The Madras Agricultural Journal

1935 - December

VOL. 23. NO. 12.

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Madras Agricultural Journal

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

Vol. XXIII] DECEMBER 1935 [No. 12.

CONTENTS

Editorial.

Fruit. The necessity for the inclusion in an increasing measure of fruits in our diet, is being emphasised of late, by food experts and reformers. The importance of fruits as sources of vitamins for preserving one in health and efficiency is being recognised and yet very little of fruit is eaten by the masses in South India.

The most common fruit available throughout the year and one which is fairly cheap is the banana or the plantain. This fruit, however, is rather difficult to digest except when fully ripe, and it contains very little vitamins, its usefulness being due only to the large amount of sugars and starches it contains. The mango is procurable only at certain seasons and some of the better and more nourishing varieties are beyond the pockets of the poorer classes. In the same category as the mango, will be the orange, several varieties of which are cultivated, including those which are eaten as fruit, like the loose jacket, the batavians and the *sathgudhi* and those which are used for pickling, like the country oranges. The value of the orange has been recognised even in Indian medicine, and it is said, that the practice of a wellknown medical practitioner in Rajahmundry who successfully prescribed orange juice for most ailments has been responsible for stimulating the extension of the area under the local indigenous orange. One can now see on either side of the Kistna canal, several acres of dry lands planted with the country orange.

It is not surprising therefore, that the demand for fresh fruits in India, as a whole has been increasing, as evidenced by the fact that the aggregate value of fresh fruits and vegetables imported into the country during 1933-34 amounted to over 28 lakhs and that in 1932-33 fruits, inclusive of almonds and dates, of a total value of 1·17 crores of rupees, were imported. It must not be foregotten however, that this increasing import reflects more the demand from the wealthier classes, and the poorer classes have not yet taken to fruit as an important item of their diet. While the necessity for a lot of propaganda work by both the Public Health and the Agricultural Departments is thus indicated, much headway cannot be made, unless attempts are made to raise the standard of living. Besides, if the campaign of "eat more fruit" is to succeed, more fruits must be produced within the country and at a cheap cost.

That the Government of the country is alive to the need for improving the fruit industry is evidenced from the large number of grants made by the Imperial Council of Agricultural Research for different schemes of fruit research in the various provinces. Almost every province has now got a scheme either already working or awaiting the provision of funds to start work.

There has been a general awakening all over the world and practically every country outside India is trying to improve or develop her fruit industry. Some of our neighbours like Malaya and Ceylon are now taking an active interest in fruit growing. While every country which has not got an adequate and establishsd fruit industry is attempting to create one, those where the industry is already well developed are out to capture fresh markets or augment already existing markets for their produce. So far as India is concerned, the imports of fruits come both from Empire and Non-Empire countries. During 1933-34 the British Empire supplied 2·73 lakhs of rupees worth of fruits while from outside the British Empire the imports were nearly 6 lakhs worth, the main exporting countries being Japan which sends a large quantity of apples and the U. S. A. which sends both apples and oranges. The market for Japanese fruit in India is of a recent origin and is definitely getting bigger every year.

There is at present in India a trade delegation from Australia studying the question of markets for some of their products. It is stated that India has a very favourable balance of trade with Australia as the total value of imports based on 1933-34 figures was Rs. 102 lakhs against the total exports to Australia of Rs. 298 lakhs leaving a big margin in favour of India. Exports from India consist mostly of Jute which alone is valued at 243 lakhs. The leader of the delegation expects that with the development of Cochin and Vizagapatam harbours there could be direct shipping service with India and the Australian fruits and dairy products should have a

better chance in South India. It may be mentioned that the Imperial Council of Agricultural Research recommended to Government two years ago, protection of the Indian Dairy manufactures. The question of letting a big import of fresh fruits from Australia into S. India will, we are sure be considered when the time comes particularly in the case of such fruits as S. India can produce economically.

