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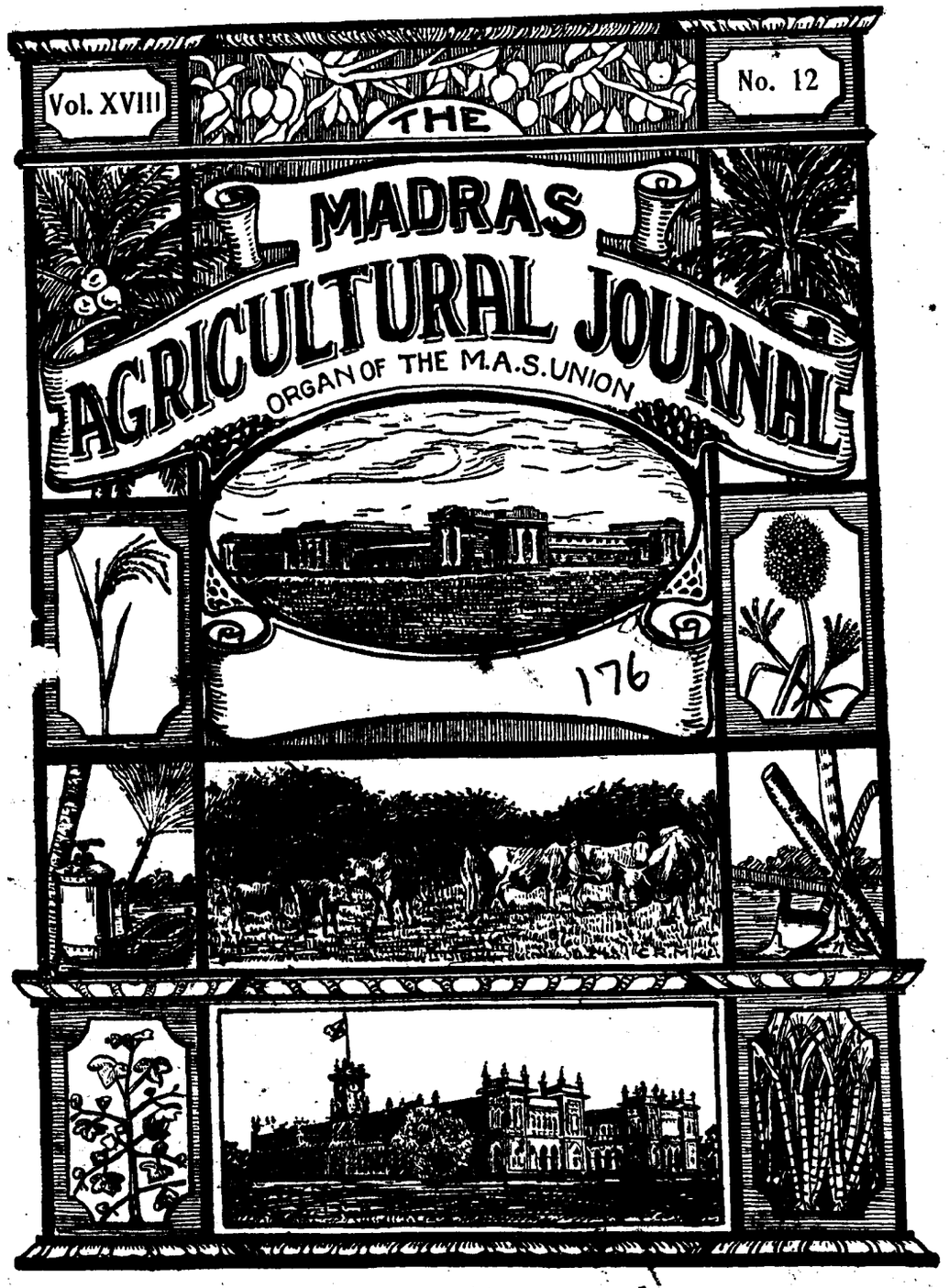




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SIR C. V. RAMAN, KT., M.A., D.Sc., F.R.S.

## NOBLE SENTIMENTS OF THE NOBEL LAUREATE

*Sir C. V. Raman, in the course of a reply to a congratulatory address at Bangalore, said:—*

Honours and degrees are mere vanities; there is a higher distinction for a scientific man, which he looks forward to and that distinction is not easy of achievement, that is to be able to believe that you have really done your best and that there is nothing more. I have not yet reached that state of mind.

There is nothing more fatal to a scientific career than to believe that he has the highest distinction of which he is capable. . . . There is one judge, one supreme judge, whose verdict is more valuable than that of any Society or Academy and that is the verdict of Time. It is the verdict of Time that will speak of a man's worth.


Farming will never be a success unless the farmer had more voice in the disposal of his produce—P. Morrel.

# The Madras Agricultural Journal

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

Vol. XVIII] DECEMBER 1930 [No. 12


## POLYEMBRYONY IN *ELEUSINE CORACANA*, Gaertn, (*Ragi*)[1]


By G. N. RANGASWAMI AYYANGAR, B.A.
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AND N. KRISHNASWAMI, B.Sc.
*Assistant to the Millets Specialist.*


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In the year 1929 in the course of a number of seed germinations of *Ragi*, odd instances occurred in which, two seedlings were found to arise from the same seed. The usual type was with two plumules and two radicles. Very rarely, two plumules in one coleoptile with a single radicle, or a single plumule with two radicles were met with. These seedlings with two plumules and radicles occurred in Family No. E. C. 663 in which out of 13 plants, 5 gave rise to these twins as follows:—

| | | | | | |
|---|---|---|---|---|---|
| Plant | I. | 1 | seedling in | 4,170 | germinated. |
| ,, | II. | 2 | ,, | 5,660 | ,, |
| ,, | III. | 4 | ,, | 5,940 | ,, |
| ,, | IV. | 5 | ,, | 11,140 | ,, |
| ,, | V. | 8 | ,, | 8,830 | ,, |

Subsequently 44 other pure lines were germinated and five of these, viz., E. C. 24, E. C. 103, E. C. 354, E. C. 363, and E. C. 593 gave each, one double seedling out of about 3,000 seeds germinated in each. It is curious that all these families belong to the Coimbatore area.

Six double seedlings from E. C. 663 were examined under the microscope and revealed the independent origin of each of these seedlings directly from the seed. One of these is figured in illustration 1. A later

[1] A paper read at a meeting of the Association of Economic Biologists, Agricultural College and Research Institute, Coimbatore on November 5, 1930.

sage of the growth showing the two plumules with the two radicles, all attached to the seed is shown in illustration 2. It will be noticed that one of these two seedlings is more vigorous than the other. This was the case in every one of these twins. In further growth in association, this difference in vigour is maintained (vide illustration 3). When twenty days old the seedlings were parted and potted separately and they are growing well, the weaker one having pulled up and appearing practically indistinguishable from the more vigorous one. It may be noted that the parted seedlings were absolutely individualistic showing no traces of earlier union. It is proposed to gather their seeds and pursue the occurrence of this phenomenon in their progeny.

Concurrently with this macroscopic experience, microscopic examination of a number of Ragi grains in the early stages of their development showed out one particular grain in which two embryos were found (vide illustration 4). These embryos are enlarged and their absolute doubleness will be apparent from illustration 5.

Eliminating instances of false or pseudo-polyembryony, true polyembryony is a comparatively exceptional occurrence in the flowering plants, and rare in cereals. In 1920 Hansen (1) records their occurrence in wheat, oats, and rye. In one strain of rye he noticed as many as 7 per cent of double germs. Komuro (1922) mentions the occurrence in Rice (2). Rodrigo (1925) found rare cases in the Philippine rices (3). In 1928 Jones (4) mentions an instance of this as a result of an artificial cross in Rice.

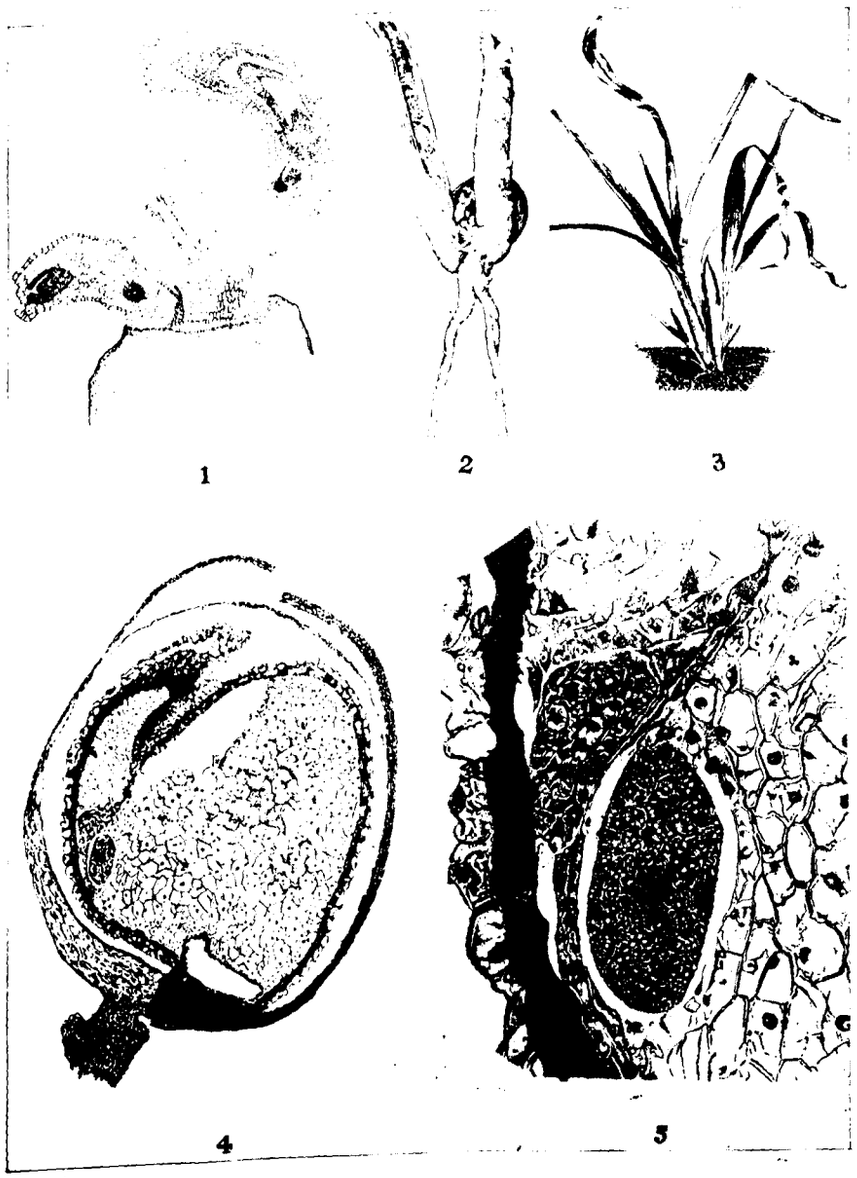
In other flowering plants the appearance of true polyembryony is not so rare. There are records of its occurrence in *Xanthoxylum* (5), *Citrus* (6), Mango (7), Soybeans (8), *Eugenia* (9), *Alnus* (10), *Erythronium* (6), and coconut (11).

It is difficult from the very nature of the material to determine the manner of the origin of the embryo from the anatomy of the seed. But examination of various other kinds show that this polyembryony may arise in one or other of the following ways :—(1) From the cells of the nucellus, (2) from the cells of the integument, (3) from the normal occurrence of two eggs, (4) from synergids, (5) from antipodal cells, (6) from endosperm cells, (7) from the suspensor. The projected intensive study in the pursuit of this phenomenon may reveal the nature of its origin in Ragi.

The question of the causes of the origin of this polyembryony is much discussed, many of the authorities attributing its occurrence to hybridity (Ernst, 12). Others put it to a weakening of sexuality (Strasburger, 13), a relic of some older condition now disappearing (Chauveaud, 14) or the early stages in the development of something new (Ganong, 15).

The development of a single embryo in preference to many seems to be the logical and natural outcome of the developmental tendencies manifest in the plant kingdom. To quote Bower " In the more specialized heterosporous forms and particularly in the seed plants with their more refined methods, individual precision supersedes mere numbers; and reduction of the propagative system has been its usual concomitant " (16).

Thus the presence of a single embryo is the progressed condition and the occurrence of polyembryony seems to be reminiscent of the similar and more cosmopolitan phenomenon in the gymnosperms—a view that accords with Chauveaud (14).




POLYEMBRYONY IN *ELEUSINE COROCANA* (RAGI)

The plant is more or less plastic and it is the inherent tendency of a plant, under certain circumstances to take, in a manner of speaking, a retrospective view, and give us the phenomenon called ' atavism '.

Hybridity may be said to have a causal connexion in this sense, that by the disturbing influence it introduces, it alters the normal tenor of the plant's life and calls out glimpses of ancestral features.

The last word has not been said on the subject and it still remains an unsolved biological problem. The view outlined above is here presented in the hope that if not acceptable, it is at least debatable.

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# SOME ASPECTS OF THE CONTROL OF BLAST DISEASE OF PADDY

By K. M. THOMAS, B. A.

*Assistant to the Government Mycologist.*

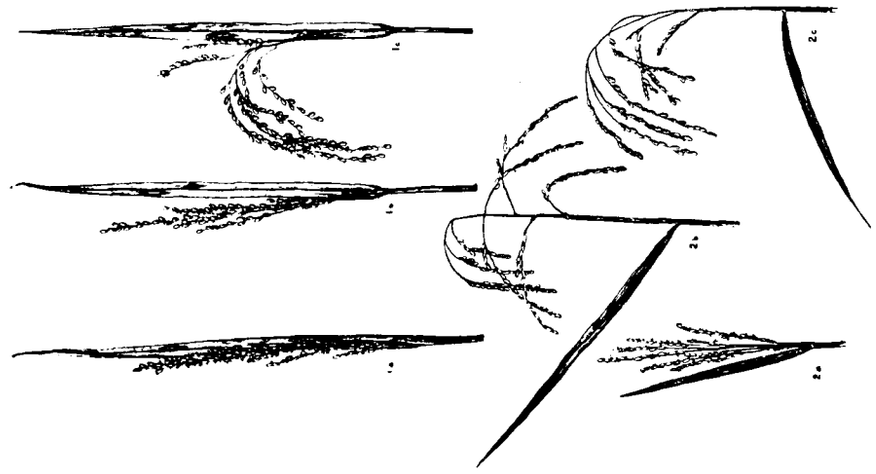
*Introductory.*—The 'blast' of paddy is known in almost all the rice-growing countries of the world. It has been recorded from Italy, Russia, China, Japan, United States of America and India. In India, it has been known to occur in Bengal, Behar and several districts of Madras. It is the most important disease of the Paddy crop in South India and in bad years has been reported to cause losses up to seventy per cent of the yield. Rice being the staple food of the South Indian, paddy ranks first in importance among cultivated crops and the area under paddy in Madras runs to about 11½ million acres. The control of a disease of such destructive possibilities is therefore of profound importance from an economic view point.

