 years old. |                         |
| 1. Vellai Cholan        | Sorghum Durra.                 | 89                         | 82           | 59           | 38           | 1            | 0            | 0            | Irrigated (Dindigul).   |
| 2. Chinna Manjal Cholan | "                              | 100                        | 99           | 86           | 22           | 5            | 0            | 0            | Irrigated (Coimbatore). |
| 3. Peria Manjal Cholan  | "                              | ...                        | 93           | 97           | 87           | 58           | 1            | 0            | Rainfed (Coimbatore).   |
| 4. Patcha Jonna         | "                              | ...                        | ...          | ...          | 92           | 16           | 4            | 0            | Rainfed (Ceded Dts.)    |
| 5. Tella Jonna          | Sorghum cernuum                | ...                        | ...          | ...          | 95           | 18           | 0            | 0            | "                       |
| 6. Talai Virichan       | Sorghum Roxburghii var. Hians. | ...                        | 94           | 90           | 69           | 21           | 2            | 0            | Rainfed Gaping glumes.  |

It will be noted that in this naked grain, grains with their glumes on the earhead retain their viability longer than when kept as loose seed. So even when larger quantities of seed are to be preserved, picked earheads can be stored in closed metal bins or earthen pots with a few balls of naphthaline.

The rate of deterioration in viability is higher in the irrigated than in the rainfed sorghums. The percentage of germination decreases rapidly in the irrigated varieties after the second year, while in the rainfed varieties the seeds retain full vitality (about 90 per cent.) for three to four years and decreases to less than 50 per cent. after five years and even when six years old stray seeds (1 to 5 per cent.) germinate. In no case did seven years old seeds germinate.

### SOME SOUTH INDIAN VILLAGE STUDIES

(A Preparatory Study of "Villur", Village No. 119, in Tirumangalam Taluq, Madura District, Madras Province.)

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#### Rainfall and Irrigation.

*Nature of Rainfall.* The rainfall is very uncertain and scanty even in the best of seasons. A study of the district during a number of years shows no indication of its being concentrated in the two short periods during which the monsoons blow. On the contrary, it appears that there is a continuous rainy season of 9 months' duration

\* Continued from Page 148, April issue.

which brings more and more rain until November, when it rapidly declines. During a first rate season there will be rain in almost every month of the year, though the bulk of rainfall is received in October and November, every fall will be of some use to one or another of the many crops that are grown, provided it be not too heavy and protracted. Usually there is nothing like regularity in their occurrence or amount. During some years rain falls in desirable abundance but either too early or too late in the season. This state of affairs naturally confuses and misleads the ordinary cultivator. Often his anticipation fails and he meets with disappointment.

(b) *Tanks.* The tanks of this village fall under the IV class, i. e., those which supply water for 3 months or under. There are two big tanks irrigating 175 and 250 acres each, a dozen small tanks irrigating under 50 acres each, and 6 private ones irrigating 54 acres in all. All the private tanks and six of the smaller ones are purely rain-fed. One big tank and four smaller ones are partly rain-fed but partly supplied by the surplus from tanks which themselves are rain-fed. The other big tank and the remaining 2 small tanks are purely surplus-fed. Not unexpectedly, therefore, some of these tanks often get exhausted in the last stages of the crops and the only hope left is in subsoil or underground water.

(c) *Wells.* When the Revenue Department started issuing agricultural loans about 30 years ago many of the cultivators took the advantage, for the purpose of digging wells. This however did not prove so beneficial as was expected. Springs are generally found at a depth of 15 to 20 feet in hard rocky strata. Good springs are hard to get and there are instances where more than Rs. 1000 has been spent for a well which could not supply enough water for one acre a day in summer. Though well-digging still remains a gamble in these parts, yet every year we find stray attempts at improving old wells or digging new ones. No scientific method is yet known. The loose soil is dug out by the country implements and when rocky strata are met they are drilled and blasted. Silting is not very rapid as the underground is mostly rocky but a parapet wall on the top is necessary to prevent the surface drains flowing into the well in rainy season. Nearly 500 wells have been dug, out of which about 300 are in working condition. About 60 are in wet lands and serve as additional sources of water for paddy and for raising a second crop in summer. The rest are in dry lands and help to grow garden crops.

The water obtained from these wells varies according to the soils through which it passes, but is in no case equal in fertilising value to rain water or tank water. On account of the saline ingredients in the soil, good water is rarely obtained. However none of the wells in the fields is unused, though those within the house-compounds are

neglected. Some people even prefer the alkaline water for irrigating certain crops like chillies.

No water pump has ever been brought to this village, though there are said to be at least 4 or 5 wells, which with slight improvement, can each engage an engine of 5 h. p. and a pump 3" diameter.

(d) *Methods of irrigation.* (i) *Flood irrigation.* Mostly in wet lands. For this the land must be level and where it is not naturally so, it is corrected by the plough.

(ii) *Furrow irrigation, in garden lands.* Furrows 4-8 feet apart are made in the fields with a gentle slope from the supply. The land is divided into small squares or rectangles, bordered on one side by a furrow. Water is turned into the plots from the furrows.

(iii) *Basin irrigation.* This is practised only for trees and creeper vegetables. A wide circular furrow or basin is excavated around each trunk and water is run from a furrow laid along the rows. Similar basins are made in case of creeper vegetables and watered by hand till they take root.

Generally the tillage operations are not planned in such manner that water may be admitted with ease and held without difficulty during the whole time the land is idle or at rest. Irrigation by underground pipes is unknown. Due to the ignorance as to the requirements of the crops in respect of water, frequent and excessive irrigation also occurs. This brings about the shallowness of rooting and other evils.

#### Manuring.

The practice of manuring is widely prevalent and various substances are used as manures. Major portion of these is not purchased but made by the cultivators themselves. Sheep penning, oil cakes, farmyard manure and green manure have to be paid for. Farmyard manure or household refuse is generally used for wet lands. Despite the fact that the villagers always try to find other material for fuel than dung cakes, the available farmyard manure is far from sufficient to meet the requirements even of the wet lands. The careless manner in which it is handled shows an utter lack of knowledge about the manurial elements of the different substances. Manurepits are rare and all sorts of refuse are thrown in a heap in the back yard of houses or vacant sites. This not only causes damage to the manure by exposure but it is also a great breeding place for the disease-bearing flies and insects. Though generally very inadequate quantities are applied, cases have occurred where its excess had led to purely vegetative growth. Cattle urine is totally neglected. Green manure is used in plenty; in fact this is the most largely used manure at present for wet lands. *Avaram*, *virale* and *kolingi* (*Sesbania aculeata*) are the crops usually employed. If the soil is alkaline (*soudu*) more leaves and tank silt are used. The first plant rarely grows wild in this locality. All the three

are mostly grown for this purpose. Sometimes horsegram or redgram is sown on wet lands after the harvests to be ploughed in as green manure for the next paddy crop. Leaves of trees such as *neem*, are also freely used. The fields are well ploughed and irrigated before green manure is spread and trodden. Oil cakes, e. g. castor, gingelly and groundnut are commonly used for wet lands though in very small proportion. They are ground to powder and applied just before flowering of the crop. Sheep penning is done for all kinds of lands as often as possible. Chemical manures are being introduced. Depots are now established within a distance of 4 miles and their use is increasing in surrounding places.

#### Crops.

(a) *Crop seasons.* The two cultivating seasons prevalent are *kalam* (winter) and *kodai* (summer). On wet lands only the *kalam* crop is raised, for the tanks can hardly supply enough water for anything else. In years of unusually good rains when the tanks get refilled, a second crop is obtained. Where there are wells in wet lands, cereals such as *cholam* (Sorghum) or *ragi* (Eleusine coracana) are grown in summer as a second crop. Dry lands without wells grow only the *kalam* crop while garden lands raise two and sometimes three. The following table gives the details of crops cultivated in the year of resettlement (1920). Since that time groundnut cultivation has nearly doubled and *tenai* and *kudiravali* have gone out of cultivation. Other crops grown are practically the same.

Table V. Extent of crops cultivated.

|         |            |            |                  |           |             |
|---------|------------|------------|------------------|-----------|-------------|
|         | Paddy      | 594 acres. |                  | Cotton    | 1740 acres. |
|         | Cholam     | 225 "      |                  | Gingelly  | 53 "        |
|         | Cambu      | 92 "       |                  | Castor    | 2 "         |
|         | Ragi       | 152 "      | Industrial       | Groundnut | 193 "       |
| Cereals | Tenai      | 3 "        | crops            | Others    | 19 "        |
|         | Samai      | 101 "      |                  | Betel     | 12 "        |
|         | Varagu     | 35 "       |                  | Chillies  | 61 "        |
|         | Kudiravali | 40 "       | Vegetables       | Plantain  | 6 "         |
|         | Others     | 383 "      |                  | Others    | 12 "        |
|         | Horsegram  | 13 "       |                  |           |             |
| Pulses  | Blackgram  | 1 "        | Double crop area |           | 155 "       |
|         | Redgram    |            |                  |           |             |
|         | Others     | 1          |                  |           |             |

(b) *Extent and nature of crops grown.* The village is hardly self-sufficient in its food crops; in fact it is so in all the essential crops. There are more than 1000 acres under cereals other than paddy. This area however produces, under the best of existing conditions, not more than a fourth of the annual requirements of the village. Less than another quarter is met by paddy, while more than half has to be purchased from outside in the form of imported rice. The same is the case as regards pulses and vegetables, though the requirements of

the latter shrink according to circumstances. Redgram and blackgram are hardly grown at all, while gingelly cultivation requires extension to meet the needs of the place. Cotton, groundnut, chillies and *pan* (betel) are the chief money crops. Though the price of cotton has gone down and the demand for groundnut is not so much as before, yet there seems to be no sign of any diminution in the extent of their cultivation. On the whole, the cotton area, though only 471·26 acres is best suited for the crop, no other equally valuable crop could be found for the rest of the lands. Groundnut oil is being increasingly consumed locally. Chillies are not successfully cultivated, and considering the importance of the crop, there is great prospect for its extension. The crop seems to be subject to many diseases and blights which have not been understood well. Selection of seed and the best methods of cultivation are not known. Betel is a crop raised almost exclusively by the Vellalas; its cultivation is generally well done. The leaves are consumed largely in the surrounding villages and so it has got a fair market. Plantain does not occupy the place it ought to, as admittedly it gives good returns. The reasons are fear of theft, the high initial expense and the costly method of water-lifting.

(c) *Rotation of crops.* All wet-lands without wells grow only paddy and receive no benefit of rotation. In cases where there are wells, the land is occasionally let out for *pan* cultivation: or a second crop cereal such as *cholam* or *ragi* or a vegetable like brinjal is grown; and rarely a green manure crop. In dry lands *cholam* and *varagu* are never sown twice running on the same land; they are usually followed by *samai* or horsegram. The advantage of rotation is also gained by the system of mixed crops with cotton or groundnut as the main crop. This practice is most common. As regards garden lands the inferior cereals, vegetables, chillies or some pulse, are raised in a system of rotation; root crops like sweet potatoes are rarely grown. Both in dry and garden lands inter-tillage is common. Catch crops are also frequently raised in the place of regular staple crops.