*The cause of the disease.*—The disease is caused by a fungus (*Piricularia oryzae*, Cav.) which attacks almost every portion of the plant, viz., the leaves, leaf-sheaths, nodes, the neck of the ear, the branches of the panicle, the glumes and rarely the internodes. The disease generally makes its first appearance on the leaves in the form of tiny brown spots which develop into oval or elongated lesions provided with a narrow brown marginal ring and a grey centre (Plate I, Fig. 1) on these spots minute hyaline three-celled pear-shaped spores (conidia) are borne in profusion. Two or more adjacent spots may coalesce to form irregular patches of dead tissue which in large numbers cause the withering of leaves (Plate III,) and in extreme cases the complete death of the plant. On the culm the attack is conspicuous on the nodes, the neck and branches of the ear which are killed and turned black, often breaking the stalk at the point of attack (Plate I, Figs. 4, 5, 6 and 7). If the attack takes place at the time of the emergence of the ear, the head fails to emerge, and the crowded flowers take the infection and entirely fail to develop (Plate I, Fig. 3). When the neck of the ear is attacked before the grains pass the milk stage, the whole earhead is starved by the cessation in the ascent of sap and the glumes are chaffed in consequence. Individual branches of the panicle so attacked are killed and the flowers borne on them fail to develop (Plate I, Fig. 2).

*History of the disease.*—Though Cavara recorded and described the disease in Italy as early as 1897, our knowledge of the disease has till recent years remained very meagre. The existence of the disease in South India was first recorded in 1918 when a serious outbreak in the Tanjore Delta brought it to the notice of the Madras Mycologist. The investigation of the disease was immediately taken up at Coimbatore and Dr. McRae[1]

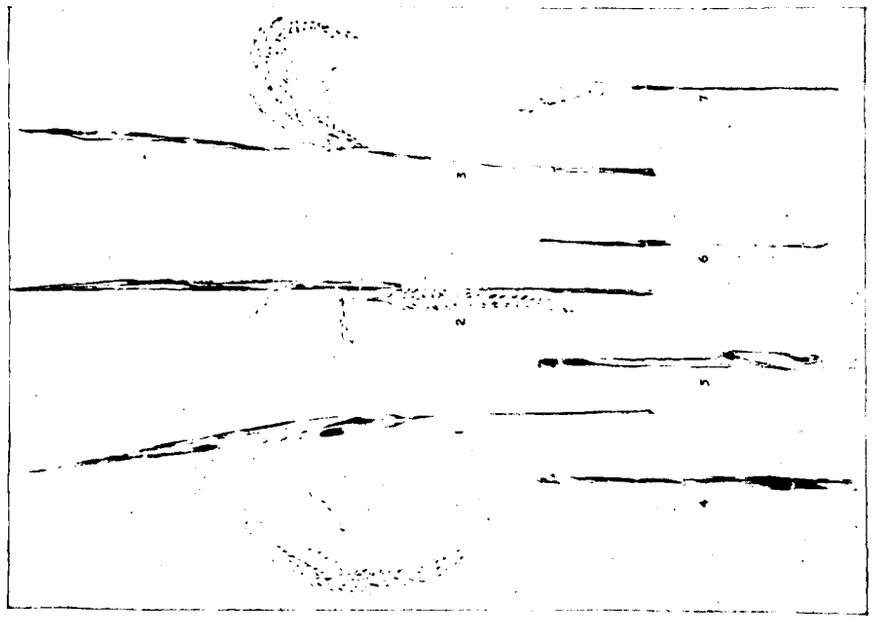
[1] McRae, W., *Jour. Madras Agric. Stud. Union*, vol. vi, pp. 115-120 and *Agricul. Jour. India*, vol. xiv, pp. 65-70.

Plate II



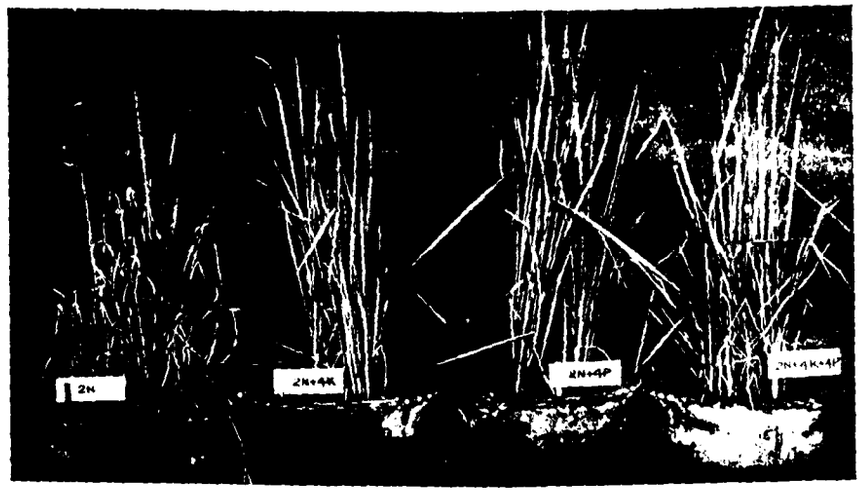
*Above.*—A variety susceptible to blast showing broad and erect 'flag', short emergence and close panicle (3 stages).
*Below.*—A resistant variety showing reclining 'flag', long emergence and spreading panicle.

Plate I



The effect of the 'blast disease' on paddy. 1. Leaf showing spots and blackening of 'neck'. 2. A branch of the panicle broken at the point of attack. 3. The disease preventing emergence of the ear. 4, 5, 6. Attacked nodes. 7. An attacked neck.


1. The effect of varying doses of Nitrogen on a susceptible variety (*Karuppu sambai*) infected by Piricularia.




2 The inhibitory effect of Potash and Phosphate in the presence of Nitrogen.


3. The effects of Potash and Phosphates are not felt when a heavy dose of nitrogen is applied.



made exhaustive studies on the symptoms of the disease and the morphological characters and parasitism of different strains of *Piricularia* isolated from a wide range of hosts, viz., Paddy, *Ragi* (Eleusine coracana), *Tenai* (Setaria italica), Wheat (Triticum vulgare), *Panicum repens* and *Digitaria sanguinalis*. About the same time Nishikado[1] in Japan made independent studies of some strains of the fungus collected in Japan. This paper does not attempt to review the work of these pioneers of Piricularia research or to recapitulate their observations, but is merely an effort to record what is really a sequel to Dr. McRae's valuable work on the subject.

*Methods of propagation and distribution.*—As far as our present knowledge goes, the fungus is propagated through its spores and mycelial threads. In a dry condition the spores of the fungus have been observed at Coimbatore to remain viable up to a period of seven months—a period sufficiently long to bridge the gulf between two successive paddy crops. Nishikado has recorded that the spores are known to live up to a period of eight months in Japan. The straw and stubbles of an infected crop have been observed to harbour the mycelium of the fungus and under favourable conditions of moisture are capable of producing new crops of spores. It is therefore evident that the fungus is capable of tiding over the off season and it is difficult of complete destruction once it has made its appearance in a field of paddy. Experience at Coimbatore goes to show that the disease recurs year after year in a previously infected field provided a variety of paddy susceptible to the disease is raised in it.

The fungus is spread from plant to plant through the agency of wind and rain. Infected straw and chaff are responsible for the dispersal of the fungus to much greater distances while infected grain distributed through human agency may carry it across all natural barriers.

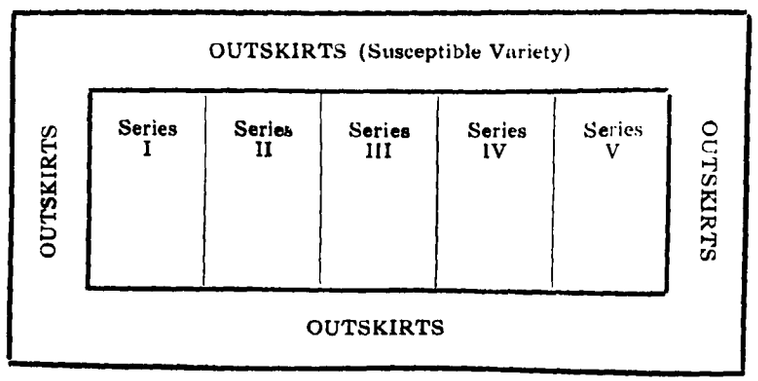
*Limitations in the control of the disease.*—Under South Indian conditions, the outbreak of *Piricularia* is closely linked with the weather prevailing during the paddy season. The sporadic nature of the outbreak and the rapidity of the spread of the disease do not admit of the usual measures of preventive and curative treatment feasible with ordinary crop diseases. Once the disease gets a foothold on the crop, it spreads like wild fire over extensive stretches of paddy fields, so that the problem of controlling the disease has baffled the best efforts of the plant pathologist.

*Study of varietal differences in resistance to the disease.*—In the light of the above observations, the chief avenue open to the pathologist is the exploitation of the possibilities of *indirect* methods of disease control. A casual survey of paddy crops in different tracts showed that while some varieties were bad victims to the disease, other varieties grown in the vicinity of infected fields and under apparently identical conditions did not suffer to the same extent, while some totally escaped the attack. But such observations were of limited value for immediate practical application so that

[1] Nishikado, Y. *Studies on the Rice blast disease, Berichte des Ohara Inst., Japan*, 1917, Band. I, Heft 2, pp. 171–218.

an attempt was made at Coimbatore to gauge in a scientific manner the relative resistance of several varieties of paddy to the disease, with a view to put the knowledge so acquired into practical application.

*Lay out of the Experiment.*—Sixteen varieties of paddy (types) grown at the Paddy Breeding Station, Coimbatore, were selected, special attention having been paid to include those which showed a wide range of variation in their duration and morphological characters. In order to grow these varieties under identical conditions of soil, climate, manuring, irrigation, exposure to spore-bombardment, etc., a rectangular block 120 feet by 60 feet was marked out in a plot in the Central Farm wetlands. Seedlings were raised in specially prepared strips and healthy single seedlings of each variety were planted in this block in equidistant rows running east to west, each row representing a variety. The distance between rows was one foot and the distance between plants in a row six inches. The series was replicated five times as in the adjoining plan. The outskirts of this rectangular block were planted 20 feet deep on all sides with *Poombalai* a variety in which the disease recurred every year. To make sure of the infection of the outskirts, pure cultures of the fungus were multiplied by inoculating the fungus on sterilized stalks and ears of paddy and the outskirts were sprayed before sunset with a spore suspension in distilled water at an opportune season when a spell of wet weather marked by cloudy days and drizzling rain prevailed during the month of September.




PLAN OF VARIETAL TRIALS

*Method of observation.*—In due course, the fungus spread rapidly through the outskirts and by the end of October the varieties were subject to a regular spore bombardment from the outskirts. It was noticed that there was considerable variation among the varieties in the number and size of spots on the leaves and the number of tillers affected per plant. Infection of the vegetative portions did not by any means give a correct indication of the loss to the crop as the latter almost entirely depended on the infection of the 'neck' and the nodes of the culm. A more correct method of estimating the loss was devised which consisted in the careful examination of the nodes, neck and panicles of every tiller and striking the percentage of infected tillers per each row of plants. The task was, no doubt, laborious



but the time and labour expended on it were amply rewarded. The following table summarizes the results of the experiment :—

TABLE I.—*Piricularia Experiments*, 1925-6. *Varietal Series.*

| No. | Variety | Duration (from sowing to flowering) in days | Percentage of infection |
|---|---|---|---|
| 1 | *Safeda* | 100 | Nil. |
| 2 | *Elanikadan* | 98 | 0·5 |
| 3 | E. B. 24 | 111 | 0·1 |
| 4 | P. S. 67 | 109 | .14 |
| 5 | Co 1 | 120 | 0·5 |
| 6 | P. S. 65 | 125 | 2·0 |
| 7 | E. B. 301 | 126 | 2·9 |
| 8 | Co 2 | 128 | 23·1 |
| 9 | Co 3 | 132 | 24·1 |
| 10 | *Kattai Sambalai* | 153 | 73·0 |
| 11 | *Sadathilai* | 153 | 75·3 |
| 12 | Adt 1 | 152 | 73·1 |
| 13 | Adt 2 | 151 | 78·2 |
| 14 | *Korangu Samba* | 153 | 73·5 |
| 15 | *Nellore Samba* | 155 | 13·0 |
| 16 | *Sadai Samba* | 147 | 24·2 |

It is seen from the above table that, within certain limits, the early maturing varieties show a relatively lower percentage of infection. It stands to reason that spore-infection increases in geometrical progression and since the early varieties come into flower at a period when the spores are comparatively less numerous, the spore bombardment is less intense. But the fact cannot be ignored that there is a wide range of variation among some varieties which are approximately of equal duration and which one should attribute to their inherent variation in disease resistance or special adaptation for disease avoidance.

The success of the above experiment in proving the existence of differences in varietal susceptibility to the disease, encouraged further trials on similar lines. With the experience gathered, the lay out of the experiment was slightly modified in subsequent years. The short duration

varieties were discarded in favour of long duration ones and departmental strains evolved from pure line selections replaced the types originally tried. *Korangu Samba* which was one of the most susceptible varieties replaced *Poombalai* for bulk planting in the outskirts and every varietal row was alternated with a row of *Korangu Samba*. The need for spraying spore suspensions on the growing crop was obviated by the use of the same piece of land for future experiments and the use of a highly susceptible variety like *Korangu Samba* in the outskirts and alternate rows. On the basis of grain development in the infected tillers, they were classified as 'lightly infected' and 'heavily infected.' The results of these trials were in general conformity with previous results as the following table shows:—

TABLE II.—*Piricularia Experiments*, 1928-9. *Varietal Series*

| No. | Variety | Duration (from sowing to flowering) in days | Total number of plants | Total number of tillers | No. of infected tillers | Percentage | No. of heavily infected tillers | Percentage |
|---|---|---|---|---|---|---|---|---|
| 1 | E. B. 24 ... | 105 | 160 | 1816 | 33 | 1·8 | Nil. | Nil. |
| 2 | Co 1 ... | 108 | 160 | 1735 | 85 | 5·4 | Nil. | Nil. |
| 3 | Co 2 ... | 120 | 160 | 1991 | 832 | 41·6 | 569 | 28·5 |
| 4 | Co 5 ... | 122 | 160 | 2056 | 1508 | 73·3 | 1042 | 50·6 |
| 5 | Co 7 ... | 122 | 160 | 1914 | 908 | 47·4 | 393 | 15·1 |
| 6 | Co 3 ... | 126 | 160 | 1680 | 1395 | 83·0 | 652 | 38·7 |
| 7 | Co 6 ... | 132 | 160 | 1720 | 831 | 48·3 | 227 | 13·2 |
| 8 | Adt 2 .. | 143 | 160 | 1126 | 977 | 86·7 | 438 | 38·8 |
| 9 | Adt 1 ... | 146 | 160 | 1794 | 1490 | 83·0 | 550 | 30·6 |
| 10 | Adt 5 ... | 148 | 160 | 1821 | 1380 | 75·7 | 408 | 22·4 |
| 11 | A. E. B. 3 ... | 151 | 160 | 1438 | 1438 | 100·0 | 1165 | 81·0 |
| 12 | Co 4 ... | 152 | 160 | 1807 | 29 | 1·6 | Nil. | Nil. |

*Note.*—'Infected' denotes the presence of infection on the leaf, node, neck, panicle or individual grains.

'Heavily infected' denotes the condition in which the disease interferes (directly or indirectly) with the development of grain affecting the yield seriously.

***Morphological characters in relation to the disease.***—It is common knowledge that Paddy exhibits varietal differences in morphological characters, viz., size of leaf, inclination of the 'shot-blade', spread of panicle, size of



grain, etc. Detailed observations on the incidence of the disease in the experimental plots suggested the existence of some relationship between morphological characters and the incidence of the disease. In the vast majority of infected tillers the loss to the crop was due to the infection of the lowest node of the panicle popularly known as the 'neck' of the earhead, for the simple reason that an attack of the neck involves the cessation of sap flow to the whole earhead (Plate I, Fig. 6). The preponderance of neck attack over other forms is attributable to two reasons. Firstly, the grooved nature of the internode immediately above the 'neck' which facilitates the conduction of spore-laden droplets of rain or dew down the ear and secondly, the existence of a fringe of short hairs borne at the telescopic ring of the node which functions as a convenient resting place and incubation ground for the spores deposited on it. It is therefore obvious that, at least to some extent, factors which aid the supply of a regular crop of spores to this vulnerable spot determine the capacity for infection. The chief factors to be considered under morphological characters are:—

(i) ***Size and inclination of the shot-blade.***—Other conditions being equal, the larger the area of the leaf surface, the greater are the chances of air-borne spores lodging on the shot-blade or 'flag' and producing disease spots. Again, the inclination of the 'flag' to the horizon is a variable factor among paddy varieties. In some varieties like *Korangu Samba* the 'flag' stands vertical throughout the life of the plant while varieties like E. B. 24, Co 1 and E. B. 301 bend their flags soon after the emergence of the ear so that they stand almost horizontally (Plate II). An infected flag which stands erect is a constant menace to the ear it subtends, because the former functions in a three-fold capacity, (*a*) a nursery for the fungus which supplies an abundant and regular supply of spores; (*b*) a channel for conducting the spores in drops of rain or dew to the base of the leaf-blade where they are collected by the ligular hairs and brought in contact with the panicle; and (*c*) a convenient dissemination ground advantageously situated by virtue of its altitude to command a wide area for spore dispersal through the agency of wind or through rain drops which spurt from it. (Plate II.)

(ii) ***Emergence of the ear.***—The length of the flower stalk between the base of the shot-blade and the neck is again a varying quantity among different varieties. In E. B. 24 and Co 1 the emergence is 6—12 c.m. with the result that the spikelets are borne correspondingly higher than the 'flag'. In varieties like Co 2 and Co 3 the emergence in flower stage is hardly 1 to 2 c. m. Extreme cases are observed in some varieties like *Korangu Samba* where the emergence at flower stage is a negative quantity, the neck remaining within the sheath and the lowest spikelets caught up within the sheath. The neck being the most vulnerable point in the earhead it stands to reason that varieties with a short or negative emergence have greater chances of ear-infection by the spores washed down the erect flag.

(iii) ***Spread of panicle.***—A panicle which possesses long branchlets has a tendency to spread out soon after the emergence of the ear from its sheath. Naturally enough, such spreading panicles permit free play of sun and air through them so that their chances of spore infection are distinctly less than those of a crowded earhead.

The following table summarises the relationship between the morphological characters discussed above and the incidence of the disease.

TABLE III.—*Relationship between morphological characters and incidence of disease.*

| No. | Variety. | Incidence of disease (per cent) | Area of flag. | | Area of penultimate leaf. | | Inclination of the flag in degrees. | | Emergence of the ear. | | Nature of panicle. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Length c. m. | Breadth c. m. | Length c. m. | Breadth c. m. | Flower stage. | Ripe stage. | Flower stage. | Ripe stage. | |
| 1 | E. B. 24 ... | 0·1 | 29·3 | 1·07 | 39·0 | 0·83 | 17·1 | 94·5 | 7·0 | 7·1 | Spreading. |
| 2 | Co 1 ... | 0·5 | 33·8 | 1·01 | 41·4 | 0·80 | 6·5 | 78·0 | 6·0 | 6·6 | do. |
| 3 | E.B. 301 ... | 2·9 | 32·3 | 1·82 | 48·3 | 1·68 | 73·0 | 93·5 | 2·1 | 4·3 | Medium. |
| 4 | Co 2 ... | 23·1 | 41·7 | 1·54 | 60·6 | 1·05 | 8·0 | 37·0 | 0·7 | 2·0 | do. |
| 5 | Co 3 ... | 24·1 | 37·0 | 1·39 | 57·5 | 1·05 | 4·5 | 30·5 | 1·3 | 8·2 | do. |
| 6 | *Sadai samba* ... | 24·2 | 34·9 | 1·19 | 46·5 | 1·00 | 15·5 | 52·0 | 3·5 | 7·1 | do. |
| 7 | Adt 2 ... | 78·2 | 35·5 | 1·17 | 50·7 | 0·97 | 11·5 | 15·0 | -0·4 | 5·5 | do. |
| 8 | Adt 1 ... | 73·1 | 34·5 | 1·31 | 45·1 | 1·05 | 9·5 | 19·0 | -0·6 | 6·3 | do. |
| 9 | *Korangu samba.* | 73·5 | 33·4 | 1·36 | 50·8 | 1·06 | 5·5 | 3·0 | -2·75 | 4·0 | Close. |
| 10 | *Nellore samba* ... | 13·0 | 34·4 | 1·39 | 49·2 | 1·24 | 6·0 | 12·5 | -1·2 | 1·0 | Medium. |

It is found that those varieties which possess a combination of the desirable qualities, viz., a reclining shotblade, a long emergence and a spreading panicle are the most resistant ones while those which combine the opposite qualities are easy to victims to the disease.

*Susceptibility in relation to environment.*—Apart from the inherent varietal variation in susceptibility, it is often observed that one and the same variety (raised from pure seed) behaves, to a certain extent, differently under different conditions of soil, manuring and irrigation. Portions of a field which show a rank vegetative growth suffer from the attack more than other portions. Patches in a field where manure heaps were dumped, portions immediately behind the inlets of irrigation channels and low-lying corners of fields are instances where heavy infection is found associated with heavy vegetative growth. Even the most resistant varieties have at times been known to suffer from the disease in such extraordinary situations. As a specific instance, it may be mentioned that a crop of E. B. 24—an almost immune variety—was grown in Field No. 59 of the Central Farm irrigated with the sullage water of the residential colony. The result was an extraordinary rank vegetative growth of the crop which suffered from an attack of *Piricularia* in a degree never observed in this strain before or since.

*The effect of vegetative growth.*—An observation was conducted in 1926 which showed the effect of heavy vegetative growth on the disease. In the varietal trials conducted during that year the rows of plants were cut in the middle by a bund. The eastern portion was at a lower level than the



western, with the result that during a period of water scarcity, the former enjoyed better irrigation than the latter and there was a correspondingly better vegetative growth in it. At the time of harvest the plants in both halves were individually examined and separate records were kept for the two halves. The results are summarized in the table below :—

TABLE IV.—*Incidence of Piricularia attack in relation to vegetative growth.*

| No. | Variety | Average height of plant in inches | | Average number of tillers | | Percentage of ear and node infection | |
|---|---|---|---|---|---|---|---|
| | | Low level | High level | Low level | High level | Low level | High level |
| 1 | Co 2 ... ... | 52·8 | 45·6 | 24·3 | 12·5 | 34·9 | 11·5 |
| 2 | Co 3 ... ... | 57·6 | 48·8 | 23·0 | 10·6 | 34·8 | 14·9 |
| 3 | *Kattai sambalai* ... | 52·8 | 46·4 | 18·0 | 10·9 | 83·9 | 67·1 |
| 4 | *Sadathilai* ... ... | 52·0 | 49·6 | 17·9 | 13·3 | 85·8 | 60·8 |
| 5 | Adt 1 ... ... | 55·2 | 47·2 | 18·2 | 9·9 | 87·0 | 56·1 |
| 6 | Adt 2 ... ... | 54·4 | 49·6 | 13·0 | 12·5 | 88·6 | 70·2 |
| 7 | *Korangu samba* ... | 56·8 | 48·0 | 15·7 | 11·6 | 73·2 | 73·8 |
| 8 | *Nellore samba* ... ... | 54·4 | 49·6 | 13·2 | 12·0 | 18·9 | 8·1 |
| 9 | *Sadai samba* ... ... | 56·8 | 52·8 | 17·0 | 15·3 | 34·5 | 13·7 |

The figures in the above table show that, other conditions being equal, one and the same variety produces marked differences in susceptibility brought about by differences in environment. Whether this difference is due entirely to the difference in vegetative growth is a point yet to be determined. It clearly proves that there are factors other than climatic conditions and the inherent disease resisting quality of a plant that determine the extent to which a paddy crop is susceptible to disease.

*The effect of manures on the disease.*—The observations recorded in the foregoing para suggested the lay out of an experiment to test the effect of different doses of nitrogen, potash, phosphoric acid and their combinations on the disease. Carefully controlled pot-cultures of a moderately susceptible variety were raised in specially prepared soil to which known quantities of the manurial ingredients were added in the form of ammonium sulphate, potassium sulphate and super-phosphate. The experiments have shown that nitrogen induces susceptibility to the disease, and in the event of favourable weather, the plants which received very heavy doses were killed outright by the fungus. In the presence of nitrogen, potash and phosphoric acid have exhibited a slight inhibitory effect on the disease, but it was evident that the higher the inherent natural resistance of the variety, the better it withstands the disease even under the influence of nitrogen. Since the tillering of a paddy plant is largely dependent on the available nitrogen supply and the yield proportionate, within certain limits, to its tilling, it is impossible to ignore nitrogenous ingredients in a scheme of paddy manuring. It is therefore a safer course to grow varieties high enough in the resistance cadre than to depend on manurial applications calculated to inhibit the disease in a highly susceptible variety.

*Limitations in the adoption of blast-resistant varieties.*—The choice of paddy varieties for different tracts of the presidency depends on several factors, e.g., the duration of the crop, the suitability of the soil, yield, colour and size of grain, milling qualities, cooking qualities, etc. Each tract has a partiality for its old varieties and as such what is suitable for one tract happens to be unsuitable for another. For instance the Tanjore ryot has a partiality for the *Sirumany* (Adt 1 and Adt 2) and *Korangu samba* types of grains but all these varieties are highly susceptible to 'blast.' Resistant varieties like E. B. 24, Co 1 and Co 4 though greatly appreciated in some tracts cannot find general favour with the Tanjore ryot. It is therefore necessary either to discover for him a resistant variety which satisfies his exacting demands or to infuse into his favourites the disease-resistant blood from others. The latter course falls legitimately within the province of the Plant Breeder.

*Acknowledgments.*—The writer has great pleasure to acknowledge his indebtedness to M.R.Ry. S. Sundararaman Avl., M.A., Government Mycologist, Coimbatore, for guidance and to Mr. P. S. Surinarayana Ayyar, Sub-Assistant in Mycology, for ungrudging help rendered during the course of the above investigations.

## Summary

1. 'Blast' is the most important disease of paddy (rice) in Madras and of great economic importance in the presidency. The cause of the disease and the methods of spread are outlined.

2. Not being amenable to direct treatment, an attempt was made to study the degree of resistance in several varieties of paddy. The plan of the experiment and the method of recording results are briefly described.

3. The varieties tried exhibited a wide range of variation in disease resistance. The incidence of disease was within certain limits, found associated with morphological characters, viz., size and inclination of the shot-blade, emergence of the ear and spread of the panicle. These factors are discussed.

4. In one and the same variety, differences in environment produced remarkable differences in disease incidence. Greater vegetative growth was found to favour greater susceptibility.

5. The effects of different manurial ingredients are briefly described.

6. The possible lines of utilizing the knowledge on blast-resistance are foreshadowed.

# STUDIES IN THE COST OF PRODUCTION OF CROPS— (DRY PADDY IN SOUTH KANARA)

By H. MUDDANNA SHETTY
*Student B. Sc., III.*

*Crop :*—Paddy.

*Area :*—1½ acres.

*Locality :*—Hejmadi, Mangalore Taluk.

The owner of the land cultivated this plot under his own management with the help of hired labour. The crop was completely rain-fed and hence there was no necessity for any irrigation.

The seeds were soaked in water for 12 hours and kept moist for another 12 hours and then sown in dry nursery. The seeds were sown at the end of May and the seedlings were transplanted in the main field by the end of June. The field was manured well with river silt and cattle manure. The crop was left to itself without any after-cultivation and then it was harvested at the beginning of October.

The variety is called *goodu bolliari* locally and is popular among the ryots of that locality. It gives a fairly high proportion of rice to paddy. This comes up well in loamy soils and has got a medium tillering capacity. It is a short duration variety taking nearly 125 days from sowing to harvest. The seedlings remain in the nursery for about 30 to 35 days. The crop of dry paddy is rotated with horse-gram which is generally sown at the end of October.