#### Methods of cultivation.

(a) *Renting lands.* Large scale cultivation has never been attempted in this locality, though there are 47 holdings possessing between 10 to 50 acres each. It is only 2 or 3 farmers among them who keep a labourer permanently. More than one pair of bullocks is very rarely seen with a farmer. The usual practice of a cultivator is to keep as much land as he can himself cultivate with his pair of bullocks and to rent out the rest. This seems to be the reason why no labour-saving machinery has ever been brought into this place. The chief method of renting lands is the system of *varam* by which the tenant bears all the expenses of cultivation with or without tax, and shares equally the produce with the land-lord, the whole of the straw being taken by the tenant. Slight variations in this system exist, when the landlord

undertakes some of the expenses as manure, or tax, for a larger share in the produce. The contract system by which the tenant agrees to pay a fixed amount (which is considerably less than half the produce in this locality) each year, himself enjoying the full produce and bearing all expenses, is rarely found. Farm servants are engaged as whole-time paid servants, or they get their food and clothing and a share of the produce, or simply a share in the produce.

(b) *Soils and cultivation methods.* The black soil requires a thorough soaking before it will raise a crop and thereafter needs no further rain; whereas the red does not retain moisture well and so wants frequent showers. Consequently on the black soils the sowing season may be deferred as late as October, when the land has received the heavy showers of the north-east rains, whereas on the red soils it must be begun in July or August, so that the crops may receive the benefit of all rains. Ploughing involves more labour in the black soil than in the red.

(c) *Wet cultivation.* Of the total cultivable area only 600 acres (16 per cent) are under wet cultivation. Paddy is the chief crop. Both transplanting and broadcasting are done. Often much time is wasted by putting off the preparation of the seedbeds and leaving the fields to soak before beginning to plough. A great deal of neglect is found, particularly in manuring. Fields at a distance from the village get practically no manure at all. Those nearer at hand are given village sweepings and farmyard manure, and sheep and goats are penned upon them once in 2 or 3 years. Only the fields next to the habitations are manured every year. After manuring, the land is flooded and the manure turned in. Then green manure is trodden in. Finally the surface of the field is levelled by *parambu*. The seedlings are then transplanted. Seed is usually soaked before being sown. The seedbed is sown thin and seedlings are planted out by twos or threes, but not in large bunches. Formerly, sometimes the young plants raised in a nursery were transplanted into a second nursery and afterwards retransplanted singly into the field. In this case the crops are good and the yield largest. Broadcasting is also done in two different ways. Here the expenses are light but the produce is not very remunerative. Fearing the failure of the rains the cultivators, of late, have more and more restricted themselves to broadcasting and stick to the 3 months' variety which suits this purpose best.

(d) *Garden lands.* The farmers having garden lands generally devote great care and attention to their cultivation. Water is available from the wells throughout the year and two or three crops can be raised. The outturn depends more on the cultivator's efforts. His main difficulties are the costliness of pumping water by the existing methods and the low output of the springs in hot weather. The chief

crops cultivated in the gardens are cereals other than paddy, and vegetables like chillies, brinjals and sweet potatoes.

(e) *Dry cultivation.* The method of cultivating dry crops seems unenterprising. First the stubble of the last crop is ploughed in. Then such manure as is available is spread, after which the land is ploughed 3 or 4 times with the usual wooden plough, which is somewhat bigger than that employed on wet-land. Lands away from the village are not manured but, now and again, left fallow to recuperate. As soon as sufficient rain has fallen, the seed is broadcast and the field again ploughed to cover the seed. Mixed crops are common. The pulses and castor are mixed and sown where groundnut, gingelly, cotton or one of the cereals is the main crop. The larger grains such as dhal, castor and beans, are dropped separately one by one in a furrow made by the plough and then. When the crop is about a foot high it is weeded by hand, a small hoe being used. Cholan and cumbu are first thinned with the plough. Neither process is carefully carried out and the fields are often choked with weeds.

#### Yields.

(a) *Wet lands.* The outturn of paddy, varies from 400 to 1000 Madras measures per acre in the different soils of the district. Almost all of the wet lands of this village are assessed at Rs. 5-10-0 or above per acre (only 2½ per cent. are assessed at Rs. 4-6-0) which shows their fertility is above average (see table III). The produce per acre therefore must be at least 630 Madras measures. In practice this is hardly reached except in small plots of half an acre or less in the better soils. In most of the rented lands it goes as low as 400 measures per acre and in owner-cultivated lands rarely above 600. This was not so 20 years back. Such high rates as 900 measures were, it is said, quite common, the highest limit attained being 1800 measures or more than double the 'grain value'.

(b) *Dry lands.* Cholan and cumbu, have been taken as the standard grains for dry lands, their outturn being 100 to 275 Madras measures per acre for the different soils of the district. These yields compared with those of wet lands are better. The reason is that dry cultivation is comparatively easy and there are no difficulties about irrigation, etc.

(c) *Garden lands.* No special rates are charged for lands converted into gardens and there is no standard available for purposes of comparison. When the same crops are grown in both garden and dry lands, the yield is naturally higher in the former on account of irrigation from wells. However, it is specially for such valuable crops as chillies, tobacco, onions, etc., that garden lands are prized and successful garden cultivation is still a rarity in the village.

**Agricultural implements.** The implements for tillage, cultivation and harvesting are the same as elsewhere and are obtained from Virudhunagar. Some are made by the local carpenters and blacksmiths and all others are mended or repaired locally. The wood of the Babul (*Acacia arabica*) tree is generally used for these implements. No special wood is bought from outside. There were 161 carts and 188 ploughs in 1920.

**Fencing.** The pan fields as a rule are always well fenced as the crop stands for three years and as the leaves are likely to be eaten away by stray sheep and cattle. Otherwise, with the exception of a few garden lands which are fenced with a line of thorny trees (*Pithecolobium dulce* Benth) or other bushes, no permanent fencing is found. Whenever necessary low mud walls were raised or thorny branches of the karuvel tree were fixed on the borders of pathways and nullahs easily accessible. Even this temporary fencing is not common at the present time. Considerable damage is done for want of fencing when second crops are raised in isolation.

**Storing.** After the grains are brought from the fields they are temporarily stocked in a corner to be dried in the sun on the roofs or house-fronts and winnowed later with the help of winds. Circular bins made of cumbu chaff called 'kulukkai' are generally used for storing small quantities. They are quite suited for the domestic requirements of a small family. Larger quantities are stored in overhead cellars. Every house possesses at least one such cellar. These are very dark, ill-ventilated and damp. Paddy and groundnuts often get spoiled by damp. Cotton is always kept in gunny bags in which rats and vermin do considerable havoc. Chillies are never accumulated in large quantities; they are disposed of at every collection. The pulses rarely require special storing arrangements. They are usually kept in covered earthen vessels, but small weevils develop in them and eat away the pulses if they are not periodically sun-dried.

**Prices.** Though prices have varied greatly since the time when the assessment was made, the standard food grains have never gone below the commutation rate. Cotton is not so paying as before, while the price of groundnut is so low that its cultivation is hardly worth the trouble. Chillies maintain good prices. The pulses and other vegetables vary in price within the usual narrow limits. Land in this village is usually selling at a higher price than its worth, on account of the Chettis competing to buy as much as possible. During the years that followed the war when agricultural produce was selling at high prices, wet lands were sold at Rs. 1500 and dry lands at Rs. 500 per acre. In the majority of cases the net income is slightly more than the assessment; often it is less. Incomes equalling the interest on the value of the land (capital) are very rare indeed. The tendency on the

part of the cultivators when high prices prevailed for agricultural produce was to increase the area of cultivation. The quality of cultivation never improved and no advance was gained in improved agricultural methods. On the other hand, neglect and deterioration are more rapid with low prices.

**Holdings.** The following table gives details of the holdings which are obviously far too high in a place where irrigation facilities are scanty, the rainfall so uncertain, and the soil not always the best. Most of these are made up of wet, garden or dry land, in the different soils. It is thus very rare that a holding is in one block. The bigger few under the last three items are not so fragmented.

**Table VI. Holdings. (Fasli) (1328).**

| Pattas paying.          | Number. |        | Total. | Extent. |        |
|-------------------------|---------|--------|--------|---------|--------|
|                         | Single. | Joint. |        | Acres.  | Cents. |
| 1. Rupee 1 and less     | 60      | 66     | 126    | 40      | 05     |
| 2. Between Rs. 10 and 1 | 482     | 235    | 717    | 1487    | 51     |
| 3. " 30 " 10            | 127     | 57     | 184    | 1216    | 28     |
| 4. " 50 " 30            | 25      | 9      | 34     | 427     | 04     |
| 5. " 100 " 50           | 4       | 4      | 8      | 243     | 11     |
| 6. " 250 " 100          | 2       | 3      | 5      | 203     | 37     |
| Total.                  | 700     | 374    | 1074   | 3677    | 36     |

Only 47 holdings (4 per cent.) are above 10 acres each (items 4, 5 and 6). Holdings of 2 to 8 acres form roughly 62 per cent. (items 2 'single' and 3), and their extent is more than half of the total cultivable area. Most of these happen to be dry land alone, in which the produce is precarious. To make out a living for 3 or 4 members under conditions like these is most trying and bordering on despair. About 34 per cent. of the holdings (items 1 and 2 'joint') are below 2 acres each and belong to the class of owner-labourers.

**Economic holding for the locality.** The daily wages per head in this locality is 4 Madras measures of paddy, i. e., one day's subsistence. On this basis the annual requirement for a family of 4 members is 5160 measures, i. e., roughly the produce from 8 acres of good land. Dry lands without wells work out to a larger extent, but where there is a well 5 or 6 acres is the limit. In case of mixed holdings, more than 8 acres in all is necessary. As regards working capacity of the people, if all the members of this family work in the field, they are generally able to do optimum cultivation in about 10 acres of dry land without a well, provided it is not too fragmented. If there is a well, or in case of wet lands, 7 or 8 acres is the maximum. Such holdings do not form even 15 per cent. of the total.

(To be continued)

## A NOTE ON PRECAUTIONS TO BE TAKEN IN THE CURING AND STORING OF TOBACCO.

BY P. GOPALARATNAM, L. Ag.

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Tobacco in its curing and storing stages is subject to being damaged by attacks of fungi and bacteria which if not controlled properly at the right time will result in serious loss to the producer as well as to the manufacturer. The diseases are peculiar in themselves and occur sporadically due to the negligence on the part of the curer and storer. The nature of the diseases and the possible remedial measures are enumerated below for the benefit of the producer and manufacturer of tobacco.