### Details of cost of cultivation, etc.

| Particulars | Pairs at 12 as. | Men at 4 as. | Women at 3 as. | Amount |
|---|---|---|---|---|
| *Preparatory cultivation* | | | | Rs. A P. |
| Ploughing with country plough 6 times... | 12 | 12 | ... | 12 0 0 |
| Trimming the bunds and digging the corners ... ... ... | ... | 3 | ... | 0 12 0 |
| Total ... | 12 | 15 | ... | 12 12 0 |
| *Manures and Manuring* | | | | |
| 32 loads of river silt at the rate of 2 as. per boat ... ... ... ... | ... | ... | ... | 4 0 0 |
| 9 cart loads of cattle manure... ... | ... | ... | ... | 13 8 0 |
| Carrying and spreading the river silt, etc. | ... | ... | 12 | 2 4 0 |
| Total ... | ... | ... | 12 | 19 12 0 |

**Details of cost of cultivation, etc.**—*contd.*

| Particulars | Pairs at 12 as. | Men at 4 as. | Women at 3 as. | Amount |
|---|---|---|---|---|
| *Seeds and Sowing* | | | | Rs. A. P. |
| Preparation of the nursery (40 cents) Ploughing 6 times ... ... | 4 | 4 | ... | 4 0 0 |
| Passing levelling board after each ploughing ... ... ... | ½ | ½ | ... | 0 4 0 |
| Application of ash and scrapings of manure pit 5 cart loads at Re. 1-8-0 per cart load ... ... ... | ... | ... | ... | 7 8 0 |
| Spreading the manure ... ... | ... | ... | 1 | 0 3 0 |
| Carrying and broadcasting the seeds ... | ... | ½ | ½ | 0 1 9 |
| Cost of seed (one *mura* of 60 seers) ... | ... | ... | ... | 3 8 0 |
| Pulling out seedlings, carrying and transplanting ... ... ... | ... | 1 | 30 | 5 14 0 |
| Total ... | 4½ | 5½ | 31½ | 21 6 9 |
| *Harvesting and threshing* | | | | |
| Harvesting ... ... ... | ... | ... | 15 | 2 13 0 |
| Carrying, threshing and cleaning ... | ... | 2 | 12 | 2 12 0 |
| Second threshing and preparing straw bundles, etc. ... ... ... | ... | ... | 6 | 1 2 0 |
| Total ... | ... | 2 | 33 | 6 11 0 |
| Grand Total ... | 16½ | 22½ | 76½ | 60 9 0 |

**Statement of yield, rates and value**

| Yield | Rate | Value | |
|---|---|---|---|
| | | Per plot | Per acre |
| | | Rs. A. P. | Rs. A. P. |
| Grain 39 *muras*. | One *mura* of 25 m. m. at Rs. 2-14-0 ... | 112 2 0 | 74 12 0 |
| Straw { 1800 prepared bundles. | 100 bundles at Re. 1-0-0. | 18 0 0 | 12 0 0 |
| Straw { ¾ cart load of ordinary straw. | Cart load at Rs. 10-0-0. | 7 8 0 | 5 0 0 |
| Total value ... | | 137 10 0 | 91 12 0 |
| Less expense ... | | 60 9 9 | 40 6 6 |
| Nett profit ... | | 77 0 3 | 51 5 6 |

# THE PROBLEMS OF HAWAII [1]

By Dr. H. L. LYON

*Scientific Officer, Hawaiian Sugar Planters' Association.*

Situated between 19° and 22°N. Lat. (the latitudes of Bombay and Rangoon) and between 155° and 160°W. Long., the Hawaii form a group of islands, lying north-west to south-east, right in the middle of the Pacific. Volcanic in origin, and with the tops entirely worn out, leaving only sand or atolls, the islands are typical of coral reef formation, and present an interesting flora which—with no factors to disturb right from the early geological times—are to be found nowhere else in the world.

The total area is about 6,000 square miles and the population 35,000. 2,000 miles away from San Francisco, the nearest point to the islands—and over 3,500 from Japan and Australia, the islands are yet in the trade routes of the world and therefore are in touch with the rest of humanity. The north easterly trade winds blowing for about eleven months in the year, bring in their wake a heavy rainfall, the mountain ranges in the islands—some of them over 10,000 feet above sea-level—causing a precipitation of over 300 inches in the year. On the leeward side of the mountains however, there is little rain—with but 10 inches or even less a year—so that the islands are partly desert, and partly rank with wild vegetation. The extreme steepness of slope, however, precludes the possibility of storing this large amount of water received during the rains, as the slope limits the capacity of any reservoirs that could be built.

As the islands were covered with wild uninhabited jungles, the early trade of the islanders was confined to forest produce chiefly sandalwood, of which a good many varieties flourish in the forests. With the advent of civilization, cattle were introduced, about the beginning of the nineteenth century, and cattle-rearing and export in hides and skins came to be important. This was not an unmixed blessing, for, with the introduction of cattle, followed the extinction of forests. As before mentioned, the flora without foraging animals to disturb them, formed a peculiar plant society with the roots of the trees in the sticky soil ecologically developing to be surface feeders, and a lot of moss and ferns associated with them. Grazing animals injured these roots, with the result that forests ceased to exist and in their place came wide grass lands. This inevitable disafforestation resulted in droughts since the moisture-holding capacity of the islands was considerably lessened. Thus the only source of revenue—namely forest produce—was spoilt by an overdose of cattle-rearing.

Then came the search for crops, and amongst these sugarcane was easily the most successful and profitable. The Chinese were the first to start the cultivation of this crop and even the manufacture of sugar and once the local demand was satisfied, it was possible to export large quantities to America chiefly. Trade flourished and one point worth noting in this connection is that the Hawaiians have no tariff to pay for their sugar, while in

[1] Lecture delivered on October 28, 1930, under the auspices of the Association of Economic Biologists, Coimbatore.

the U. S. A. a tariff, of 2 cents per pound of sugar is charged on other sugars.

Requiring good sunshine and facilities for drainage, the sugarcane is grown on the dry lands, and here the chief difficulty is water, as rainfall is the only source of supply. The canes grow for a period of 18, 24 and even 30 months and there are about 200,000 acres under crop. It requires about a ton of water to grow a pound of sugar, and it was only in 1918 that it was recognized that preservation of forests should be paid more attention to, if one wanted to escape periods of drought during the growth of the crop. Rigorous forest laws were introduced and steps were taken to rejuvenate the old forests, not only by reviving the old indigenous trees, but by importing foreign trees as well—amongst which may be mentioned the Terminalia Sp. from Assam. Since then, conditions have improved, and there is not so much drought now.

Another problem confronting the sugarcane cultivator is the depletion of soil. There is practically no rotation of crops, and the continuous growth of sugarcane for the last fifty years has removed much of the plant food. This led to the application of commercial fertilizers, very heavy doses (as probably obtain nowhere else in the world) being applied. One ton of fertilizers or 1,000 lbs. of sodium nitrate are very often applied. These fertilizers have to be obtained from distant places like Chile, the slaughter houses of America, and so on, and manuring is therefore very costly. As against this, there has been an increase in yield from four to nine tons per acre. There are, in fact, plantations giving an incredible yield of 18 tons of sugar per acre.

A leaf hopper pest of the cane which appeared in 1903 and which devastated large areas, had to be tackled. A parthenogenetic parasite was obtained from Australia, but even this did not do much benefit, as there were alternate periods of leaf hopper and parasite ascendency and once the damage was done to the crop, it could not be rectified. Later, a parasitic red bug which was found in Australia, was let loose on the islands. This multiplied rapidly and sent the leaf hopper out of existence. This bug does no harm whatever to the cane and since its introduction, there has been no trouble from the hopper. Similarly, a borer found attacking the roots of cane, was got rid of by a parasitic wasp from Japan.

The hunt for a commercial crop in addition to sugarcane, led to the introduction of the pine-apple. This flourished very well on the island, soon a market for the commodity opened, and a great demand has arisen for the fruit. The chief difficulty is preserving and packing, (since San Francisco the nearest port is 2,000 miles away), and the keeping during transit. In addition there is only one variety, the kewpine grown, and as this is subject to diseases and fungus attacks during transit, the problem is to produce a disease-resistant variety. A Breeding Station has been opened and work on this has been started and a few varieties have been evolved.

It will be interesting to know that pine-apple on certain soils of the island showed a sickly yellow colouring and a chemical analysis indicated as high as 2 per cent. of Manganese dioxide in the soil. These plants were then sprayed with a 2 per cent. solution of iron salt periodically and the normal colour and growth of the plants were restored.

## IN LIGHTER VEIN

### A MIDSUMMER DAY'S DREAM

By 'BETA'

It was a particularly hot day in May. Tired and done out I came home from the fuming laboratory, for my mid-day meal. I was hungry and the dishes that my wife set before me were appetizing and I must have taken much more than my usual dose of food. Soon, I was fast asleep in my easy chair where I had reclined for just forty winks and no more.

* * * * *

I was walking along an avenue, with tall rain trees on either side; the scene seemed very familiar to me. Surely this must be the Lawley Road and yonder building must be the Agricultural College—no—for there was something different in the whole aspect of the building from what I had known it before. And there was some change in me too, I could perceive; I no longer had that firm, erect, and elastic step I was once proud of. I breathed hard and leant heavily on the stout stick I held in my right hand.

Slowly I trudged along, and came to the portals of the building. The whole structure seemed to be made of paper and bamboos and gaily coloured; there was not a single brick in the edifice. A pompous-looking individual clad in khaddar and green and yellow livery stood on the steps.

'Who are you, old man, and why do you trespass here?' called he. I was wroth at his calling me old and half raised my stick in anger, but then I realized that I was really old, and the flowing white beard on my chin must have dispelled all impressions to the contrary. I cooled down, and ingratiating myself with suave language into his favours, asked him, what that building was and what office he held there.

'Oh, this, this is the Senate House of the Coimbatore University and I was once the peon of the Principal of the Agricultural College. As head of the oldest institution attached to the University, the Principal, Agricultural College is the *ex-officio* Registrar of the University and I am doing the dual function of steward to both the institutions.' 'But what happened to the old building and when was this erected?' cried I in dismay. 'The old College was destroyed by an earthquake,' replied my informant, 'and to prevent any further repetition of the event, this structure has been entirely built with paper and bamboos. As a further precautionary measure, the Principal every evening just manipulates this switch here, and the whole building collapses and packs itself into a small packet; he then puts it in his pocket and walks home, where he can keep it secure for the night.' 'Indeed' said I quite amazed, 'this is highly interesting. But if things can be done so easily as you say, what is the necessity for you all here, a peon, a watchman and so on?' 'Ha, Ha,' laughed the peon, 'that is *mamool* you know. However can a Principal live without a peon,' and then he added in a whisper, 'the real truth is, that the Legislative Council has sanctioned the expenses for a Steward in the budget of 1960–61 and the

money has got to be spent. Now you see how it is.' 'Quite' said I, and then mused to myself, 'and so this is the year of our Lord 1960 and science has advanced to the extent of enabling men to make buildings collapsible and pocketable; still they are not free from Legislative Councils and 'annual grants'.

Just then a messenger came running into the room 'Please, sir,' said he to the steward, 'the Farm Manager wants field No. 45 to be irrigated at once.' 'Very good' said the mechanic, and forthwith he removed two pieces (they were electrical plugs I understood later) numbered 4 and 5, and made some other adjustments on a switch board near by. After the lapse of about a minute, he turned to the messenger and said to him 'All, right, you can go and tell the Farm Manager that field 45 has been irrigated.'

I was astounded. So fields were being irrigated by the mere manipulation of an electrical switch. But what was the necessity for a messenger to go on errands? It was puzzling; I turned to the steward and ventured to put the question, 'Why you old fool, however can you conceive of a Government Officer, without a peon or messenger?' 'True, true' I admitted and turned out of the room. I enquired after the way to the chemical laboratory. I was a Chemist once and was filled with a longing to see if the laboratory also had undergone any changes.

I was however absolutely unprepared for the spectacle that met my eyes. In place of the old dear laboratory, was a single room, but its structure was very peculiar. It was neither square nor rectangular as all rooms are, but quite polygonal, with I do not know how many walls. Inside were any number of fume cupboards all along the walls, right from the floor level. There was not a single burner as far as I could see; and all the staff were ladies and these were engaged each with a mortar and pestle and a marble slab, compounding some ingredients and turning out pills and tabloids by the hundreds. An elderly lady with a grave-looking face and diamond ear-rings, I gathered to be the chief. To her I turned and put my preliminary questions.

'We are now at the tabloid solution of all problems connected with Agriculture and Humanity. As the result of elaborate investigation in our laboratories, we have been able to formulate specific recipes for definite defects of soil, plant-growth and our work is very easy. Demands for our tabloids are pouring in, and with my limited staff, I do my best to manufacture large quantities.'

'What are your hours of work,' I asked with a look of pity on the tender hard-worked damsels. 'Hours?' the chief queried cynically, 'H'm, we have no hours at all. We work day and night, the enthusiasm of the thing just keeps us going.' 'But what do you do for food and drink,' said I with a feeling of superior wisdom. 'Pangs of hunger trouble us not, and thirst we easily allay. Here Kamala,' she called to one of the girls at the farthest table 'bring me one of those maintenance tabloids.' The chief held up to my view the pill that the girl brought and continued, 'Here you see, this tabloid when taken three times a day, will just keep your body and soul together. The fat, carbohydrates and proteids have been concentrated and so combined in this tabloid, that its nutritive value is 1/12. We have other tabloids with narrower ratios suited for different kinds of work. In fact, we have here a tabloid which is in great demand—which is particularly adapted for people doing a lot of brain work.'



I was very eager to see it and even ask for a dose, but refrained, lest she should think that I was wanting in brains.

'And we have inoculation pills specially prepared, for remedying particular defects of the soil and to ensure greater and heavier yields of crop.' 'But why should you have crops,' asked I, 'if the food problem is going to be so easily solved by these tabloids'? 'Ah, there is the breeder you know,' the lady replied, 'Is all the botany and science he learns in the University to run to waste? And how can he evolve better strains, if there are no crops to breed them from. And then there is the Entomologist and the Mycologist. Without crops, how can insect attacks and diseases prevail? But that is not all. We have not entirely succeeded in our experiment. We have been able to put into these tabloids all those ingredients necessary for growth, but vitamins—these we are unable to fix up. I was entirely feeding on these tabloids last year and developed a sort of colour blindness due to deficiency of vitamins, and then I had to swallow two bottles of Cod liver oil. And moreover we occasionally crave for a hearty meal, prepared from crops grown on the soil—dear Mother Earth.'

'But what about your husbands and children' said I, 'you must be paying a very poor compliment to your families, if as you say, you are here in the laboratory day and night.' 'Oh, that is easily done,' replied she, 'here you see' and she pointed to her diamond ear-rings, 'inside this is a tiny wireless set and my hubby has one in his sleeve links, so I can converse with him all day long, if I choose.'

'And why are there so many cupboards and no burners at all?'

'Oh, Oh,' she laughed, 'they are not fume cupboards but television closets; the room has been specially built, so that these closets point to all possible directions of the compass. We get into them and immediately can have a view of persons whom we want to see. Our radio set helps us to find the direction the person is in, and the closet that we have to enter into.' 'Indeed,' said I elated, 'then will you please help me to see my wife?'

'Wife indeed, you impudent old beard' and she shook me by the shoulder and sent me out of the room—but I was agreeably surprised for it was a sweet voice saying 'get up, dear, it is time for you to go to office' —It was my wife waking me up.

# THE WORLD'S COCONUT CROP

By F. C. COOKE

Some useful information may be obtained from the statistics of nut, copra and oil exports from the nut-producing countries of the world recently prepared in the Imperial Institute, London.

In the final summary of these statistics, coconut products exported are all reduced to one common denomination namely, nuts, and to achieve this, the following nut equivalent have been employed.

| | |
|---|---|
| 1 ton of copra | 5000 nuts. |
| 1 ton of oil | 8125 nuts. |
| 1 ton of nuts | 1400 nuts. |

It must, of course, be understood that these equivalents are not true for all localities because of regional differences in wet meat weight per nut, in oil content per nut, and in whole fruit weight. For Malaya, the figures should be about 10 per cent less than those shown above. This purely incidental observation does not detract from the value of the comparisons which may be made by a study of the abbreviated Table of Exports which has been prepared from the statistics of the Imperial Institute.

In this Table, only coconut products (exclusive of soap and glycerine) expressed as nut equivalents and actually exported are shown. Because one-third of the copra trade of Malaya is in copra imported into Penang and Singapore from surrounding islands for conversion into copra locally or for re-export in this and in similar cases due correction has been made, and only the true exports shown. In one case, where the figures for 1928 are not available, an estimated figure, obtained from the figures for the previous three years is given instead.

The pre-eminence of the Philippine islands and the Netherlands East Indies as nut-producing and copra-producing countries is very marked. Between them they produce about two-thirds of the world's nuts and over one-half of the world's total annual productiou of copra which is in the neighbourhood of 10,000 tons of copra equivalent to 5,000,000 nuts. In Copra production for export, Malaya comes fifth, with Ceylon a close sixth, though if consideration is allowed for the copra converted into oil in Ceylon then that colony becomes the senior copra-producing country of the two.

In the export of whole nuts, Malaya comes a good third. The collection of nuts for this purpose is confined to a few small districts, the bulk being mainly exported through Penang to Burma. Such nuts, whether for home use or for export are preferred under ripe and for this reason, where nuts are picked both for conversion into copra and for human consumption, the quality of the copra is apt to suffer, as the very under-ripe all-green



nuts which are preferred for eating yield only about half the weight of copra which may be obtained from fully ripe brown nuts, and the oil percentage of the copra obtained is much lower.

It will be seen that among the nut-producing regions of the world, the Philippine Islands take the lead for oil production, because nearly half the annual crop is converted into coconut oil on the spot. Ceylon comes next by crushing 38 per cent of its annual crop. About one half of the oil so produced is imported to Great Britain and India takes a large proportion of the remainder for cooking and for domestic use. The Netherlands East Indies follows next in order and although only 10 per cent of the annual crop is turned directly into oil, the aggregate so converted is almost equal to that for Ceylon. Malaya, on the other hand, is a bad fourth and although of the nuts produced locally, 10 per cent are converted to oil, the aggregate is very small. When consideration is allowed for the total nut equivalents imported and also those consumed locally, the oil production drops to 5 per cent of all the nuts handled.

In Malaya, oil mills are to be found at Penang, Singapore, Klang and Kuala Selangor, but very little of the oil produced is for export to Europe or to the U.S.A. but is consumed mainly in Malaya and in the surrounding countries in the form of cooking oil and soap, and for other domestic purposes.

The explanation for the continued pre-eminence of the Philippine Islands in oil production may be due to the fact that they have satisfactory markets for cattle cake in the U.S.A. and Eastern Siberia or else to the absence of import duties and the preferential tariff for the entry of the oil into the U.S.A. This industry was first established on a large scale, on account of high prices ruling during the war. The exports of oil and copra from the Philippines are now nearly three times what they were in 1917 and it would appear that the stimulus of war prices resulted in a considerable extension of the planted areas which have since come into bearing.

The total consumption of nuts in all forms in Malaya is high, and may be estimated at 50 nuts equivalent per annum per head of the population of 4,000,000 people. This brings the total consumed locally to the not inconsiderable total of 200,000,000 nut equivalents, or 25 per cent of the annual crop. While this does not appear in the Table of Exports, the exports of nuts and oil for native consumption to the surrounding islands are, of course, included in the figures shown.

If allowance is made for local consumption of nuts in coconut-growing countries at an overall average of 10 per cent of the crop, the world's annual yield of coconuts may be estimated as being in the neighbourhood of 8,000,000,000 nuts.

## The World's Annual Coconut Crop—1928

Table to show in what form nuts are exported and the total number of nut equivalents exported from each of the principal coconut-growing regions of the world.

**Millions of Nuts Exported**

| Locality. | As nuts | As copra | As oil. | Totals exported. |
|---|---|---|---|---|
| Dutch East Indies ... ... ... | N. | 2191 | 255 | 2446 |
| Philippines ... ... ... | N. | 1154 | 1137 | 2291 |
| Oceania— | | | | |
| Fiji ... ... ... ... | N. | 342 | N. | ... |
| New Guinea ... ... ... | N. | 230 | N. | ... |
| Solomons ... ... ... | N. | 78 | N. | ... |
| Tongon Isles ... ... ... | N. | 110 | N. | ... |
| West Samoa ... ... ... | N. | 60 | N. | ... |
| New Hebrides ... ... ... | N. | 51 | N. | ... |
| Papua ... ... ... ... | N. | 48 | N. | ... |
| Bilbert Isles ... ... ... | N. | 13 | N. | ... |
| | ... | 932 | ... | 932 |
| India and Ceylon— | | | | |
| Ceylon ... ... ... ... | 18 | 494 | 317 | ... |
| Malabar, etc. ... ... ... | N. | ½ | 2½ | ... |
| | 18 | 494 | 320 | 832 |
| British Malaya— | | | | |
| Federated Malay States ... ... | N. | 342 | N. | ... |
| Unfederated Malay States ... ... | N. | 190 | N. | ... |
| Straits Settlements ... ... | 9 | N. | 60 | ... |
| Sarawak ... .. ... | N. | 10 | N. | ... |
| North Borneo ... ... ... | N. | 16 | N. | ... |
| | 9 | 558 | 60 | 627 |
| West Indies, etc.— | | | | |
| Trinidad ... ... ... | 7 | 48 | 2 | ... |
| Jamaica ... ... ... | 31 | 17 | N. | ... |
| British Guiana ... ... ... | N. | 17 | 1 | ... |
| Remainder ... ... ... | N. | 6 | N. | ... |
| | 38 | 88 | 3 | 129 |
| East Africa— | | | | |
| Zanzibar ... ... ... | ½ | 47 | ½ | ... |
| Tanganyika ... ... ... | N. | 47 | N. | ... |
| Mauritius ... ... ... | N. | 7 | N. | ... |
| Kenya and Uganda ... ... | N. | 7 | N. | ... |
| | ½ | 108 | ½ | 109 |
| West Africa— | | | | |
| Nigeria ... ... ... ... | N. | ½ | N. | ... |
| Sierra Leone ... + ... | N. | N. | N. | ... |
| Gold Coast ... ... ... | N. | 7 | N. | ... |
| | ... | 7 | ... | 8 |
| Grand totals ... | 65 | 5533 | 1776 | 7374 |
| N is less than ½ | | Million equivalents. | | |

*Malayan Agricultural Journal*, Vol. xviii, No. 7, July 1930.

## NOTES AND COMMENTS

### Prickly Pear in its palmy days

Mr. R. Swami Rao sends us the following which he has culled from the *Salem District Gazetteer*:—

'Strenuous efforts were made by Read and his assistants to encourage the cultivation of prickly pear (*Opuntia dillenii*) in Salem District with a view to developing an industry in cochineal. Instructions to this end were issued to Read by the Board of Revenue early in March, 1796, and Dr. Andrew Berry was appointed 'Superintendent of the Honourable Company's Nopalry.' In his Proclamation of November 15, 1796, the following concessions were granted in favour of those who cultivated certain special products.

The Company being desirous to introduce the manufacture of silk and other valuable productions, only one-sixteenth of the ordinary rates or tirva will be required for lands growing the mulberry, the Mauritius cotton, the Opuntia, black pepper, coffee, cinnamon, cardamoms, sandal and other exotic plants for the first seven years and after that only half of these rates while they continue to grow them.

By the end of the year Macleod reported the establishment of nurseries in the Kasba of each Amildari for 'the purpose of furnishing plants for the rest of the districts.' Munro ordered 50,000 plants to be planted in different villages, but could not 'prevail on any of the inhabitants to make plantations of it.' He 'put down a few thousand plants' himself. 'I feel a pleasure' wrote Graham to Read in January 1797, 'in intimating that exclusive of what the Tahsildars have put down by my desire at the Kasbas, about 10 acres at each, Mr. Ord, our Assistant Surgeon has prevailed upon the ryots of Krishnagirir Jagadev and Maharajakadai to plant about 7 lakhs of kalli . . . Our joint efforts shall not be wanting to encourage its extensive propagation and I am sanguine in my expectation that a considerable portion of our useless waste lands will in a short time be made to contribute largely to the attainment of our object, which holds out so much public benefit.'

A hundred and thirty years ago the problem was to find a crop, which would provide a dye industry by harbouring the cochineal insect; the prickly pear ushered in with such ceremony has now become a nuisance and we are now out to multiply the pest that will eradicate it. What will be the fate, we wonder, a hundred years hence, of the cochineal insect? Will we have to look for fresh crops to save it from starvation and extinction?

## Coconut Slump

As the result of enquiries which we instituted on this, two months ago, we are now flooded with a crop of answers, from which we extract the following for the information of our readers. The chief reason for the reduction of prices seems to be the preponderance, during recent years of competing materials, chiefly palm kernal and whale oil. Groundnuts, cotton seed and soya beans also contribute their share; indiscriminate over-production of coconut without providing a good margin of profit to the cultivator is beginning to tell. The remedy seems to be to find ways and means for larger consumption of coconut products in India and put better oil in the markets. Otherwise it would not be possible to capture the foreign markets.

## From Groundnut to Artificial Silk

A correspondent draws attention in the *Hindu* of October 24, 1930, to the depression in the groundnut industry and says that unless the State intervenes there will be a very serious situation developed. From an article in the *Scientific American* (October 13) we understand that investigations in Virginia are in progress to see if rayon or artificial silk could be manufactured from peanut shells and it would appear that a product containing 90 per cent. alpha cellulose can be obtained from peanut shells, the requirements of good rayon materials being thus satisfied. From groundnut to artificial silk is not a far cry either and if science could achieve yet one more success one can visualize the day when groundnut will be grown only for its husk and the oil industry becomes a by-product source of revenue.

## A Case for other Crops in Place of Paddy

In a lecture delivered under the auspices of the Indian Economic Association on November 6, at Madras, Mr. Hilson focussed attention on the need that has arisen for lessening the area under paddy and growing more profitable crops in its place. He emphasized on the fact that paddy did not give scope for subsidiary occupation and the surplus population had either to migrate or remain in the place and be a burden on others as dependents or as competitors. In our opinion, the note of warning has not come a whit too late. Everywhere there is slump in the market and unless our cultivators will adapt their methods to changed conditions of the market, agriculture is likely to suffer a serious blow. Industrial crops like cotton, sugarcane, while being more profitable to pay attention to, will provide raw materials for existing industries and scope for others to be started in future. Will the ryots of the deltaic tracts consider this seriously?

## The Nobel Award

The news of the award of the Nobel prize to Dr. Sir C. V. Raman, will be received with great joy all over the country. This is the second time an



Indian has been honoured by the award of this prize, Sir Rabindranath Tagore being the first recipient of it, for literature. Sir Raman's discoveries and investigations into the intramolecular structure of matter and his able and lucid exposition of his theories have revolutionized the scientific world, and a physical phenomenon which he discovered during his investigation into the optical properties of crystals, has come to be known after him, as the 'Raman effect.' A few days before this award it was announced that H. M. the King was pleased to confer the Hughes Medal for researches in physics on Sir Raman and we hasten to congratulate him on this well merited double distinction.

## Silk Cotton Cures Alkalinity

The reclamation of alkaline lands is a serious problem confronting agriculturists in several parts of the country and many have been the remedies suggested. It is with interest, therefore, that we learn from a Bombay Department leaflet (No. 5 of 1930) that the silk cotton tree can be grown with advantage on alkaline soils since, it is a salt feeder and possessed of deep tough roots, penetrates into and opens up the soil. Two years' flooding and draining (after dividing the land into convenient compartments) followed by a crop of Sevari or silk cotton (*Bombax malabaricum*) for three years, considerably improves the soil and makes it quite fit for other crops to be raised later on. The crop is topped when it is about three feet high to induce greater number of side branches, and the topping can be done five or six times a year. Depending on the condition of the soil and care bestowed, silk cotton yields from 10,000 to 35,000 lbs. of cuttings and leaves per acre per year and this makes excellent green fodder for milch cattle. Immediately after the ploughing up of the silk cotton at the end of the third year, a crop of paddy may be raised and this requiring large quantities of water, will also incidentally help to drain off injurious salts still remaining. We understand, that by adopting this method in the Gokak Canal Farm, the total soluble salts in the top six inches of soil which amounted in 1911–12 to 0·59 per cent were reduced to 0·23 in 1914–15 and to 0·16 in 1928–29, and where no crop could be grown before, normal crops of paddy and wheat are being raised now.

## The Upper Subordinate Service—Madras Agricultural Department

In a previous issue of the Journal we had occasion to comment on the inadequacy of pay and prospects in the gazetted services of the Agricultural Department, as compared with other Government departments. We publish below a statement sent to us by the Secretary, Upper Subordinates' Association, which speaks for itself, and which clearly shows that in the non-gazetted ranks as well, our Presidency compares very unfavourably with other provinces both with regard to pay, and the percentages in the several grades. We invite the attention of the authorities to this inequality and trust that ere long steps will be taken to redress this grievance of a section which forms the bulk of the Agricultural Department in this Presidency.

*Statemcnt showing scales of pay, number of posts, etc., of the Upper Subordinate cadre in the different provinces.*

| Province | Starting pay | Grades and pay | Maximum pay | Number of years to reach maximum ordinarily | Percentages of posts in each grade | No. of grades |
|---|---|---|---|---|---|---|
| Bombay ... | 100 | (1) 100-5-140<br>(2) 150-5-200<br>(3) 220-10-300 | 300 | 28 | (III) 66<br>(II) 25<br>(I) 10 | 3 |
| Punjab ... | 100 | 100-10-300<br>Eff. bar at 200 | 300 | 20 | ... | 1 |
| Bengal ... | 125 | 125-150-160<br>(PP) 160-170-10/2<br>220 (E. B.)-10/2-240<br>-20/2-300 | 300 | 24 | ... | 1 |
| Central Provinces | 80 | 80-85-5-150-10-250 | 250 | 25 | ... | 1 |
| Madras ... | 85 | (V) 85-85-5-120<br>(IV) 120-10-170<br>(III) 200<br>(II) 225<br>(I) 250 | 250 | Indefinite | (V) 76·5<br>(IV) 11·2<br>(III) 3·0<br>(II) 5·6<br>(I) 3·7 | 5 |
| Burma ... | 150 | 150-160-7½-220-10-300 | 300 | 18 | ... | 1 |
| Pusa ... | 100 | 100-10-300 | 300 | 20 | ... | 1 |

## Enterprise and Agriculture

Elsewhere in this issue is published a summary of an interesting lecture by Dr. Lyon of Hawaii, to a special meeting of the Association of Economic Biologists. The lecture shows how the development of Hawaii is a typical example of the conquest of wild nature by man, with the aid of science. We are sure that it will set many an enthusiastic but amateur agriculturist thinking and to wonder why a predominantly agricultural country like India is not like Hawaii. It must be noted that what they have in Hawaii is an *Agricultural Industry* as distinct from the *Agriculture* of India with its peasant farmers and small holdings.