**White veins.** In hot places like Guntur, continuous spell of dry weather causes the appearance of white-veins in the barn. The white veins are due to the outer cells of tobacco leaf getting killed soon, by the rapid drying of the leaf. Such leaves allow the admission of air under the epidermis and appear to be devoid of the colouring matter (chlorophyll) in leaf. This condition reduces the value of the leaves for wrappers but seldom for any other purpose. The keeping of the air in the barn slightly humid in dry weather by sprinkling water on the floor may be tried as a preventive measure.

**Pole-burn.** This is also known as pole-sweat or house-burn. This is due to excess of humidity in the barn in prolonged warm weather and is first noted by the appearance of small dark spots near the base and mid-rib of the leaf. The spots rapidly increase in size and number, and in a short time become confluent. Within the course of 48 hours all the leaves in the curing barn may be affected and destroyed. As a result, the tobacco becomes dark in colour and thoroughly decayed. The decay is due to the presence of a bacterium that gains access to the leaf through wounds on the surface or through the openings made by fungus growths. A reduction of humidity and rise of temperature to 110° F. can put an end to its action. Hence this can be controlled by the judicious regulation of temperature and humidity of the room, with the aid of heating apparatus and ventilators.

**Saltpetre.** At times while curing and in the process of fermentation a saline efflorescence, caused by the presence in the leaf of large quantities of salts such as potassium, sodium, calcium, and magnesium tends to make the tobacco appear as if attacked by mould. The best way of overcoming the difficulty is to brush the surface of the leaf and spray on it a 4% solution of acetic acid. This removes the deposit.

**Moulds and Rots in cured tobacco.** The presence of moisture in the cured leaf at the time of storage favours the growth of rots and moulds. The storage room must be kept clean and warm.

In the case of black rot, the affected tobacco leaf has to be subjected to the forced sweating to kill the fungus and drive away the musty odour. There are special air tight rooms constructed and steam is let in it through a metal tubing with a big nozzle attached. Thus the tobacco is subjected to hot air and steam whereby the fungus as well as the spores are killed. The duration of heating depends on the nature of the attack and the quantity of the stuff handled. The tobacco treated for a long time deteriorates to a certain extent. There is a room of this type at Cheerala in the tobacco factory of Messrs. India Leaf Tobacco Development Coy. The trouble, though it may not appear to be serious, causes a good deal of loss in big godowns, if proper care is not taken at the outset.

## Research Notes.

### Male Sterility in Rice.

During the season of 1932-33, a sterile plant was spotted out in the seed multiplication block of the pure line G. E. B., 24, characterised by a protracted growing habit, with non-emergent panicles bearing spikelets which failed to open and contained considerably reduced and non-dehiscent anthers. The pollen when examined was all aborted, there being no normal grains. The plant, however, set a dozen seeds, which in the succeeding season gave rise to normal individuals with perfect pollen and good seed-setting. When the dozen plants were cultured the following year, segregation of normal and sterile plants was noted in the progenies, the original mutant type coming out as a simple recessive, as shown by the figures in the table.

|                                  | Normal | Male-sterile |                   |
|----------------------------------|--------|--------------|-------------------|
| Total in 10 segregating families | 838    | 287          |                   |
| Calculated 3:1                   | 844    | 281          | Dev 0.97<br>S. E. |

The sterile mutant is designated as 'Male-sterile' on an analogy with similar recessive mutants recorded in maize (Eyster 1921). These are easily distinguished in the field from the normals by their characteristic appearance there being no intermediate types. Each plant sets about 10-15 seeds, due to cross-fertilisation by fertile pollen from contiguous normal plants, which gave rise to heterozygous individuals resembling the normals.

Cytological examination of pollen meiosis carried out to ascertain the cause of sterility revealed no apparent irregularities at reduction division, but the spores degenerated following a fairly normal sporogenesis. It may be stated here that this mutant closely resembles another 'the asynaptic mutant' (Unpub) isolated in another strain where the sterility affects both the pollen and ovule and is the result of irregularities of chromosome behaviour at meiosis brought about by lack of pairing of chromosomes at meiosis.

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\* Eyster L. A. 1921. Heritable characters of maize VII, Male-Sterile—*Jour. Heredity* 12: 138-141.

## ABSTRACT.

Ammonium in the nutrition of higher green plants—Jose—H Pardo—*Quarterly Review of Biology*, Vol. 10 No. 1 pp. 1-31.

A detailed review of the salient features of the work so far done in the absorption and assimilation of nitrogen in the form of nitrate or ammonium in the nutrition of higher green plants is succinctly given in the above article with 106 references. This was gathered by the author in connection with a series of solution culture experiments carried out by him on  $\text{NH}_4$  assimilation by sugarcane. Though the review presented in the publication is representative of the technique and trend of investigation in this field of study, no definite and satisfactory conclusions could be reached at on the basis of the results reported. What could be gathered in a general way is this that: the  $\text{NO}_3$  ion is a suitable source of nitrogen for higher green plants in general but many forms have been found to thrive with  $\text{NH}_4$  ion as a sole nitrogen source while in some cases these two ions, when supplied separately, showed almost the same degree of effectiveness, in some other cases  $\text{NO}_3$  was superior to  $\text{NH}_4$  although the latter was nutritionally effective to a considerable extent. In a few cases  $\text{NH}_4$  was found to be definitely superior to  $\text{NO}_3$  and a good many tests indicated that  $\text{NH}_4\text{NO}_3$  was equal or superior to either of those two ions supplied separately.

This review presents generally the results of experiments conducted in solution cultures (including *sind* cultures to which solutions are added) as practical field tests which have been carried out in great numbers by many workers involving a larger group of unknown influences or conditions that can be considered only when physiological cultures are employed. Even in this field of work different experimenters have in many instances obtained very different results with the same kind of plant. It seems clear that such disagreement must be related to experimental influences or conditions that have not been adequately reckoned with. Amongst the number that may possibly be involved are mentioned as those due to (1) employment of varieties or strains of same species. (2) Preliminary treatment of seed and the developmental stages. (3) differences in the employment of criterion to judge growth and development. (4) Want of proper elimination of Concomitant factors position of the media as H. ion concentration (5) Alterations in the nutrient solutions and (6) Physical environment of experimental cultures. In section III the author has presented briefly the summary of experiments arranged with reference to plant families—amongst which gramineae occupies an important position because of their economic importance—It appears that all the gramineae tested were capable of deriving at least a portion of their new N. from  $\text{NH}_4$  as well as from  $\text{NO}_3$  but that the use of  $\text{NH}_4$  as the only source of N has sometimes apparently resulted in secondary conditions that were more or less injurious to the plants, notably high H-ion concentration of the medium. Different plant forms appear to differ in regard to their capacity to thrive with ( $\text{NH}_4$ ) as the only source of N and different varieties of the same species as well as different developmental phases of the same form have shown marked differences in this regard. Definite conclusions as to the relative capacities or nitrogen preferences of these different plant forms are not yet permissible but it may be said with certainty that rice has greatly surpassed the other gramineae tested with regard to its tolerances of such injurious or retarding influences as may have resulted from the employment of  $\text{NH}_4$  as the sole nitrogen source. Under the various conditions of the experiments that have been carried out rice has generally seemed to prefer ammonical N to nitrate N but it has grown better with  $\text{NH}_4\text{NO}_3$  than with  $\text{NH}_4$  alone as a source of N.

Maize and wheat appear to have grown about as well with  $\text{NH}_4$  as with  $\text{NO}_3$  under suitable conditions but different experimental conditions seem to have swung the apparent nitrogen preferences to one or other of these two sources. Sorghum appears to have preferred  $\text{NO}_3$  to  $\text{NH}_4$  although the latter gave fair growth in some tests and good growth resulted from the use of  $\text{NH}_4 \text{NO}_3$ . Sugarcane seems to have preferred  $\text{NO}_3$  to  $\text{NH}_4$  in early phases of development while  $\text{NH}_4$  or  $\text{NH}_4$  and  $\text{NO}_3$  together were superior to  $\text{NO}_3$  alone in more nearly mature phases. Barley has given good growth with  $\text{NH}_4 \text{NO}_3$  as double source of N. The use of this double source led in some tests to better growth than was given by either  $\text{NH}_4$  or  $\text{NO}_3$  alone, for rice, maize and the more and more advanced phases of sugarcane.

### PLACE OF ENTOMOLOGICAL COLLECTIONS IN ENTOMOLOGICAL RESEARCH

**Use in Research:** What is the value in scientific research of insect collections? The first evident purpose of a scientific collection is perhaps as a reference in order to secure positive identification of insects requiring study and this may account for the building up of reference collections at museums, experiment stations, colleges and in the hands of private collectors.

Of fundamental importance is the place the collection holds in taxonomic studies. In all such work it is vitally important to know what the earlier systematists had in hand when describing the species which were accumulated from the various regions of the earth and in many cases described in such brief and inadequate manner as to leave their identity from description in question. This is especially true of cases where later discovery of related forms has brought to light many species any one of which would meet the specifications given in the early description where perhaps only one species of a genus was known to the describer.

It is an easy matter to criticise and decry the unsatisfactory work of the entomologists of a century or even a half century past but if we stop to consider the difficulty of writing descriptions of a species when only one or a few of what becomes a large genus are known we can feel more respect and sympathy for the pioneer.

Much as it may be ignored or treated with contempt by some groups of biologists it must be recognized that correct identification of species is essential to accurate biologic work and many instances of gross inaccuracy could be cited to show that these have resulted from neglect to determine with certainty the specific standing of the organism treated.

We may even have instances where questions of enormous practical concern are involved where in cases of recognition of introduced pests from other faunal regions or the occurrence of destructive species in objects entering into commerce or affecting public health or sanitation.

Beyond this however a little study will disclose that the collection is a tool for the attack upon many biological problems. Comparisons of specimens from different regions or from different ecologic environments are necessary to the solution of many puzzling questions that arise to confront a student. It is hardly necessary to detail the essential nature of extensive collections in any faunistic study involving the classification of any group of insects. So much of the earth's surface has now been explored at least superficially that scarcely any region can be studied without recourse to previous publications or collections. The necessity is perhaps even greater when an

attempt is made to secure a comprehensive ecologic survey of any particular ecologic unit. There should be much larger demand and greater opportunities for trained taxonomists in charge of national and institutional collections.

We all recognize I believe that the problems awaiting solution in Entomology are of very various characters and there may be differences in appreciation of their relative urgency. We need not overlook the pressing nature of problems in other branches when we argue for a greater attention to those taxonomic problems which are really fundamental to permanent advances in our science and in such problems we must certainly recognize the insect collection as a most essential tool.

[T. V. R.]

### Gleanings.

**Fertilising Elements in Fowl Manure.** Fowl excreta is comparatively rich in manurial constituents, but naturally varies to some extent in actual composition.