The use of very large quantities of fertilisers for sugarcane is a point of interest to the cultivator of this crop in South India. The use of 1,000 pounds of sodium nitrate on basal dressings of similar quantities of slaughter-house refuse and other organic manures, may be profitable in the manufacture of sugar, but not in the manufacture of jaggery. Excessive manuring is known to give juice which will not set to hard crystalline jaggery, which is in great demand in the South Indian markets.

Further, Hawaiians have no tariff to pay for their sugar and in addition America levies a protective tariff of two cents per pound on all sugars other than that of Hawaii.

Breeding superior varieties, improving methods of manuring and decreasing the cost of cultivation, however efficient, cannot support Indian sugar industry, without protective tariff.

## Rainy October

The month of October had an unprecedented rainfall of 16·03 inches as recorded at the Research Institute Observatory as against an average of 6·5 inches for the month. In the 60 years between 1870 and 1930 such heavy rainfall did not occur in Coimbatore either in October or in any month. Heavy rainfall in October is, however, not uncommon for Coimbatore. In the years 1875, 1877, 1880, 1891, 1899, 1902, 1905, 1908 and 1910 rainfalls between 10 and 13 inches were recorded. There is no periodicity, however, as some people think for these aberrations of nature.

## Dr. Mann for Russia

We learn from a note in *Nature* that Dr. H. H. Mann, Assistant Director of the Woburn sub-station of the Rothamstead Experimental Station, is shortly leaving England for South Russia, to advise as to the possibility of extension of the tea-growing industry. Dr. Mann, before he joined the Bombay Department of Agriculture, was Chemist to the Indian Tea Association, Assam.

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# A USEFUL RECIPE

## Tobacco decoction

Cold infusions can best be prepared by soaking one lb. of tobacco waste in a tin or pot containing one gallon of water overnight, and draining the supernatant liquid the next day. This lacks keeping qualities and has been found to be less effective as against hot infusions got by soaking a similar quantity in the same quantity of simmering water after removing it from the fire. The infusion can conveniently be used after it has cooled. The waste might be pressed and thrown out.

Generally, the decoction is diluted to four times its volume and sprayed against soft bodied insects like Thrips, Aphides, etc., with beneficial results; a small quantity of soap has to be added to increase its spreading and wetting power.

# GLEANINGS

## The Role of Bacteria

Bacteria are the chief chemists of the multiplex changes of material that are constantly going on in the soil. We have begun to understand their work, but our understanding so far is only a beginning, and soil microbiology is on the threshold of a development that will dwarf all present accomplishments in that field. These were among the ideas presented by Professor Selman I. Waksman, of the New Jersey Agricultural Experiment Station. Professor Waksman's paper summed up the present status of soil microbiology, with special stress on recent development. While soil microbiology is rapidly growing up into an independent branch of science, its future still depends on its continued contact with its parent sciences, Professor Waksman emphasized. General bacteriology and the study of the fungi, on the one hand, and soil chemistry on the other, will both make large contributions to its development and receive new growth themselves from the data which it will produce. (*Science, July 25, 1930*).

## Roots and Soil Bacteria

Every plant that sends its roots down into the soil gathers to itself a great growth of microscopic hangers on, like the vassals around a baron of old. It greatly promotes the growth of soil bacteria and to a less degree it encourages fungi and other soil microbes, according to Professor Rober L. Starkey, of the New Jersey Agricultural Experiment Station. Plants seem to produce a substance or substances through their roots, that bacteria find available for their needs, for the micro-organisms grow thickest in immediate contact with the roots and are much scarcer a fraction of an inch away. (*Science, July 25, 1930*).

## Artificial Method of Transmitting Virus of Mosaic

In this method a slip of leaf from a sugarcane infected by mosaic is wrapped in a tight band around the exposed spindle of a healthy plant and a small black No. 0 or white No. 2 Asta insect pin is thrust through the diseased into the healthy tissues. About 100 pricks are made per experiment. The plant infected in this way generally shows signs of the disease in about 15 days if the variety is susceptible.—(*Facts about Sugar*, Volume 25, No. 26).

## Spirit of Research in Agriculture

The past has been rich in the joys and thrills of discovery; but it has taught this lesson: that discoveries in applied science inevitably follow advances in pure science. If we would improve our agriculture the surest way is to increase knowledge of the soil, the plant and the animal. Empirical methods, it is true, have often given advances in the past, but they



are slow, hesitant and uncertain; dependent on accident. Exact knowledge is the only sure basis for improvements; encourage, therefore, those among you who are striving to win it.—Sir John Russel in *Science*, (April 18, 1930, p. 409.)

## Critical and experimental investigation of aluminium utensils from the standpoint of hygiene

The average daily diet contains approx. 20–25 mg. of Al. and appears to be increased but slightly by the use of aluminium utensils in the preparation of the food. Long-continued cooking of acid food in aluminium may increase the Al. content to 40–50 mg. or to 100 mg. under extreme conditions. It is probable that more aluminium is ingested in the U.S. through the use of alum baking powders than through the use of aluminium cooking utensils.—(*Biological Chemistry, Chemical* Volume 24, *Abstracts*, No. 11.)

## Agriculture the most Profitable of Arts

'The produce of the husbandman's labours is the only merchandise which all the world is obliged to deal in, and it was such a consideration that induced many early writers to recommend agriculture as the most profitable of all the arts.

'War, navigation and commerce can never dispeople a wise nation whose agriculture flourishes in full vigour, as industrious nations are the most populous as well as the most virtuous. Industry is the "vis matrix" of husbandry.' (Canon Hartein '*Essays on Husbandry*'.)

## Origin of Maize

The origin of maize, which was widely cultivated by the Indians in North and South America at the time of the discovery of these lands, has long been a subject of hypothesis and investigation. The botanical evidence points to Mexico or Central America as the original home of the plant, but it has never been found wild and must have been greatly altered during the long period of Indian cultivation. It has been generally assumed that the wild plant, whatever its form, was extinct, perhaps even in Aztec times. Mrs. Zelia Nuttall (*Journal of Heredity*, Vol. 21, No. 5) now cites documentary evidence which may lead to a different view. The Chevalier Boturini, an Italian traveller and naturalist, published a work in 1746 after spending eight years in Mexico collecting evidence of its former civilization. He describes the native tradition concerning the origin of agriculture, that while setting fire to the forests to clear them of wild beasts they noticed grains of maize which had been roasted, and finding them delicious collected fresh seeds to plant in the soil. Boturini asserts that he himself found in New Spain a maize growing wild in the forests with a small ear and few seeds but more delicate in flavour than the cultivated kind. This may have been the wild progenitor of maize, since become extinct through deforestation and other causes. That the plant may still survive in Guatemala is suggested by the experience of Mr. Oliver la Farge, an American, who recently found there, at an altitude of 5,000–6,000 feet, a wild plant used by the natives in May, when the maize fields had only just been sown. This plant had ears about two inches long 'looking rather like oat-sheaves without the 'whiskers' and having the unmistakable flavour of corn.'—*Nature*, October 18, 1930.

## CORRESPONDENCE

### I

### The Prices of Coconuts

To

The Editor, ' The Madras Agricultural Journal '.

Sir,

I encolse herein an extract from the *Tropical Agriculturist* which gives the reasons for the decline in the price of copra and cocoanuts, which Mr. N. Subba Row, wished to know in his letter to you published on page 550 ot the current year's *Journal*.

VIZAGAPATAM,
*4th November 1930.*

Yours faithfully,
G. JOGIRAJU.

THE FALL IN THE PRICE OF COPRA

*Tropical Agriculturist*
March 1930, Volume 74, page 129.

' The copra market was affected by the large and cheap supplies of grain which were available and by the consequent fall in demand for oil-cake for the feeding of cattle. It will be noted that present-day copra production is almost double that of pre-war years. The high prices obtained by growers during the years immediately following the war led to an extension of coconut planting which is responsible for the present over-production. Further, new areas have yet to come into bearing, and it follows that a remedy for the present position lies in an increase in the demand for copra through the finding of new markets and new uses for it and through the cheapening of production.'

' There is also the question of competing products. The production of whale oil, groundnuts and vegetable oils in general has increased, and soya beans have been used by the makers of margarine in increasing quantities. The soya bean is exported from China and Korea, and, whereas the exports of China averaged 685,000 tons over the years 1909–13, they rose to 1,732,000 tons in 1927. The soya bean is therefore a serious competitor in the vegetable oil market.'

### II

### Stripping of Canes

To

The Editor, ' Madras Agricultural Journal '.

Dear Sir,

' Stripping of canes was not only not advantageous to the cane but on the contrary was definitely detrimental.' So says Mr. Arthur H. Rosenfeld in an article in *Facts About Sugar* (Vol. 25, 1930. September) Experiments at Hawaii and other places have thoroughly demonstrated not only the



futility of this process, but also the evil effects that usually follow stripping, such as the invasion of diseases which follow in the wake. Light and air are not necessary for the stalks and lower leaves which cease to function, and the need for this process is indeed doubtful.

May I, sir, through the columns of your valuable journal invite information from men of experience in the district on the advantages or otherwise of stripping canes ?

Yours truly,
C. S. KRISHNASWAMI.

## NOTES ON BOOKS RECEIVED IN THE LIBRARY

HUMAN FACTORS IN COTTON CULTURE.—By Rupert B. Vance. *The University of North Carolina Press. Price 3 dollars.*

A study in the social geography of the southern states of North America, this book deals with how not merely human activities and habits but social organization as well is affected by the economics surrounding the cultivation of a single crop, namely cotton. Original in conception and comprehensive in survey, the treatment of the book makes a successful attempt to show how distinctive cultural and sectional traits have developed as a complex round the cotton plant. Starting with the regionalism of cotton culture, the author traces the relationship to human ecology, and then comes to the evolution of the cotton system, the unit of the culture complex. Then, are given details of the economics of the plant, of the importance of weather and weevil, of the risks of cotton trade, speculation and so on. Two chapters on ' How the Cotton Farmer Lives ' and ' The Human Elements in Cotton,' are chiefly of interesting illustrations with several case studies of men who have been made and marred by cotton. The chapter on ' Cotton Culture Complex ' is by far the most instructive and thought provoking, as it is there that culture traits associated with cotton are discussed and explained. We understand from the preface that the present book is the first of seven about the human geography of the South, which he intends to complete within the next three years; those who have read this book with its racy, incisive style will be looking forward eagerly to further works by the author on similar subjects.

[M. R. B.]

THE CORRIDORS OF TIME.—By Harold Peake and Herbert John Fleure. *Clarendon Press, Oxford (Vols. I to VI, Apes and Men, Hunters and Artists, Peasants and Potters; Priests and Kings; the Steppes and the Sown and the Way of the Sea).*

A review and recital in popular language of the scientific interpretation of geological data and records giving the history of the world from the beginning of time to about 2,000 B.C., each volume dealing with one particular geological period. Volume I treats of the origin of man, Volume II of the cave-man stage, Volume III of the time when food production came to be considered as an important factor by human beings,

Volume IV of the beginnings of civilization and the growth of Governments, Volume V with clash of rival interests characterised by raids and Volume VI with the advance of civilization and maritime pursuits.

[M. R. B.]

RURAL SCIENCE.—A Handbook for Teachers in Ceylon Schools. By F. A. Stockdale, C.B.E. and J. C. Drieberg. *Published by H. Ross Cottle, Government Printer. 1928. Price 40 cents.*

The need has long been felt for a book which will help the elementary and secondary school teacher in the rural areas to create an 'agricultural bias' in his pupils. The present book is an attempt to satisfy the need. We have no doubt that it will be of a very great help to the earnest teacher who wishes to stimulate in the young pupil an intelligent interest in his surroundings, to impress on his mind the dignity of labour and the usefulness of developing his powers of observation and to rouse in him the creative instinct. These will develop among the pupils a love of agriculture as a vocation.

The book has been divided in two parts—Part I embodying a syllabus of topics which are to be used throughout the schools up to the fifth standard and Part II consisting of a more advanced syllabus for use in the special subject rural science.

[C. S. K.]

## A USEFUL RECIPE

### Bait for House Flies

The Potchefstroom School of Agriculture states that the most efficacious poison-bait for use against house flies is made up as follows :—Arsenite of soda, 1 lb. ; crude treacle, 1 gallon, or sugar (cheapest), 8 lb. ; water, 8 gallons.

Branches of trees, preferably with hard, smooth leaves (Eucalyptus leaves answer well) are dipped in this solution, and then hung around the kitchen, stables, etc., wherever the flies foregather. Arsenite of soda is a deadly poison, and should be kept out of the way of children and animals.

Another effective bait, and one that is not harmful to children and animals and may thus be used in the house, is made up as follows :—Milk, ¼ pint; water, ¾ pint; formalin (commercial) 3 teaspoonfuls; sugar, 2 teaspoonfuls. This bait, with the addition of a small piece of bread on which the flies can settle is placed out in saucers.—(*'Farming in South Africa'*, Vol. IV, No. 47, p. 559.)

# College News and Notes

*Students' Club.*—On Monday, November 10, Mr. T. S. Ayyar of the Theosophical Society, delivered a lecture on the 'New Era', Mr. T. V. Rajagopalachariar, Vice-Principal of the College, presiding. The lecturer dwelt on the need for a sympathetic and rational outlook in bringing up children, in whose education, example by parents and elders should play a more important part than precept. He spoke of the three 'D's' that should characterize the New Era :—Democracy, Discrimination and Daring; democracy in ideals and actions, discrimination to choose between right and wrong, and daring to speak and adhere to truth, be the consequences what they may.

On Sunday 24, the Rev. H. C. Balasundaram, Secretary of the Student Movement, spoke on 'Service in the Changing Times'. Mr. K. Gurumurthy, B. Ag., Assistant Lecturer in Dairying, presided. In an extremely instructive and thought-stimulating address, punctuated by homely and apt illustrations and anecdotes, the lecturer spoke of the four features that are characteristic of the change that has appeared the world over including India. These are, the defiant spirit of youth coming to the front, its alertness to injustice, its impulse to evolve new standards for measuring codes of life, and its tendency to live in the present, oblivious of the past and regardless of the future. In a period of such changes, service had to be rendered not by equipping oneself with or gathering information, but by developing an attitude towards life and to expound that attitude to others around you, with courage and conviction, and without trying to get cheap popularity, by pleasing everybody and compromising your principles.

The attendance of students at both the meetings was very poor. It is devoutly wished that students of the college will evince more interest in the activities of their Club.

*Class Tours.*—From 1st to the 10th the students of Class II were on tour visiting Hagari and Hosur. Messrs. V. Muthusami Ayyar, E. Kunhappa Nambiar and S. V. Duraiswami Ayyar were in charge. From the 12th to the 21st, Class III students were taken to Koilpatti and Palur, Messrs. S. Narayaniah, K. L. Ramakrishna Rao and V. T. Subbiah Mudaliar being in charge of the party.

*Athletic Activities.*—The Inter-Class Tournament for the 'Victory Cup' began on the 22nd with a Hockey match between Class I-B and Class II-B. The teams were evenly matched and the match ended in a draw of one goal all, even after the extra time allowed.

*The Association of Economic Biologists.*—A meeting of the Association was held on Tuesday, November 4, under the presidency of Dr. T. V. Ramakrishna Ayyar, B. A., PH. D., the President of the Association in the chair. Two papers were read, the one on 'Blast Disease of Paddy and its Control' by Mr. S. Sundararaman, M. A., the Government Mycologist, and the other on 'Polyembryony in Ragi' by Mr. G. N. Rangaswami Ayyangar, Millets Specialist and Mr. N. Krishnaswami, B. Sc., Assistant to Millets

Specialist. After each paper, there was lively discussion, and questions and doubts from the audience were answered and cleared by the speakers.

*Visitors.*—Rao Bahadur M. R. Ramaswami Sivan, B. A., F. M. U., Retired Principal of the Agricultural College and now Honorary Warden at the Indian Officers' Association, Madras, and Mr. G. R. Hilson, B. Sc., Director of Agriculture, Madras, were here to attend a meeting of the Board of Studies for revision of the Syllabus for the B. Sc. (Ag. Degree). Mr. Sivan left on the 12th for Madras, while Mr. G. R. Hilson stayed on till the 15th when he left for Pattambi. He returned to Coimbatore on the 20th and stayed till 1st December. Mr. Mahendar Bahadur, Deputy Director of Agriculture, Hyderabad, was here from 19th to 22nd on a visit, to study the Agriculture of this locality.

*The Soil Physicist.*—Dr. T. R. Seshadri, M. A., Ph. D., the newly appointed Soil Physicist joined duty on November 12. Passing out of the Presidency College in 1922, Dr. Seshadri distinguished himself by winning, as Research scholar of the Madras University, the Wedderburn and the Maharajah of Travancore Curzon prizes. Later, he worked in Manchester where he took his PH. D.,—in London, in Graz (Austria) and in Edinburgh coming into contact with distinguished scientists in those places. Besides his main line of investigation on plant bio-chemistry he has had training in physical chemistry, technical and agricultural chemistry, botany and bacteriology.

# Weather Review

## FOR NOVEMBER 1930

**Rainfall Data**

| Division | Station | | Actual | Departure from normal | Total since 1st January |
|---|---|---|---|---|---|
| Circars | Gopalpore | ... | 9·2 | + 5·6 | 50·3 |
| | Vizagapatam | ... | 8·2 | + 4·2 | 46·9 |
| | Cocanada* | ... | ... | ... | ... |
| | Masulipatam | ... | 8·1 | + 2·9 | 58·7 |
| Ceded Dists. | Kurnool | ... | 0·5 | — 0·6 | 24·5 |
| | Bellary | ... | 0·7 | — 1·2 | 26·0 |
| | Anantapur | ... | 1·5 | — 0·1 | 28·0 |
| | Cuddapah | ... | 2·3 | — 1·1 | 39·9 |
| Carnatic | Nellore | ... | 7·8 | — 4·0 | 48·0 |
| | Madras | ... | 21·5 | +12·5 | 73·7 |
| | Cuddalore* | ... | ... | ... | ... |
| Central | Vellore | ... | ... | ... | ... |
| | Salem | ... | 4·9 | + 1·5 | 40·7 |
| | Coimbatore Town | | 8·0 | + 4·2 | 36·2 |
| | Coimbatore Research Inst. | ... | 6·9 | + 2·1 | 34·8 |
| | Trichinopoly* | ... | ... | ... | ... |
| South | Negapatam* | ... | ... | ... | ... |
| | Madura* | ... | ... | ... | ... |
| | Pamban* | ... | ... | ... | ... |
| | Palamcottah* | ... | ... | ... | ... |
| West Coast | Trivandrum* | ... | ... | ... | ... |
| | Cochin | ... | 8·3 | + 2·1 | 115·6 |
| | Mangalore | ... | 0·2 | — 2·5 | 137·3 |
| | Calicut* | ... | ... | ... | ... |
| Mysore and Coorg Hills | Bangalore | ... | 1·1 | ... | 37·9 |
| | Mercara | ... | 2·9 | — 0·3 | 109·8 |
| | Kodaikanal* | ... | ... | ... | ... |
| | Coonoor | ... | 4·7 | — 7·6 | 62·3 |

* Owing to telegraphic interruption no data is available.

### General Summary of Weather Conditions

The weather at the beginning of the month was of the same type as that at the end of October with widespread rain over the south of the Presidency. On the 7th, a depression entered the Andaman sea from the Gulf of Siam, and concentrating into a storm moved rapidly in a N. N. E. direction, and crossed the coast near Akyab on the evening of the 10th. This storm caused a withdrawal of moist winds from the west of the Bay and rainfall practically ceased till the 15th over the Presidency. On the 16th a depression appeared off the Madras Coast and after developing, moved in a North Westerly direction, crossed the coast near Masulipatam on the morning of the 18th as a cyclone of small extent but great severity. It weakened and moving in the same direction lay over the East Central Provinces on the 19th and then moving to the N. E., lay over Bengal on

the 20th. This storm caused heavy rain over the North Madras Coast and Bengal. A third storm formed in the South-West of the Bay on the 28th, and after intensification crossed the coast just south of Madras on the 29th morning, and moving westwards rapidly weakened, and on the 30th morning lay as a shallow and diffuse area of low pressure over the south of the area, and subsequently passed out to sea off the Malabar Coast. The storm was of great severity, and caused very heavy rain in the Carnatic during its passage inland.

Information is not available from most of the stations in the south owing to telegraphic interruption. Rainfall over the north of the reporting area was mostly associated with the second and third disturbances and was markedly above the average on the North Madras Coast and the Madras Coast. Some heavy falls were recorded, the chief among them being :— Vellore 11·77″ on the 30th, Madras 6·99″ (29th), Masulipatam 6·0″, and Cocanada 6·1″ (18th), and Gopalpore 5·5″ (19th).

Temperature fluctuations were irregular owing to the incidence of rainfall associated with the storms. There was a notable decrease in the night temperature between the 9th and 15th over the East Coast and temperature was appreciably below the normal.

## Weather Report for the Research Institute Observatory

| | | |
|---|---|---|
| Absolute Maximum in the Shade ... | ... | 88°·0 |
| Absolute Minimum in the Shade ... | ... | 59°·5 |
| Mean Maximum in the Shade ... | ... | 84°·9 |
| Mean Minimum in the Shade ... | ... | 69°·0 |
| Total Rainfall in the month ... | ... | 6·88 inches |
| Mean Rainfall for November ... | ... | 4·75 ,, |
| Departure from normal ... | ... | +2·13 |
| Heaviest fall in 24 hours ... | ... | 1·72 |
| Number of rainy days ... | ... | 10 days |
| Mean daily wind velocity ... | ... | 0·9 M.P.H. |
| Mean 8·00 hours wind velocity ... | ... | 0·6 ,, |
| Mean humidity of saturation ... | ... | 83·6 per cent. |
| Total hours of bright sunshine ... | ... | 177·0 hours |
| Mean daily hours of bright sunshine ... | ... | 5·9 ,, |

## Summary of Weather Conditions

The weather at the beginning of the month was unsettled and rainy, the conditions being similar to that at the end of October. Weather improved thereafter, and was fine till the 27th, when pressure fell briskly by nearly 0·2 inch in four days. This fall was due to the storm which crossed the coast on the 29th, the pressure being lowest on the 30th when the storm was traversing nearest to this observatory.

Rainfall was heavy for the first week of the month and totalled 6·88 inches and was 2·13 inches above the average. The heaviest fall was 1·72 inches in 24 hours.

Temperature was low throughout the month and reached the minimum value of 59·5 on the 29th. Air movement was very light throughout the month.

P. V. R.
B. S. N.

# Departmental Notifications

*First Circle.*—T. V. Krishnaswami Rao, F. M., Samalkota, L. A. P. for 16 days from 20-10-30. M. Gopala Rao, A. A. D., Berhampore, L. A. P. for 22 days from 2-12-30 with permission to affix Christmas and New Year Holidays. K. Suryanarayana, A. A. D., Anakapalle, L. A. P. for 15 days from 3-1-31 with permission to prefix Christmas and New Year Holidays.

*Third Circle.*—S. Varadarajulu Nayudu, A. D., Guntakal, L. A. P. on medical Certificate for 2 months from 6-10-30. M. Vaidyanathan, A. D., Gooty, L. A. P. for one week from 5-11-30. A. Krishnaswami Ayyar, A. D., Anantapur, L. A. P. for one and half months from or after 5-12-30. P. Nagadhara Nayudu, A. A. D., Bellary, L. A. P. for 2 weeks from 17-11-30, with permission to avail Sunday 16-11-30.

*Seventh Circle.*—K. Soopi Haji, A. A. D., Kasargode, L. A. P. for 16 days from 1-12-30. K. M. Jacob, Manager, Taliparamba, L. A. P. for 20 days from 24-11-30 with permission to avail of holidays on 23-11-30 and 14-12-30. P. Abdullah Haji, A. D. Manantody, L. A. P. for three weeks from 11-11-30. In partial modification of previous order K. M. Jacob, F. M., Taliparamba granted L. A. P. for 18 days from 26-11-30.

*Eighth Circle.*—M. Subrahmanya Pillai, A. D., Erode, L. A. P. for one month from 9-11-30. C. K. Subrahmanya Ayyar, A. A. D., Coimbatore L. A. P. for 10 days from 3-11-30. P. S. Manian, A. D., Annur, L. A. P. for 7 days from 13-11-30.

*Livestock Section.*—M. V. Narasimha Sastry, A. A. D., Ongole, L. A. P. for ten days from 3-11-30. M. A. Narasimha Sastry granted extension of leave for 18 days.

*G. A. C's. Section.*—C. V. Ramaswami Ayyar, Assistant, L. A. P. for four months from or after 12-11-30. P. A. Raghunathaswami Ayyangar, Assistant, L. A. P. for 13 days from 3-11-30.

*Cotton Section.*—L. A. P. for 13 days granted to R. Sankara Ayyar, Assistant, from 10-11-30 cancelled and in partial modification L. A. P. for 15 days from 12-11-30 granted.

*Paddy Specialist's Section.*—M. P. Sankara Nambiyar, Farm Manager, Pattambi, L. A. P. for one month from 24-11-30, with permission to affix Xmas Holidays.

*G. S. B's. Section.*—J. David, Sub-Assistant, L. A. P. for 15 days from 6-11-30.

*Millets Specialist's Section.*—V. Panduranga Rao, Assistant, L. A. P. for 15 days from 26-10-30.

### Transfers, etc.

*First Circle.*—N. Rama Doss, A. D., Visagapatam on relief of his duties with the Exhibition Vans will report to D. A. O. Rajahmundry.

*Fourth Circle.*—P. S. Venkatasubrahmanyam, F. M., Kalahasti School Farm to Cuddalore Division for District work. V. Kumaraswami, F. M., Palakuppam Research Station to Vellore Division for District work. P. S. Venkatasubrahmanyam, Farm Manager, Kalahasti School Farm, posted as A. D., Chidambaram Taluk from 1-12-30.

*Sixth Circle.*—P. Kannappa Pillai, A. A. D., Madura, transferred to the Tinnevelly Division.

*M.S's Section.*—K. Narayanan Nayar, Upper Subordinate, Science Section, V grade on probation transferred to Agricultural Section in the same grade with effect from 1-11-30 in an existing vacancy. He will however continue to be under training at the Millets Breeding Station, Coimbatore. T. S., Seshukutti, B.A. (Hons.) appointed Upper Subordinate, Science Section, V grade, on probation in the vacancy caused by the transfer of K. Narayanan Nayar.