Mr. E. Griffiths gives the following analysis of average fresh fowl manure:—

|                                            |     |     |               |
|--------------------------------------------|-----|-----|---------------|
| Nitrogen                                   | ... | ... | 1.6 per cent. |
| Phosphoric acid ( $\text{P}_2\text{O}_5$ ) | ... | ... | 1.7 " "       |
| Potash ( $\text{K}_2\text{O}$ )            | ... | ... | 0.8 " "       |
| Lime ( $\text{CaO}$ )                      | ... | ... | 2.8 " "       |

Fowl manure enriches the soil in all manurial elements, and is particularly rich in available nitrogen and phosphoric acid (*The Agricultural Gazette of New South Wales*, October 1, 1934).

**Dehydration of Bananas or Banana "Figs".** To produce the best quality banana "figs" the fruit should be just approaching the ripe stage, but should still be firm.

The skin is removed from the fruit, should this process prove somewhat difficult it can be facilitated by immersing the fruit in boiling water for a few seconds. The fruit is cut into halves lengthwise and placed on wooden trays. It is then submitted to sulphur fumes the concentration of sulphur fumes being from 1 to 1.6 per cent, which is equal to burning approximately  $1\frac{1}{4}$  to  $2\frac{1}{4}$  oz. of sulphur for each 100 cubic feet of air space contained in the sulphur hood or sulphur house. The length of exposure to the sulphur fumes will vary slightly but 15 minutes will usually prove satisfactory.

From the fumigating chamber fruit is dried either by placing it out in the sun or in dehydrators. Dehydration is much more satisfactory than sun drying. The fruit can be dried sufficiently in 18 hours in the dehydrator with temperatures ranging from 120 to 125 deg. Fahr. On removal from the dehydrator the fruit is placed in the boxes and allowed to sweat for one to two weeks. It is then packed in attractive  $\frac{1}{4}$  lb. and 1 lb. packets.

This product should prove of great value in outlying districts where it is difficult to obtain fresh bananas. The banana "fig" forms a delicious sweetmeat when crystallised.

The loss of weight in the manufacture of banana "figs" from fresh fruit is about 75 to 80 per cent., which means that it will take from 4 to 5 lb. of fresh fruit to manufacture 1 lb. of figs. (*The Agricultural Gazette of N. S. Wales*, April 1, 1935)

**Banana "Coffee".** The process followed in the manufacture of banana coffee is as follows:—

The skin is removed from the fruit. Should this prove somewhat difficult it can be facilitated by dipping the fruit in boiling water for a few seconds.

With stainless steel knives the fruit is quartered lengthwise and cut into pieces approximately 2 inches long. It is then placed on wooden trays, which are placed in the dehydrator for 9 hours at an approximate temperature of 120 degrees Fahr., and then the temperature is raised to 130 deg. Fahr., and the process is continued for another 9 hours.

At the end of the 18-hour period the fruit is ready for roasting, and this is carried out in an ordinary coffee roaster. Care must be exercised during roasting to see that the fruit does not stick to the sides of the machine.

Definite information cannot be given as to the exact temperatures and the time that the product will take to roast satisfactorily. These will vary, of course, with the condition of the fruit when received from the dehydrator, and also with the colour the manufacturer desires.

When the product is bone dry it is ground in an ordinary coffee mill. The loss of weight from the fresh stage to the ground product is about 80 per cent.

In many instances banana "coffee" is used pure, but other products have now been made by blending it with ordinary commercial coffee.

This method of using the "coffee" will vary according to individual taste, but the following procedure will give satisfactory results:—To make a pint of beverage, take 2 heaped teaspoons of the coffee and boil in a half-pint of water for 10 minutes. Then strain and to the liquid add half a pint of hot milk and sugar to taste.

Banana "coffee" is also being used as a flavour for chocolates. (*The Agricultural Gazette of New South Wales*, April 1, 1935).

**Efficient Rat Trap.** An effective rat trap can be made from a kerosene tin. Cut the top away, and have about 6 inches of water in the bottom. Float chaff on the surface of the water so that the rats do not see it, and on the chaff rest the bait—something rather strong such as a piece of old meat. Lean a plank against the side of the tin so that the rats can climb up to the top of the tin. One drowned rat does not prevent others from jumping in. It is possible to catch quite a number of rats in this way. (*Queensland Agricultural Journal*).

## Review.

**Lalgudi Sivagnanam Co-operative Society.** The 9th Annual Report of the Lalgudi Sivagnanam Co-operative Agricultural Society for the year 1933-34 records another year of usefulness. Improved methods of cultivation of paddy in wet-lands and of Ragi and Cotton in dry lands were demonstrated. The manufacture of white sugar with small centrifuges and of cream jaggery was on show in a member's holding at Peruvalavanallur. Sales of manures were effected to the tune of nearly a lakh of rupees. Green manure seeds and improved strains of paddy were distributed to members.

The Society has to be congratulated on the marketing programme of paddy of its members on a co-operative basis that has been inaugurated during the year. With the zeal and enthusiasm that the society has been evincing in all its activities and with the loyalty and co-operation of all its members, this new venture should succeed.

The Society has purchased during the year a building for Rs. 4750 from out of its building fund. That during the brief existence of 9 years, the society has put by Rs. 5060 towards the building fund, contributing to the reserve and common good funds at the same time, speaks highly of the management; and we wish the society success in all its endeavours.

**The Permanent Committee of the International Institute of Agriculture.** The Permanent Committee of the International Institute of Agriculture, assembled for the first time under the Presidency of Professor Baron Giacomo Acerbo, has now terminated its March meeting after holding six sessions. After the discussion of certain questions of finance and internal administration, the Committee proceeded to consider the question of the special studies to be undertaken by the Bureau in carrying out the resolutions adopted by the General Assembly at its reunion in October last, and adopted the recommendations of the Secretary General that special attention should be paid to cotton and to the international market for meat of all kinds.

In addition, the Committee unanimously accepted the recommendations of a special Commission, appointed to give effect to a resolution of the recent Assembly, arising out of a report presented by Mr. F. L. McDougall, Delegate of Australia, and referring to the scientific work of the Institution. This commission consisted of Sir John Russell, Director of the Rothamsted Experimental Station (England), Senator Strampolli, the Italian wheat geneticist and Professor Jonescu Sisesti, Director of the Agricultural Experiment Station of Bucarest, together with certain members of the Permanent Committee and of the Staff of the Institute. The report recommended that the Institute should concentrate its scientific work rather upon the practical and international side of the results of scientific developments than upon recording the progress of the more purely scientific aspects.

The Committee next approved the method proposed for the regular publication in convenient form of the collected measures notified by the Governments of the various countries, relating to prices, tariffs, premiums on exports and monopolies in so far as they relate to agriculture.

In dealing with the preparations now in force for collaboration between the Institute and the other great International Organizations, the Committee *inter alia*, approved the agenda proposed for the meeting of the Joint Agricultural and Advisory Committee (the liaison organ between the Rome Institute and the International Labour Office), to be held in Geneva on 28th May, and established the general lines of the co-operation of the Institute with the Economic Committee of the League of Nations in the matter of the sanitary inspection of the imports and exports of plants and of other vegetable products, a question referred by the Monetary and Economic Conference of London to the International Institute of Agriculture and to the Economic Committee of the League of Nations.

The Committee in addition signified its approval of the provisions made for collaboration between the International Institute of Agriculture and the International Federation of Olive Growers recently established in Rome. Definite instructions were also given regarding the future conduct of the Institute's statistical work, founded on the data supplied by Farm Accountancy offices.

It was further arranged that the date of 4th June 1935 should be fixed for the meeting in Rome of the International Diplomatic Conference for the standardization of the methods adopted for the analysis of wines intended for international trade, while the date of 15th October 1935 was arranged for the other proposed International Diplomatic Conference on the question of the standardization of the systems for the keeping and uses of cattle herdbooks. Lastly the Committee nominated its own representatives at the various Conferences, etc., for the consideration of questions relating to agriculture, which will be held during the current year.

*International Year-book of Agricultural Statistics 1933-1934.* This Year-book has been published recently by the International Institute of Agriculture, Rome

and provides an extensive, complete and exact summary of statistical information for agriculture of a quite unique kind. Every agricultural product reaching international markets is included, e. g., wheat, wool, cotton, tobacco, sugar, tea, oilseeds and many others. For the reference library, the economist, financier, merchant, manufacturer and farmer, these concise and exhaustive tables are of the highest value. Agricultural Engineers, implement makers and persons engaged in the fertilizer trade will also be particularly interested.

*Annuaire International De Legislation Agricole, Vol. XXIII, 1933.* This annual publication contains the most important legislative measures of the year, with, in addition, an analytical introduction. For the less important laws the title only is given, in the original language and in French. The Yearbook has two indexes, one a chronological index by countries, the other an alphabetical index by subjects. This Yearbook is of great interest to all who, as legislators or economists, are interested in agriculture, as well as to agricultural associations and persons engaged in the trade in agricultural products or in the allied industrial processes.

## News and Notes.

**College Day and Conference.** We are glad to announce that the 24th College Day and Conference will be held by the middle of August; the exact dates will be notified later. The Hon. Mr. C. A. Souter, C. S. I., I. C. S., first member, Board of Revenue has kindly consented to preside. We extend our invitations to all members of the Union, and our subscribers and well wishers to attend the College Day and Conference, to contribute papers on Agriculture and allied subjects for the conference and thus make the function a success. It is requested that those who contribute papers would kindly send in their papers with an abstract to the Union Secretary sufficiently early to facilitate their inclusion in the agenda.

**The Silver Jubilee,** was celebrated with great eclat at the College. The Research Institute was tastefully illuminated and there was a large monster procession with the pictures of their Majesties the King and Queen round the estate. The coolies of the Central Farm and the Millet Station provided rural dance and music. Poor feeding was done by Mr. M. Ratnavelu, Assistant Farm Manager, Central Farm, at the Central Farm premises.

We are glad to note that the following officers of the Madras Agricultural Department have been awarded the Silver Jubilee medal. Messrs 1. S. V. Ramamurthy, Director of Agriculture, 2. Rao Bahadur D. Ananda Rao, 3. R. C. Broadfoot, 4. K. Ramiah, 5. N. S. Kulandaiswami Pillai, 6. Sitarama Patrudu, 7. Jogi Raju, 8. P. Subrahmaniam, 9. K. Cherian Jacob and 10. C. S. Gangadara Iyer; also Rao Bahadurs T. S. Vankataraman and B. Viswanath of the Imperial Department of Agriculture.

**The University Examinations** which started last month came to a close by 2nd May and the following students have been declared successful:—

**First Examination:—** Anantanarayanan T.M., Chalamiah Sastry V., Dharmarajan K.D., Ganeshasundar Rao H., Gopalakrishna Kamath M., Hariharan S.V., Adishesayya H.A., Khadder Razak S., Krishna kumar B., Krishnada Sastry S., Kulandaisami S., Lakshmana Babu P., Lakshminarayana S., Mahadeva Iyer S., Parthasarathy A.V., Pitchumani A.V., Ragothama Reddi J., Rajagopalan D.V., Sattanadhan R.S., Sayeed P.K., Srinivasamurthy G., Tobias K.I., Venkayya N., Sundararaman S., Brahmayya G.V., and Lakshmana Rao.

**Second Examination:—** Albuquerque M., Annaswami S., Arunachalam T., Coloco J., Gitachari R., Ityachan C.T., Jayaraman R., Kannayan K., Kelukutty

Menon M., Krishnan R.H., Krishnanunni Nayar, Lingiah M.K., Parasuraman N.A., Ragavan K., Rajabaniya K., Rajaraman S., Ramandha Rao P., Ramanatha Rao H., Renganathachari M., Ali Hyder R., Sangameswara Sarma S., Shivasankar Rao G., Venkataramana G., Venkataramana Rao V.G., Murugesan Y., and Samuel Joshua.

**Final Examination:—** Arunachalam S., Balakrishna Nayar M., Bhujanga Rao C., Govinda Rao P., Kameswara Rao G., Kanakaraj Kasiviswanatham M., Kesavan C.P., Krishna Marar N.M., Kutti Mudali S., Lakshmanan K., Mariekolan-dai A., Narasinga Rao U., Narayana Pillai V., Ragava Rao M., Ramakrishnan T.S., Sadasiva Iyer V., Satyanarayanamurthy S., Srinivasan T., Sriraman K., Soundra-  
rajan R., Suryanarayanamurthy B. and Venkata Rao N.

**Old Regulations, Part II:—** Azimuddin A., Muthusami N., Radhakrishna Rao K., Sundaresan K.R., Vadamalai, Veerayya and Reddi Nayudu K.V.

We understand that a few more students have got through the Second Examination—New Regulations, with references in one or two subjects, and their list will be published next month. We wish the successful students all success in after life as well.

## Crop & Trade Reports.

**Cotton (Madras) — 1934-35. Fifth or Final Report.** The average of the areas under cotton in the Madras Presidency during the five years ending 1932-33 has represented 9 per cent. of the total area under cotton in India.

2. The area under cotton in the Madras Presidency in 1934-35 is estimated at 2,271,800 acres as against 2,095,800 acres for the corresponding period of last year and 2,135,100 acres according to the February forecast of the current year. The present estimate for the Presidency represents an increase of 4.5 per cent. over the finally recorded area of 2,174,738 acres in 1933-34. Last year's estimate fell short of the actuals by 3.6 per cent.

3. Picking of cotton is in progress and may be finished within a month.

4. A normal yield is expected in East Godavari, West Godavari, Kistna, South Arcot, Salem and Tanjore. A yield below normal is expected in the other districts. The yield is the lowest in Anantapur (37 per cent.)

The seasonal factor for the Presidency works out to 91 per cent. of the average for irrigated cotton and 81 per cent. for unirrigated cotton, the final figures according to the season and crop report of last year being 101 per cent. and 92 per cent. respectively. On this basis, the yield works out to 454,900 bales and 400 lb. lint as against 451,690 bales in the previous year, an increase of 0.7 per cent. and against an average yield of 466,430 bales. It is, however, too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests.

5. The estimated area and yield under the several varieties are given below:—

| Variety.           | Area.    |          | Corresponding yield. |          |
|--------------------|----------|----------|----------------------|----------|
|                    | 1934-35. | 1933-34. | 1934-35.             | 1933-34. |
|                    | Acs.     | Acs.     | Bales.               | Bales.   |
| (1)                | (2)      | (3)      | (4)                  | (5)      |
| Irrigated Cambodia | 258.8    | 205.8    | 147.7                | 126.7    |
| Dry Cambodia       | 238.1    | 140.9    | 48.0                 | 29.8     |
| Total Cambodia...  | 496.9    | 346.7    | 195.7                | 156.5    |

|                                    |         |         |       |       |
|------------------------------------|---------|---------|-------|-------|
| Karunganni in Coimbatore ...       | 125,0   | 135,3   | 25,7  | 31,4  |
| Uppam in the Central districts ... | 38,2    | 31,1    | 5,6   | 4,7   |
| Nadam and Bourbon ...              | 22,7    | 31,5    | 1,0   | 1,6   |
| Total, Salems...                   | 185,9   | 197,9   | 32,3  | 37,7  |
| Tinnevellies * ...                 | 575,2   | 527,9   | 123,5 | 123,9 |
| Northerns and Westerns ...         | 852,5   | 879,0   | 76,3  | 99,6  |
| Cocanadas ...                      | 149,2   | 130,8   | 25,6  | 22,5  |
| Others ...                         | 12,1    | 13,5    | 1,5   | 1,6   |
| Presidency ...                     | 2,271,8 | 2,095,8 | 454,9 | 441,8 |

\* Includes Uppam, Karunganni and mixed country cotton in the South.

6. The table below gives final information so far as it is available on the crop of 1933-34.

(Figures in hundreds of bales of 400 lb. of lint.)

| Particulars.                                                                   | South.                           |                 | Deccan.                       | Rest of the Presidency.     |                 | Total. |
|--------------------------------------------------------------------------------|----------------------------------|-----------------|-------------------------------|-----------------------------|-----------------|--------|
|                                                                                | Tinnevel-<br>lies and<br>Salems. | Cambodia.       | Northerns<br>and<br>westerns. | Cocanadas<br>and<br>others. |                 |        |
| (1)                                                                            | (2)                              | (3)             | (4)                           | (5)                         | (6)             |        |
| 1. Pressed at presses<br>plus loose cotton<br>received at mills in<br>1934-35. | Bales.<br>186,7                  | Bales.<br>242,2 | Bales.<br>137,8               | Bales.<br>32,8              | Bales.<br>599,5 |        |
| 2. Add estimate of<br>extra factory<br>consumption.                            | 6,0                              | Nil             | 6,0                           | 4,0                         | 16,0            |        |
| 3. Total crop of<br>1933-34.                                                   | 192,7                            | 242,2           | 143,8                         | 36,8                        | 615,5           |        |
| 4. Yield as estimated<br>in April 1934.                                        | 161,6                            | 156,5           | 99,6                          | 24,1                        | 441,8           |        |
| 5. Yield as estimated<br>in the season and<br>crop report.                     | 167,3                            | 150,4           | 111,4                         | 22,6                        | 451,7           |        |

Note (1) Item 1.—The entries mainly relate to the crop of 1933-34. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

(2) Item 2.—The figures are approximate.

(3) Figures of carry over of crop are not available nor are figures of arrivals and despatches of the different varieties available.

7. The wholesale price of cotton lint per imperial maund of 82.27 lb. as reported from important markets towards the close of March 1935 was Rs 19-2-0 for Cocanadas, Rs. 21-6-0 for red Northerns, Rs. 23-13-0 for white Northerns Rs. 18-13-0 for (early crop) Westerns, Rs. 28-8-0 for Cambodia, Rs. 26-14-0 for Coimbatore Karunganni, Rs. 25-10-0 for Tinnevelly Karunganni, Rs. 24-10-0 for Tinnevellies, and Rs. 24-15-0 for Nadam. When compared with the prices reported towards the close of January 1935, these prices reveal a rise of about 1 per cent. in the case of red Northerns and 9 per cent. in the case of white Northerns and a fall ranging from 2 to 18 per cent. in the case of other varieties.

Crop Gingelly (Madras)—1934-35—Fourth or Final Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1932-33 has represented 12 per cent. of the total area under gingelly in India.

2. The area sown with gingelly up to the 25th March 1935 is estimated at 657,300 acres. When compared with the area of 848,500 acres estimated for the corresponding period of last year, it reveals a decrease of about 22.5 per cent. This year's estimate also reveals a decrease of about 21.4 per cent. as compared with the finally recorded area of 836,145 acres last year. Last year's estimate was in excess of the actual area by about 1.5 per cent.

3. 194,700 acres have been reported as sown since the previous forecast report was issued in January, as against 240,500 acres during the same period last year. These late sowings were mainly on wet lands in the Circars, Cuddapah, South Arcot, Trichinopoly and the South where gingelly was raised as a second crop after paddy.

4. As compared with the actual area sown last year, there has been a decrease in area in all the districts except Guntur, Cuddapah, Nellore, Chingleput, Chittoor, Salem and South Kanara.

5. The yield has been below normal except in Kistna, Cuddapah, Ramnad and South Kanara where it has been normal. The yield is markedly low in Anantapur (20 per cent) and Bellary (60 per cent). The condition of the late sown crop is generally fair.

The seasonal factor for the Presidency works out to 84 per cent of the average as against 93 per cent according to the season and crop report of last year. On this basis, the yield is estimated at 75,200 tons as against 105,690 tons in the previous year and an average yield of 105,660 tons.

Statistics—Crop—Forecast—Groundnut. 1935—First Report. The area sown with the summer or irrigated crop of groundnut during the three months of January to March 1935, is estimated at 39,100 acres, as against 41,800 acres for the corresponding period of last year, a decrease of about 6.5 per cent.

2. The whole-sale price of groundnut per imperial maund of 82.27 lb. as reported from important market centres towards the close of March 1935 was Rs. 5-15-0 in Vizagapatam, Rs. 5-13-0 in Cuddalore, Rs. 5-12-0 in Vizia-Rs. 5-15-0 in Vizagapatam, Rs. 5-13-0 in Cuddalore, Rs. 5-12-0 in Vellore, Rs. 5-7-0 in Salem, Rs. 5-5-0 in Guntur, Rs. 5-4-0 in Vellore, Rs. 5-3-0 in Cuddapah, Rs. 5-1-0 in Nandyal and Rs. 4-14-0 in Adoni. When compared with the prices in the corresponding period of last year these prices reveal a rise of 144 per cent in Adoni, 138 per cent in Nandyal, 129 per cent in Vizia-Salem 127 per cent in Vellore, 124 per cent in Cuddapah, 119 per cent in Vizia-nagram, 113 per cent in Guntur, 98 per cent in Vizagapatam and 94 per cent in Cuddalore.

## Weather Review (APRIL 1935).

Summary of General Weather Conditions. Thunderstorm rain was general in the central parts of the country and in South East Madras for the first seven days of the month. Thereafter normal hot weather conditions prevailed.

A depression formed in the South East of the Bay on the 26th associated with an advance of the monsoon, and caused widespread rains in Burma, and disappeared with the withdrawal of the monsoon from the bay. It failed to affect the weather in the peninsula.

Rainfall was General over the Presidency and in excess in parts of Deccan, in the Central and Southern districts, and parts of Circars.

The chief falls reported were: Kodaikanal 4.7" (2nd), Pamban 3.2 (3rd), Coonoor 3.3" and Negapatam 3.1" (4th) and Palamkottah 2.7" (5th).