## APPENDIX

## LIST OF BOOKS, BULLETINS AND OTHER PUBLICATIONS RECEIVED IN THE AGRICULTURAL COLLEGE LIBRARY DURING OCTOBER 1930

### A. BOOKS

| | | | |
|---|---|---|---|
| 1. | *Agriculture—Theoretical and Practical.* | By Wrightson, J. and Newsham, J. C. 3rd Edn. Rvd. | 1929 |
| 2. | *Nature and Properties of Soils* ... | ,, Lyon, T. and Buckman, H. O. | 1922 |
| 3. | *Farm soils, their Management and Fertilization.* | ,, Worthen, E. L. ... | 1930 |
| 4. | *Evolution of Earth and Man* ... | ,, Woodruff, L. L. and others. | 1929 |
| 5. | *The Sun* ... ... ... | ,, Abbot, C. G. ... | 1929 |
| 6. | *Romance of the Moon* ... ... | ,, Mary Proctor ... | 1928 |
| 7. | *The care and Handling of Milk* ... | ,, Ross, H. E. ... | 1927 |
| 8. | *Poultry Diseases* ... ... | ,, Kaup, B. F., 5th Edn. | 1929 |
| 9. | *Agricultural Economics* ... ... | ,, Boyle, J. E., 3rd Edn. | 1928 |
| 10. | *Agricultural Economics* ... ... | ,, O'Brien, G. ... | 1929 |
| 11. | *Economic Development of India* ... | ,, Ansley, V. ... | 1929 |
| 12. | *Human factors in Cotton Culture* ... | ,, Vance, R. B. ... | 1929 |
| 13. | *Population Problem of India* ... | ,, Ranadive, B. T. ... | 1930 |
| 14. | *Revised Co-operative Manual, Vol. I...* | ,, Hood, H. M. ... | 1930 |
| 15. | *Elementary Analytical Chemistry* ... | ,, Clowes and Coleman. Revised. 11th Edn. | 1930 |
| 16. | *Introduction to Modern Organic Chemistry.* | ,, Coles, L. A. ... | 1929 |
| 17. | *Intermediate Inorganic Chemistry* ... | ,, Mellor, J. W. ... | 1930 |
| 18. | *Comprehensive Treatise on Inorganic and Theoretical Chemistry, Vol. X.* | ,, ,, ... | ,, |
| 19. | *Organic Synthesis, Vol. X* ... | ,, Clarke, H. T. ... | ,, |
| 20. | *Photometric Chemical Analysis, Vol. I, Colorometry.* | ,, Yoe, J. H. ... | 1928 |
| 21. | *Do. Vol. II, Nephelometry.* | ,, ,, ... | 1929 |
| 22. | *Volumetric Analysis, Vol. I, Theoretical.* | ,, Kolthoff and others ... | 1928 |
| 23. | *Do. Vol. II, Practical* ... | ,, ,, ... | 1929 |
| 24. | *Hydrogen Ions* ... ... | ,, Britton, H. T. S. ... | 1929 |
| 25. | *Science of Soils and Manures* ... | ,, Murray, J. A., 3rd Edn. | 1925 |
| 26. | *Handbook for Cane-sugar Manufacturers and their Chemists.* | ,, Spencer, G. L., 7th Edn. Revised. | 1929 |
| 27. | *Minerals in pastures and their relation to animal nutrition* | ,, Orr, J. B. ... | 1929 |
| 28. | *Text-book of Dairy Chemistry* ... | ,, King, E. R. ... | 1930 |
| 29. | *Dairy Bacteriology* ... ... | ,, Hammer, B. W. ... | 1928 |
| 30. | *Manual of Determinative Bacteriology.* | ,, Bergey, D. H. ... | 1930 |
| 31. | *Mechanism of Enzyme Action and Associated Cell Phenomena.* | ,, Nord, F. F. ... | 1929 |
| 32. | *Bacteriophage and its Behaviour* ... | ,, Herelle, F. D. ... | 1926 |
| 33. | *Botany—A Text-book* ... ... | ,, Robbins, W. J. and Ricket, H. W. | 1929 |
| 34. | *Text-book of General Botany* ... | ,, Smith, G. M. Revised Edn. | 1929 |
| 35. | *Introduction to Structural Botany, Part I—Flowering Plants.* | By Scott, D. H., 11th Edn. | 1927 |
| 36. | *Do. Part II—Flowerless Plants.* | ,, ,, ,, ... | ,, |
| 37. | *Classification of Flowerless Plants, Vol. II—Dicotyledons.* | ,, Rendle, A. D. ... | 1925 |
| 38. | *Dictionary of the Flowering Plants and Ferns.* | ,, Willis, J. C., 5th Edn. | 1925 |
| 39. | *Index Kewensis—Supplement VII* ... | ,, Hill, A. W. ... | 1929 |
| 40. | *Methods of Descriptive systematic Botany.* | ,, Hitchcock, A. S. ... | 1925 |
| 41. | *World's Grasses* ... ... | ,, Bews, J. W. ... | 1929 |
| 42. | *Handbook of Coniferae* ... ... | ,, Dallimore, W., and Jackson, A. B. | 1923 |
| 43. | *Principles of Plant Physiology* ... | ,, Raber, O. ... | 1929 |
| 44. | *Plant Ecology* ... ... | ,, Weaver, J. E., and Clements, F. E. | 1929 |
| 45. | *Introduction to Cytology* ... ... | ,, Sharp, L. W., 2nd Edn. | 1926 |
| 46. | *Botany—Principles and Problems* ... | ,, Sinnott, E. W., 2nd Edn. | 1929 |
| 47. | *Scientific papers of William Bateson Vol. I and II.* | ,, Punnet, R. C. ... | 1928 |
| 48. | *Origin of species by Natural Selections* | ,, Darwin, C., 6th Edn.... | 1929 |
| 49. | *Manual of Mendelism* ... ... | ,, Wilson, J., 2nd Edn. ... | 1929 |
| 50. | *Genetics—An introduction to the study of Heredity.* | ,, Walter, H. E., Revised Edn. | 1929 |
| 51. | *Text-book of Evolution and Genetics...* | ,, Lindsey, A. W. ... | 1929 |
| 52. | *The cell in Development and Heredity.* | ,, Wilson, E. W., 3rd Edn. Revised. | 1928 |
| 53. | *Heredity in Man* ... ... | ,, Gates, R. R. ... | 1929 |
| 54. | *Manual of Elementary Zoology* ... | ,, Borradaile, L. A., 6th Edn. | 1930 |
| 55. | *Paleontology* ... ... ... | ,, Berry, E. B. ... | 1929 |
| 56. | *Home pests and their Destruction* ... | ,, Bainbridge, J. S. ... | 1929 |
| 57. | *Manual of External Parasites* ... | ,, Ewin, H. E. ... | 1929 |
| 58. | *Hand-book of the Mosquitoes of North America.* | ,, Matheson, R. ... | 1929 |
| 59. | *The Garden of Enchantment* ... | ,, Klein, S. T. ... | 1929 |
| 60. | *Oligochaeta* ... ... ... | ,, Stephenson, J. ... | 1930 |
| 61. | *Fungus Diseases of Plants* ... | ,, Eriksson, J., 2nd Edn. | 1930 |
| 62. | *Plant Diseases* ... ... ... | ,, Brooks, F. T. ... | 1928 |
| 63. | *The Fungi of Manitoba* ... ... | ,, Bisby, G. R. and others | 1929 |
| 64. | *Gastromycetes of Eastern United States and Canada.* | ,, Coker, W. C., and Cough, J. N. | 1928 |
| 65. | *Use of Iodine and its Compounds in Veterinary Practice.* | , Reid, H. A. ... | 1929 |
| 66. | *Making of Man* ... ... | ,, Lodge, O., 2nd Edn. ... | 1929 |
| 67. | *How to Enjoy the Starry Sky* ... | ,, Woodward, M. ... | 1928 |
| 68. | *The Universe Around Us* ... ... | ,, Jeans, J. ... | 1930 |
| 69. | *Indian Culture through the Ages, Vol. I, Education and the propagation of Culture.* | ,, Venkateswara, S. V. ... | 1928 |
| 70. | *Corridors of Time Series—* | | |
| | 1. Apes and Men ... ... | ,, Peake, H., and Fleure, H. J. | 1927 |
| | 2. Hunters and Artists ... | ,, ,, ... | ,, |
| | 3. Peasants and Potters ... | ,, ,, ... | ,, |
| | 4. Priests and Kings ... ... | ,, ,, ... | ,, |
| | 5. Steppe and the Sown ... | ,, ,, ... | 1928 |
| | 6. Way of the sea ... ... | ,, ,, ... | 1929 |
| 71. | *Introduction to the Theory of Statistics* | ,, Yule, G. N., 9th Edn., Revised. | 1929 |
| 72. | *Statistical Methods for Research Workers.* | ,, Fisher, R. A., 3rd Edn. | 1930 |
| 73. | *Adjustment of Errors in Practical Science.* | ,, Gibbs, R. W. M. ... | 1929 |
| 74. | *Calculus of observations* ... ... | ,, Whittaker, S. T., and Robinson, G., 2nd Edn. | ,, |

| | | | |
|---|---|---|---|
| 75. | *Priced Vocabulary of Medical Stores, India, 1929*— | | |
| | 1. Drugs ... ... | ..... | 1929 |
| | 2. Surgical Instruments ... | ..... | 1930 |
| | 3. Veterinary ... ... | ..... | |
| | 4. Medical and Surgical Appliances. | ..... | |
| | 5. Bandages, dressings, ligatures and rubber tubing. | ..... | |
| | 6. Veterinary appliances ... | ..... | |
| | 7. Veterinary bandages, dressings, ligatures and rubber tubing. | ..... | |
| 76. | *Gazetteer of the Nellore District, Vol. II.* | ..... | 1929 |
| 77. | *Do. North Arcot District, Vol. II.* | ..... | 1929 |

## B. REPORTS, PROCEEDINGS, Etc.

| | | |
|---|---|---|
| 1. | Administration Report, Ceylon Agricultural Department for 1929. | ..... |
| 2. | Technical Reports, Ceylon Agricultural Department for 1929. | ..... |
| 3. | Reports of Divisional Officers, do. ... | ..... |
| 4. | Report of the Agricultural Department, Leeward Islands. | 1929-30 |
| 5. | Report of the Agricultural Department, Trinidad and Tobago for 1929. | ..... |
| 6. | Annual Report (55th) Ontario Agricultural College and Experimental Farm. | 1929 |
| 7. | Annual Report Statistics Ontario Agricultural Department. | 1929 |
| 8. | Report on higher Education in New York for 1928. | ..... |
| 9. | Report on the cattle breeding operations in the Central Provinces and Berar for 1928. | ..... |
| 10. | Report of the Department of Industries, Madras for 1929-30. | ..... |
| 11. | Abridged report of the Royal Commission on Agriculture in India (Tamil Edition). | ..... |
| 12. | Second Conference of West African Agricultural Officers, 1929. Vol. I. Proceedings. | *Gold Coast Agricultural Department Bulletin Nos.* 19 *and* 20. |
| 13. | Do. Vol. II. Papers ... ... | |
| 14. | University of Madras Calendar for 1930-31. Vol. I, Part 1. | ..... |
| 15. | Do. Vol. I, Part 2 ... | ..... |

## C. MEMOIRS, BULLETINS AND PUBLICATIONS.

| | | |
|---|---|---|
| 16. | Studies in soil colloids, part I and II ... ... | *Memoirs of the Department of Agricultural India Chemical Series, Vol. XI Nos.* 1 *and* 2 |
| 17. | The nutritive values of some typical Indian hays... | ,, *No.* 4 |
| 18. | The nutritive value of gram husk ... ... | ,, ,, 5 |
| 19. | The influence of exchangeable ions in soil colloids on bacterial activity and plant growth. | ,, *Bacteriological Series, Vol. II, No.* 4. |
| 20. | Classification and study of characters of the cultivated rices in the United Provinces. | ,, *Botanical Series, Vol. XVIII, No.* 6 |
| 21. | The Coffee berry Borer .. ... ... | *The Mysore Coffee Experiment Station Bulletin No.* 2. |
| 22. | Facilities for advanced study and research in agricultural science and cognate pure sciences in the United Kingdom. | *Statement prepared by the Imperial Agricultural Research Conference* 1927. |



| | | |
|---|---|---|
| 23. | The Dissemination of Research results among agricultural producers. | *Empire Marketing Board Publication No.* 33. |
| 24. | Index to the Literature of food investigation ... | *Scientific and Industrial Research Department Publications.* |
| 25. | Medical Research—The Tree and the fruit ... | *The British Science Guild. The Norman Lockyer lecture* 1929. |
| 26. | Progress in English farming systems—III—A Specialist in Arable farming. | *Oxford University—Agricultural Economics. Research Institute Publication,* 1930. |
| 27. | Wasps and how to destroy them ... ... | *England—National Farmers' Union Publication.* |
| 28. | Some problems of Indian Meteorology ... | *Oxford University Publication. The Halley lecture of* 1929. |
| 29. | Investigations on Panama disease in Malaya ... | *S.S. and F.M.S. Agricultural Department Scientific Series No.* 2. |
| 30. | An historical note on the greater coconut spike— (*a*) Moth and its three parasites in Malaya (*b*) Preliminary observations on Sogata spp—pests of paddy. | *do.* ,, 3. |
| 31. | On the differences of the physico-chemical properties of the protein, oryzenin, as found in glutinous and in common rice. | *Japan—Hokkadio—Imperial Union Agricultural College Journal Vol. XIV, Part* 3. |
| 32. | (*a*) Physico-chemical studies on the specificity of proteins of different rice varieties and sub-varieties. (*b*) On the differences between some colloidal and chemical properties of common and glutinous rice Starch—II. | *do. Vol. XVI, Part* 2. |
| 33. | (*a*) On the differences in physico-chemical properties of various proteins in plant seeds (1st report). (*b*) On the differences in the physico-chemical properties of the four kinds of rice proteins. | *do. Vol. XVIII, Part* 3. |
| 34. | The Woolly apple aphis in Chosen ... ... | *Japan Chosen Agricultural Experiment Station Bulletin No.* 4. |
| 35. | Results, organization, programs and plan for the period from 1927-28 to 1931-32. | *Publication by the Soviat R.S.F.S.R.* |
| 36. | The coat of the Angora goat ... ... | *Union of South Africa Agricultural Department Bulletin No.* 83. |
| 37. | A study of the Lesser Migratory grasshopper ... | *U.S.A. Agricultural Department Technical Bulletin No.* 190 |
| 38. | Effects of Rye and Vetch green manures on the Microflora, Nitrates and Hydrogen-ion Concentration of two acid and Neutralized soils. | *Reprint from the Journal of Agricultural Research Vol. XLI, No.* 2. |
| 39. | Sheep killing dogs ... ... ... | *U S.A. Agricultural Department Farmers' Bulletin No.* 1268 |
| 40. | Cleaning milking machines ... ... | *do.* ,, 1315 |
| 41. | Strawberry diseases ... ... ... | *do.* ,, 1458 |
| 42. | Marketing Farm Produce by parcel post ... | *do.* ,, 1551 |
| 43. | The results of physical tests of Road building rock. | *U.S.A. Agricultural Department Miscellaneous Publication No.* 76 |
| 44. | American medicinal plants of commercial importance. | *do.* ,, 77 |
| 45. | Summary of state and Territorial plants quarantines affecting inter-state Shipments. | *do.* ,, 80 |

| | | |
|---|---|---|
| 46. | Recommendations of the Bureau of Animal industry on problems of live-stock production. | *U.S.A. Agricultural Department Miscellaneous Publication. No.* 81 |
| 47. | How the National Forests of California benefit the State. | *do.* ,, 82 |
| 48. | Directory of Field activities of the Bureau of Entomology. | *do.* ,, 83 |
| 49. | The United States Department of Agriculture—its growth, structure and functions. | *do.* ,, 88 |
| 50. | The World Wheat outlook 1930 and facts that farmers should consider. | *do.* ,, 95 |
| 51. | Feeding wheat to livestock ... ... ... | *do.* ,, 96 |

**D. LEAFLETS, CIRCULARS, Etc.**

| | | |
|---|---|---|
| 52. | How to send specimens for examination ... | *Madras Agricultural Department Leaflet No.* 71. |
| 53. | 'Coltsfoot' ... ... ... ... | *England—Ministry of Agriculture and Fisheries —Advisory leaflet No.* 3. |
| 54. | Fruit tree red spiders ... ... ... | *do.* ,, 10 |
| 55. | Winter moths ... ... ... ... | *do.* ,, 11 |
| 56. | Rabbit recipes ... ... ... ... | *U.S.A. Agricultural Department Leaflet No.* 66. |
| 57. | A comparative study of dusting by means of airplane and ground machine for the control of the Blueberry maggot. | *do. Circular No.* 123. |
| 58. | Cyprus fisheries ... ... ... ... | *The Cyprus Gazette No.* 2077, *Agricultural Supplement No.* 26. |
| 59. | The Discriminate use of Chemica Fertilisers ... | *The Cyprus Gazette No.* 2082, *Agricultural Supplement No.* 27. |

B.O.





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# The Madras Agricultural Students' Union

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