Temperature was generally below normal, but rose about the middle of the month and was in excess in the Deccan and along the North Coromandel Coast. The highest maximum reported was 110° at Nellore on the 29th.

## 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              | 1.0              | +0.2                  | 1.6                     | South            | Negapatam    | 4.5              | +3.9                  | 10.1                    |
|              | Berhampore*            | 1.7              | +0.9                  | 2.9                     |                  | Aduthurai*   | 0.1              | -0.9                  | 3.9                     |
|              | Calingapatam           | 0.8              | -0.1                  | 1.1                     |                  | Madura       | 2.4              | +0.4                  | 3.2                     |
|              | Vizagapatam            | 0.1              | -0.7                  | 0.1                     |                  | Pamban       | 6.4              | +4.7                  | 10.5                    |
|              | Anakapalli*            | 0.4              | -1.1                  | 0.4                     |                  | Koilpatti*   | 3.6              | +0.5                  | 4.4                     |
|              | Samalkota*             | 2.5              | +1.8                  | 2.5                     |                  | Palamkottah  | 4.8              | +2.3                  | 7.2                     |
|              | Maruteru*              | 0.2              | -0.3                  | 0.2                     | West Coast       | Trivandrum*  | 8.1              | +3.6                  | 11.5                    |
|              | Cocanada               | 1.1              | +0.5                  | 1.4                     |                  | Cochin       | 2.2              | -2.5                  | 2.5                     |
|              | Masulipatam            | 1.3              | +0.7                  | 1.5                     |                  | Calicut      | 1.1              | -2.2                  | 1.7                     |
|              | Guntur*                | 0.0              | 0.0                   | 0.0                     |                  | Pattambi*    | 2.5              | -0.9                  | 2.5                     |
| Ceded Dists. | Kurnool                | 0.9              | +0.3                  | 1.1                     |                  | Taliparamba* | 0.0              | 0.0                   | 0.0                     |
|              | Nandyal*               | 1.6              | +1.2                  | 1.6                     |                  | Kasargode*   | 3.4              | +0.7                  | 3.7                     |
|              | Hagari*                | 1.4              | +0.6                  | 1.6                     |                  | Nileshwar*   | 2.0              | +0.5                  | 2.0                     |
|              | Bellary                | 0.3              | +0.4                  | 0.5                     |                  | Mangalore    | 0.3              | -1.0                  | 0.3                     |
|              | Anantapur              | 1.3              | -0.3                  | 1.3                     | Mysore and Coorg | Chitaldrug   | 1.3              | +0.3                  | 1.7                     |
| Carnatic     | Cuddapah               | 0.2              | -0.3                  | 0.3                     |                  | Bangalore    | 1.2              | -0.1                  | 1.3                     |
|              | Nellore                | 0.0              | -0.4                  | 1.3                     |                  | Mysore       | 2.7              | +0.3                  | 3.1                     |
|              | Madras                 | 0.0              | -0.5                  | 0.6                     |                  | Mercara      | 2.6              | 0.0                   | 3.4                     |
|              | Palur*                 | 0.0              | 0.0                   | 0.0                     | Hills.           | Kodaikanal   | 10.0             | +5.7                  | 14.0                    |
| Central      | Palakuppam*            | 0.1              | -1.0                  | 3.4                     |                  | Coonoor      | 12.3             | +0.4                  | 15.8                    |
|              | Cuddalore              | 0.5              | -0.1                  | 3.4                     |                  | Ootacamund*  | 3.6              | +0.4                  | 4.1                     |
|              | Vellore                | 0.6              | -0.3                  | 2.1                     |                  | Nanjanaid*   | 4.8              | +1.5                  | 5.1                     |
|              | Hosur cattle farm*     | 0.0              | 0.0                   | 0.0                     |                  |              |                  |                       |                         |
|              | Salem                  | 2.0              | +0.2                  | 2.9                     |                  |              |                  |                       |                         |
| Carnatic     | Coimbatore             | 2.5              | +1.1                  | 3.0                     |                  |              |                  |                       |                         |
|              | Coimbatore Res. Inst.* | 3.1              | +0.9                  | 3.5                     |                  |              |                  |                       |                         |
|              | Trichinopoly           | 4.9              | +3.2                  | 5.8                     |                  |              |                  |                       |                         |

\*Meteorological Stations of the Agricultural Department.

Weather Report No. 435 of the Research Institute Observatory.

|                            |     |            |
|----------------------------|-----|------------|
| Absolute Maximum in shade  | ... | 99° F.     |
| Absolute Minimum in shade  | ... | 68.2° F.   |
| Mean Maximum in shade      | ... | 95.5° F.   |
| Departure from normal      | ... | 0.4° F.    |
| Mean minimum in shade      | ... | 72.7° F.   |
| Departure from normal      | ... | -0.2° F.   |
| Total Rainfall             | ... | 3.07"      |
| Departure from normal      | ... | +0.91"     |
| Heaviest fall in 24 hours  | ... | 1.17"      |
| Total number of rainy days | ... | 7          |
| Mean daily wind velocity   | ... | 2.3 m.p.h. |
| Mean humidity at 8 hours   | ... | 72 %.      |

## Departmental Notification

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|                                     |     |       |
|-------------------------------------|-----|-------|
| Departure from normal               | ... | +1.4% |
| Total hours of bright sunshine      | ... | 255.2 |
| Mean daily hours of bright sunshine | ... | 8.5   |

Summary:— Rainfall was above normal, heaviest fall in 24 hours being 1.2". Other climatic elements were about normal. Normal hot weather conditions prevailed.

P. V. R. & A. S.

## Departmental Notifications.

**Postings and Transfers.**— Mr. S. Varadarajulu Naidu, A. D. on leave to be A. D. Royadrug; Mr. P. S. Narayanasamy Iyer, permanent upper subordinate Agricultural Section and officiating assistant in Entomology to be temporary assistant in Entomology in the Madras Pempheres Scheme; Mr. Muhammad Basheer, temporary Assistant in Entomology in the Madras Pempheres Scheme on relief by No. 1 to officiate as assistant in Entomology, *vice* Mr. M. Subbiah Pillai on other duty; Mr. N. M. Bhukta to continue as A.A.D. Vizianagaram; and Mr. M. V. Kondala Rao, A. D. Vizagapatam to be A. D. Chodavaram and relieve Mr. M. Narasimham to join duty at Samalkota.

**Leave.**— Mr. V. K. Kunhunni Nambiar, F. M. Kasargod extension of l. a. p. on M. C. for 2 months from 25th April 1935; Mr. T. V. Srinivasachari, A. A. D., l. a. p. on M. C. for 2 months from 3—5—1935 in continuation of l. a. p. for 4 months granted already; Mr. T. S. Venkatarama Iyer, A. D. is granted leave on average pay for 2 months and 22 days from 24—4—35 preparatory to retirement; and Mr. M. Eggiassamy Iyer, A. D. Tindivanam is granted l. a. p. for 4 months from 24th April with permission to prefix the Easter holidays.



**UNIVERSITY OF MADRAS**  
**B. Sc. (Agriculture) Degree Examination, 1935.**

Time—3 hours for all papers.

**I. New Regulations—First Examination.**

**1. AGRICULTURE—60 Marks.**

Note: 1. *The answers to questions in A and B must be written in separate answer-books.*  
2. *Only three questions are to be answered in A and three in B.*

*All questions carry equal marks.*

**A**

1. What is meant by climate? How does it differ from weather? What factors modify the climate of a locality? Explain the differences in climate between Bellary and Berhampore.
2. What will be the effect of the failure of the South-west Monsoon on crops in general in the following districts, viz:—Malabar, Madura, Salem, Chingleput, and Vizagapatam?
3. Write short notes on—internal surface, surface tension, hygroscopic moisture, viscosity, laterite, regur, felspar, colloid, derivative rock and schist.
4. Draw a sketch of a cutting of a soil in formation in the vicinity of Coimbatore, indicating the various differences you would notice in it. Explain the causes that contribute to the formation of soil.

**B**

5. Sketch, name, and detail the functions of the essential parts of (a) a bullock-power sugar-cane mill, and (b) a modern Persian wheel.
6. Some soils tend to form into clods. What methods of cultivation would you adopt to lessen this tendency or to overcome it?
7. Explain the proper uses of the following implements.—(a) tooth harrow, (b) blade harrow, (c) junior hoe, (d) roller, and (e) double mould-board plough.
8. Compare the effects, on the soil, of tillage for swamp paddy with that for an irrigated dry crop like cholam.

**2. BOTANY—60 Marks.**

Note: 1. *The answers to questions in A and B must be written in separate answer-books.*  
2. *Only three questions are to be answered in A and three in B.*  
3. *Questions 3 and 7 are compulsory.*

*All questions carry equal marks.*

**A**

1. What is a bud? Describe in detail the different kinds of buds, giving examples.
2. Write a short account of the various modifications of the stem, with examples and sketches.
3. Give an account of the different systems of classification known to you, and mention the important characteristics of the families *Euphorbiaceae* and *Scitamineae*.
4. Describe, with sketches, the vascular bundles in the stem of a dicotyledon, explaining the functions of the various tissues in them.

**B**

5. Explain briefly how the mineral nutrients and water are absorbed and translocated in plants.

6. Compare and contrast *photosynthesis* and *respiration* in plants.
7. Draw a typical plant-cell and name its constituents. State what happens in each of the two types of cell-division.
8. Write short notes on:—karyokinesis, protoplasm, vegetative reproduction and sexual reproduction.

### 3. CHEMISTRY—60 Marks.

Note: 1. The answers to questions in A and B must be written in separate answer-books.  
2. Only three questions are to be answered in A and three in B.

All questions carry equal marks.

#### A

1. State briefly how you would establish the molecular weight of a pure organic compound.
2. Describe any two general methods for the preparation of aliphatic aldehydes and give their important reactions.
3. State what you understand by the terms—(a) open and closed chain compounds, (b) isomerism, (c) unsaturation, (d) homologue, and (e) compound radical. Give two examples of each.
4. Explain what is meant by primary, secondary, and tertiary alcohols, giving examples; and state how you would distinguish them.

#### B

5. Describe, with suitable details, the preparation of the following substances:—formic acid, glycerol, malonic acid, urea, and acetanilide.
6. Differentiate between an amine and an amide. Classify the amines and describe their formation. How are the different classes of amines distinguished from one another?
7. Define carbohydrates. Differentiate between an aldose and a ketose. Describe how a monosaccharose can be synthesized from, and how it can be degraded to, a simpler one.
8. Explain and elaborate the statement that 'the six hydrogen atoms of benzene possess equal values or are similarly situated within the molecule'.

### 4. ZOOLOGY—60 Marks.

Note: Only six questions are to be answered. Question 1 is compulsory.

All questions carry equal marks.

1. Ontogeny is in its main features a recapitulation of the phylogeny of an animal. Discuss this statement, with examples.
2. Explain briefly, with diagrams wherever possible, how locomotion is performed in the following animals:—*Amoeba*, *Ball animalcule*, jelly-fish, leech, sea-urchin, earthworm, snail, bee, fish, and bat.
3. Explain clearly, with examples, what you understand by the terms:—alternation of generations, homologous and analogous structures, animal skeleton, secondary sexual characters and metamerism.
4. Classify the following forms into their respective groups, and write a few lines on what you know of each of them:—pelican, *Opalina*, *Obelia*, eel, millipede, toad, kangaroo, liver fluke, flea, and oyster.
5. Discuss the position of the group *Insecta* in the animal kingdom, indicating briefly those features which are common to insects and their allies and those which differentiate insects from the latter.

6. Explain, with examples, the economic importance of the following groups:—round worms, Protozoa, Formicidae, Acarina, and Mollusca.
7. Describe briefly, with diagrams, the life-history of any arthropod you have studied.
8. Write short notes on:—Nephridia, ruminant, ovipositor, shark, and caterpillar.

### II. New Regulations—Second Examination.

#### 5. AGRICULTURAL ENGINEERING—60 Marks.

Note: 1. Only six questions are to be answered.  
2. Questions 1 and 8 are compulsory.

All questions carry equal marks.

1. A ryot has 50 acres of wet land under paddy and 50 acres of dry land under groundnuts. He desires to store his produce after harvest when prices are low, and sell it later when prices rise. Design a storage house for the purpose, giving dimensioned sketches and stating clearly the reasons for fixing the same.
2. Work out the cost of construction of the shed in Question 1. Give reasons for the kinds of materials used.
3. A farmer in Coimbatore district desires to replace his oil-engine, driving a centrifugal pump by an electric motor. The pulley on the pump is 7 inches in diameter and the driving pulley has a radius of 12 inches, the number of revolutions of the engine being 320 per minute. How would you proceed to do it? Give sketches and sizes of pulleys to be used for the new arrangement.
4. A borehole 150 feet deep is sunk on a farm to supply water for domestic purposes for a family of twelve and for the use of a herd of 50 cattle. The water-level in the borehole stands at 60 feet below ground. Describe, with sketches, a suitable pump for this borehole, and state the capacity of the pump.
5. Describe, with sketches, a lever safety valve used on a boiler. Can a boiler be worked without a safety valve? Give reasons for your answer.
6. Describe, with sketches an iron plough with which you are familiar, and state its uses. You are required to sharpen and harden a ploughshare. Explain in detail how you would do it.
7. Find the weight of a cylindrical tank, 4 feet in diameter inside and 6 feet deep, when full of water. Thickness of sides is  $\frac{3}{8}$  inch and of bottom  $\frac{1}{4}$  inch. The weight of rivets is equal to  $1\frac{1}{4}$  per cent. of the weight of the empty tank. Metal weighs 490 lb. to the cubic foot.
8. A ryot in Coimbatore district has 10 acres under sugarcane and eight of his neighbours have 5 acres each. It is proposed to have one cane-crushing mill to crush all the cane. Determine the capacity of the mill that you would install and arrive at a rough approximation of the capital cost required to crush all the cane and convert it into jaggery. Would you recommend a separate crushing mill for each ryot? Explain your answer, giving reasons.

#### 6. AGRICULTURAL ZOOLOGY—60 Marks.

Note: 1. Only six questions are to be answered.  
2. Question 1 is compulsory.

All questions carry equal marks.

1. A knowledge of the main facts in the life-history and habits of insects will be of very great help to the farmer in devising proper control measures against such insects. Justify this statement clearly, with suitable examples.
2. Write a brief account of *Parasitism*, with special reference to its existence among insects, pointing out its effect on the individual and its general economic importance.

3. Write what you know of the bionomics of the important insect pests of stored agricultural products in South India, and suggest practical remedies against such pests.

4. Classify the following forms into their respective families or groups, adding a few words on what you know of each of them:—*Phylloxera*, sawfly, bogworm, fig insect, silver fish, cochineal, eriworm, and cockroach.

5. (a) Name the insect which you consider to be the most serious pest of each of the following crops:—chillies, coconut, ragi, turmeric, and betel vine.

(b) With regard to each pest, give briefly, in tabular form, information under the following heads:—(i) the family to which the insect belongs; (ii) main features in its life-history; (iii) nature and extent of damage done to the crop; (iv) natural enemies and alternate food plants, if any; and (v) suitable control measures.

6. Write what you know of legislative measures for the control of insect pests, with special reference to South India.

7. What is apiculture? Explain clearly in what ways the modern artificial methods of apiculture are better than the old methods. What are the chief requisites for starting apiculture?

8. Write short notes on:—lac, galls, fruit-flies, insecticides, and protective adaptations among insects.

#### 7. ANIMAL HYGIENE—60 Marks

Note: 1. Only six questions are to be answered.

2. Questions 2 and 5 are compulsory.

1. Describe *haemorrhagic septicaemia* as regards aetiology, animals susceptible, mode of infection, and immunization. How would you differentiate it from anthrax and black-quarter?

2. Describe the sexual organs of the cow with the aid of a diagram. When does the oestrus occur, and what is the normal period of gestation in the cow and the sheep respectively?

3. Give the origin and uses of the following drugs, and specify the doses for cattle in the case of those used internally:—(a) *Oleum Arachis*, (b) tincture of iodine, (c) carron oil, and (d) catechu.

4. Write short notes on the symptoms and treatment of the following:—(a) pricked foot, (b) choking, (c) scaly leg in the fowl, and (d) liver rot in the sheep.

5. You are required to attend on a cow that is becoming debilitated in spite of liberal feeding. Detail the methods you would employ in diagnosing the actual cause of debility.

6. What is meant by active immunity? Describe the method you would adopt and the precautions you would take in immunizing imported cattle against rinderpest.

7. Describe the kidney of the ox, and compare it with that of the sheep. State the physical properties and composition of cows' urine.

8. What are the common ailments observed in the new-born calf? Outline your treatment briefly under each.

#### 8. AGRICULTURE, PLANT HUSBANDRY I—100 Marks.

Note: 1. Only five questions are to be answered.

2. Question 7 is compulsory.

1. What is meant by soil fertility? What are the factors that control it?

2. What is 'erosion'? When and how does it occur? What steps should the farmer take to prevent it? (19 marks.)

(19 marks.)

3. Name and describe two appliances for lifting water; considered improvements upon local methods. In what directions have improvements been effected? What is the cost of each appliance, and the benefit each gives to the ryot adopting it? (19 marks.)

4. What are the different methods of irrigating a crop? When will you adopt each method? What are their respective advantages and disadvantages? How does the duty of water vary under each method? What is the cost per acre under each? (19 marks.)

5. What are the relative advantages of green manuring and green-leaf manuring? What are their limitations? Under what circumstances would you recommend each? (19 marks.)

6. Name the most important oilseed crops of the Presidency. What is the approximate area under each, and in what districts are they most important? What are the improvements aimed at with regard to any three of them? (19 marks.)

7. What is market gardening? What are the possibilities and limitations for it in the Coimbatore district? How much area must a cultivator having five members possess to make the farm self-supporting? Prepare a cropping scheme for one year for the area. (24 marks.)

#### 9. AGRICULTURE, PLANT HUSBANDRY II—100 Marks.

(For Old Regulations—Part II also).

Note: 1. Only five questions are to be answered.

2. Question 1 is compulsory.

1. Name the most important fibre crop in this Presidency. Give details of method and cost of production under irrigated conditions. (24 marks.)

2. Describe a modern method of composting waste organic matter and converting it into valuable manure. Give the probable analysis of such manure. (19 marks.)

3. State briefly, with examples, how seed selection may facilitate (a) the interculture of the crop, (b) the harvesting operations, (c) the preparation of the produce for the market, and (d) its marketing. (19 marks.)

4. How are manures classified? What do you mean by 'unit value' and of what use is it? (19 marks.)

5. (a) Describe suitable methods of storing either cholam or red gram for seed purposes. (19 marks.)

(b) How are germination tests carried out and of what use are they?

6. Give the details of management for an acre of either mangoes or oranges, up to ten years old. (19 marks.)

7. Describe the method of making silage in a pit silo, and the effect or temperature on the quality of the final product. (19 marks.)

#### 10. AGRICULTURE I.

#### ECONOMICS AND FARM MANAGEMENT—100 Marks.

Note: (1) Only five questions are to be answered.

(2) Question 6 is compulsory.

1. What factors must you take into consideration in working out rations for dairy cows, calves and breeding bulls? Illustrate your answer from actual cases you are familiar with. (19 marks.)

2. Distinguish between hay, silage and straw. If you have a herd of twenty cows, which would you prefer and under what circumstances? What quantity must you have of some or all of them to maintain the herd for a year? (19 marks.)

3. What is the difference between whey, skim milk, and buttermilk? Under what circumstances will there be large surpluses of each? What steps will you take to dispose of them profitably? (19 marks)
4. (a) Draw a plan and elevation, with measurements, of a *hyra*, in a locality near Coimbatore, for a dairy herd consisting of twenty cows and 10 buffaloes.  
(b) What will be the returns of a farmer, if he (i) disposes of all milk as such, (ii) sells two-thirds as milk and one-third as butter, and (iii) sells three-fourths as milk and one-fourth as ghee? (19 marks)
5. A field on the College Farm is sown in June 1935 to a mixture of *Cajanus indicus* and *Italian Millet*. In 1936 this will be followed by cotton. Describe the various agricultural operations the field will receive from June 1935 to August 1936. What would be the cost of cultivation and profit per acre for each crop, taking the seasons to be normal? (19 marks)
6. Supposing that there are three stations in the vicinity of Coimbatore for the three important crops of paddy, cotton, and millets, each having an area of thirty acres, what is the equipment required for each station under the following heads:—cattle, labour, seed, fodder, and implements? (24 marks)
7. (a) What is a score card? Write down one for a cow producing 25 lb. of milk per day.  
(b) What are the differences between an Ongole and a Scindhi cow? Which is the better animal for the dairy and why? (19 marks)

#### 11. AGRICULTURE—ESSAY—50 Marks.

(Old Regulations—Part II only.)

Write an essay on one of the following:—

- Either, (a) Discuss whether, under present conditions, it is desirable or not to levy duty on foreign rice or paddy imported into South India.  
Or, (b) Discuss the relationships of the following in the marketing of agricultural produce:—quality of produce, transport, credit, and central markets

#### 12. AGRICULTURE II. ANIMAL HUSBANDRY—100 Marks.

(New Regulations only.)

Note: 1. Only five questions are to be answered.  
2. Question 1 is compulsory

1. Describe how you would rear and feed a Scindhi bull calf from date of birth to one and half years old, with costs. (24 marks.)
2. (a) Describe briefly one of the three imported breeds of poultry maintained on the Central Farm.  
(b) Give the feeding costs, egg, production, and probable profits of hens of this breed at maturity. (19 marks.)
3. Why is it necessary to analyse statistically the results of agricultural experiments? Describe one method of doing so. (19 marks.)
4. Describe briefly the part, if any, which the following play in cost of production of agricultural produce:—(a) rent of land and buildings, (b) insurance, (c) wages, (d) supply and demand, and (e) transportation to marketing centre. (19 marks.)
5. In a herd of Coimbatore country cattle (not Kangayams), describe the means you would adopt to improve and fix the type, without the introduction of outside breeds.
6. Discuss the organization of a fifty-acre farm on a co-operative basis versus a capitalistic basis, in regard to (a) capital, (b) labour and (c) disposal of produce.
7. Lay out an experiment for determining the relative manurial values of ground-nut cake, sulphate of ammonia, and nitrate of soda on ragi. Show how you would interpret the results. (19 marks.)

#### 13. AGRICULTURAL BOTANY—100 Marks.

Note: Only six questions are to be answered. Questions 2 and 6 are compulsory.

1. Write an account of the special adaptations seen in aquatic plants. Illustrate your answer. (15 marks)
2. Give a detailed botanical description of *Nicotiana Tabacum* with drawings and mention half a dozen plants of economic importance allied to it, giving their distribution in South India. (20 marks)
3. Classify the fibre plants grown in India, noting their families, and explaining how fibre is obtained in each plant and from what part of it. (15 marks)
4. Describe fully, with sketches, the fruit of a mango, of a cashew-nut, and of an apple, explaining the chief differences between them. (15 marks)
5. Give an account of parasites among flowering plants which are destructive to crops, and state what measures you would adopt to prevent their occurrence. (15 marks)
6. What is pruning? Of what importance is it to fruit trees, and what points should be determined before beginning the operation? (20 marks)
7. Give an account of 'testing' seeds for their vitality and germinating capacity. How is it useful to the farmer? What are the factors which affect germination? (15 marks)
8. Describe the arrangement that exists in 'angiosperms' to facilitate passage of gases. (15 marks)

#### 14. AGRICULTURAL BOTANY II—100 Marks.

Note: Only six questions are to be answered. Question 6 is compulsory.

1. Mention an important fungus disease of any of the three crops i.e. paddy, cholam, and sugar-cane. Give the life-history of the fungus and the measures to combat the disease. (16 marks.)
2. Mention the distinguishing characteristics of—Phycomycetes, Ascomycetes, and Basidiomycetes. (16 marks.)
3. Compare and contrast the modes of reproduction in Algae and Ferns. (16 marks.)
4. What are the significant characteristics distinguishing the Bryophyta from the Thallophyta? (16 marks.)
5. What are the salient features of the various theories on the 'origin of species'? (16 marks.)
6. Taking two important annual crops of your district, one self-fertilized and the other cross-fertilized, chalk out a ten-year programme for breeding the improved types. (20 marks.)
7. Write short notes on:—pure line, linkage, segregation, and recombination. (16 marks.)
8. Explain, with examples, the importance of the method of back-crossing  $F_1$  generation, with the 'pure recessive' parent. (16 marks.)

#### 15. AGRICULTURAL CHEMISTRY. I—100 Marks.

Note: Only six questions are to be answered. Question 1 is compulsory.

1. Describe any experiment that you have performed to study the percolation and rise of water through a sandy soil and a clayey soil, and state clearly the observations made and the inferences drawn therefrom. (20 marks.)
2. What are the principles on which the mechanical analysis of a soil is based? Describe any one method of carrying out such analysis. (16 marks.)

3. What do you understand by 'base exchange' in soils? Explain the formation of alkaline soils in terms of base exchange reactions. (16 marks.)
4. Make up a manure mixture of concentrated manures to give the following amounts of nitrogen, phosphoric acid, and potash:—30 lb. of Nitrogen, of which 15 lb. should be organic and 15 lb. inorganic nitrogen; 45 lb. of phosphoric acid, of which 15 lb. should be water-soluble; and 30 lb. of potash. (16 marks.)
5. Describe the significance of carbon-nitrogen ratio with reference to the biological decomposition of organic matter in the soil. (16 marks.)
6. Describe fully how you would estimate the percentage of total nitrogen in a mixture made up of eighty parts of bone-meal, eighteen parts of sulphate of ammonia, and two parts of nitrate soda. (16 marks.)
7. Mention the more important physical and chemical characteristics of laterite soils, red soils, black cotton soil and swamp-paddy soils. (16 marks.)
8. Describe briefly the ways in which fixation of nitrogen occurs in soils and the agencies responsible for it. (16 marks.)

#### 16. AGRICULTURAL CHEMISTRY—PAPER II—100 Marks.

Note: Only six questions are to be answered. Question 3 is compulsory.

1. Write short notes on:—auximones, hormones, and vitamins. (16)
2. Explain the changes that take place during the malting of barley or cholam, with special reference to conditions that influence the reactions. (16)
3. Discuss the formation of sugars, starch, fats, and proteins in plants. (20)
4. Describe a process of making white sugar direct from cane juice, and explain the changes that take place during manufacture. (16)
5. Write short notes on:—hay equivalent, starch equivalent, maintenance ration, digestive coefficient, and nutritive ratio (16)
6. Explain the general principles on which the valuation of fodders and feeding stuffs is based. (16)
7. Discuss the factors that influence yield of milk in cows, its butter-fat content, and the quality of butter in it. (16)
8. Describe how adulteration of milk may be practised and how it can be detected in the laboratory. (16)

### ADDITIONS TO THE LIBRARY DURING APRIL 1935

#### A. Books.

1. Analysis of Manurial Experiments in India—3 volumes. Vaidyanathan, M. (1934).
2. Field Studies in Ecology Brocher, R. (1934).
3. Embryology and Genetics. Morgan, T. H. (1934).
4. Filterable Viruses. Fairbrother, R. W. (1934).
5. A Book about the Bee Mace, H.
6. The Natural Organic Tannins. Nierenstein, M. (1934).
7. Civil Engineering Hand Book. Urquhart, L. C. (1934).
8. The Endless Quest: 3 000 years of Sciences. Westaway, F. W. (1934).

#### B. Reports.

1. Report on the Administration of the Department of Agriculture, United Provinces of Agra and Oudh for the year ending 30th June 1934.
2. Report on the Season and Crops of the North-west Frontier Province for the year 1933-34.
3. Season and Crop Report of Burma for the year ending the 30th June, 1934.
4. Kenya Colony and Protectorate Department of Agriculture Annual Report, 1933.
5. Annual Report of the Department of Agriculture, Sierra Leone for the year 1933.
6. Annual Report of the Department of Agriculture, Colony of Seychelles for the year 1933.
7. New York Agri. Experiment Station. Fifty-third Annual Report for the Fiscal year ended June 30, 1934.
8. Forty-fourth Annual Report Fiscal Year Ending June 30, 1933 of the Agri. Expt. Station of the Alabama Polytechnic Institute, Auburn.
9. Iowa Agri. Expt. Station Report on Agricultural Research for the Year Ending June 30, 1934.
10. Dominion of Canada Agricultural Department Report of the Dominion Agrostologist for the Years 1930 to 1933 inclusive.
11. Dominion of Canada Agri. Department Report of the Dominion Cerealists on Cereal work on Dominion Experimental Farms and Stations for the Years 1930-1933, inclusive.
12. Annual Report of the Department of Agriculture of the Province of Ontario, 1933.
13. Ontario Agri. Department, Sixty-fourth Annual Report of the Entomological Society of Ontario, 1933.

#### C. Bulletins, Memoirs etc.

14. Host Plant Index of Indo-ceylonese Coccidae. Imp. Conn. of Agri. Res. Misc. Bull. No. 4
15. A Note on Pine-apple. U. P. of Agra. & Oudh Agri. Dept. Bull. No. 9.
16. Green Peas. 17. Mushroom-Growing. England Min. of Agri. & Fish. Bull. Nos. 81, 34.
18. Soil Erosion. 19. Organic Manures, with Special reference to Composts. Kenya Agri. Dep. Bull. Nos. 1, 9.
20. Lessons in Elementary Book-keeping for Co-operative Workers. Gold Coast Agri. Dept. Bull. 29.
21. The Amount of Vitamin A Potency Required by Hens for Egg Production.
22. Growing Cotton Under Irrigation in the Wichita Valley of Texas.
23. The Vitamin A Requirements of Dairy Cows. Texas Agri. Exp. Stn. Bull. Nos. 493, 494, 495.
24. Plants Poisonous to Livestock. Wyoming Agri. Exp. Stn. Bull. 200.
25. Some Factors which Influence the Fruiting Habit of Henderson's Bush Lima Bean. Ohio Agri. Exp. Stn. Bull. 535.
26. Groundwater Part I. Fundamental Principles Governing its Physical Control. Utah Agri. Exp. Stn. Bull. 252.
27. Effect of Frequent Cutting and Nitrate Fertilization on the Growth Behavior and Relative Composition of Pasture Grasses. Florida Agri. Exp. Stn. Bull. 269.
28. Growth and Development with Special Reference to Domestic Animals XXXIV. Basal Metabolism Endogenous Nitrogen, Creatinine and Neutral Sulphur Excretions as Functions of Body Weight.
29. The Structure of the Cow's Udder.
30. Pregnancy Disease in Sheep. Missouri Agri. Exp. Stn. Res. Bull. Nos. 220, 344, 345.
31. Random Notes on Fruit Tree Root-stocks and Plant Propagation.
32. Zinc Oxide as a Seed and Soil Treatment for Damping-off. New York

*Agri. Exp. Stn. Bull. Nos. 649, 650.* 33. Physiological and Chemical Changes in Carrots During Growth and Storage. 34. A Physiological Study of Dormancy in Tilia Seed. *Cornell Agri. Exp. Stn. Mem.* 161, 169.

**D. Circulars, Leaflets etc.**

35. The House-sparrow. 36. Making Silage Without Buildings. *Eng. Min. of Agri. & Fish. Leaf. Nos. 169, 243.* 37. Field Practices Affecting the Control of Cotton Root Knot in Arizona. 38. The Rusts of Cereal Crops. *U. S. Agri. Dep. Cir. Nos. 337, 341.* 39. Starting the Orchard. *Missouri Agri. Exp. Stn. Cir. 181.* 40. The Production of Spring Vegetables in the Lower Rio Grande Valley. *Texas Agri. Exp. Stn. Cir. 72.* 41. Durable Whitewashes. *Florida Agri. Exp. Stn. Press Bull. 468.*

**List of New Periodicals added to the Library during April 1935.**

1. The Rice, Sugar and Coffee Journal. 2. Plant Science Literature. 3. Stylaps. 4. Plant Physiology. 5. Scientific Horticulture. 6. Annual Statement of Seaborne Trade of British India. 7. Quarterly Review of Biology.

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