There are no doubt possibilities of increasing the production of fruits in the country but the industry has to be taken up by men with enterprise. That even tracts with poor soil and inadequate water-supply can be converted into prosperous fruit-growing areas is exemplified in the case of Palestine which has now a flourishing industry in grape fruit and oranges. Besides increasing the area under fruits, a definite knowledge is required as to what particular kinds of fruits can thrive under particular conditions of soil and climate. It is in giving information and guidance in these points, that the work of the several Agricultural Departments in India could come in handy and help the people to take to fruit growing. While generally in the case of most fruits one has to wait for some years before his plantation can be expected to give any returns, there are other varieties of fruits which can be cultivated by every one without much difficulty. The tomatoe and papayas are instances in point. These fruits contain the important vitamins A, B and C and when eaten in sufficient quantities are said to be a sure protection against beri beri and scurvy.

Almost every agricultural research station of Madras is doing some work on fruit trees suited to the locality with a view to gain experience and making it available to the people in the neighbourhood. Work on plantains is being carried on at the Agricultural Research Stations, Samalkota, Maruteru, Aduturai, Coimbatore and Pattambi. At the Pattambi Station in S. Malabar, it has been demonstrated beyond doubt that the growing of pine apples in dry *modan* lands is a highly paying proposition. Distribution of the pine apple and plantain suckers to various parts of the province is taken in hand by the department as a definite item of propaganda work. The need for a good orchard at the Coimbatore Central Farm to give some training in horticulture for the students has been a long felt want and the one started a few years back promises to be a success. The variety and the nature of fruits produced at this orchard which had been exhibited during the last College day and Conference would have easily convinced everyone of the enormous possibilities of fruit growing in particular tracts of this district.

Though there are a large number of nursery-men in the province who supply budded and grafted fruit trees, complaints about the material supplied are not uncommon. This is engaging the attention of the Department and the propagation of reliable seedlings and budded and grafted plants suited to the locality is now becoming an

important item of the Department's work. Even when suitable plants are not available in the Agricultural Station, the district staff help the growers in getting reliable material from reputed seedsmen. It must be remembered however, that the planting of reliable and good plants does not finish the problems of fruit cultivation. The plants must receive unremitting attention during the early stages if they are to develop into good bearing trees. The district staff is giving assistance by conducting demonstrations in proper methods of pruning, improved methods of irrigation and manuring. There is still another aspect connected with fruit growing in which the Department plays a very important part. Unlike agricultural crops, the fruit trees are subject to numerous insect and fungus pests. Any neglect of these at the proper time might spoil the whole crop. In countries where fruit growing is a developed industry, the growers themselves spray their trees periodically with insecticides and fungicides to protect them from pests. The only crop in S. India where as a result of intensive propaganda the practice of spraying with a fungicide is becoming general is the grapes. The application of chemical sprays and dusts to the fruit trees whenever necessary has now to be carried out by the district staff. This the Department will have to do until such time as the fruit growers themselves realise the importance of such treatment and are prepared to spend some money annually on it as a form of insurance.

Some work has already been done in Madras in the Government Fruit Gardens at Coonoor, Burliar and Kallar with regard to problems connected with fruits of temperate regions like pears, plums, apples, etc., but still there is a wide field for research on the essentially tropical fruits like mangoes, oranges and limes which are all important in Madras. The long felt need for a research station to work on these fruits has now been met by the starting of a station at Anantarajpet near Kodur in Cuddapah district from which tract comes the famous *Sathgudy* oranges of Madras. The Honorable Minister for Development who formally opened this station on the twelfth of this month rightly pointed out that it was an important land-mark in the history of fruit culture in the plains of this Presidency. All important aspects of fruit cultivation will no doubt receive attention at this new station, but one of the problems that will be immediately taken up is to make a survey of the existing orchards in this Presidency and outside in order to stock the station with the choicest parent trees for multiplication and ultimate distribution to the cultivators. It is also proposed to impart training in fruit gardening at this station.

We would like in this connection to draw attention to another important problem connected with the breeding of citrus which includes all the cultivated oranges and limes, which, we are sure, will receive attention at this station in due course. As a result of the

work of the famous Russian Botanist, Professor Vavilov, the importance of exploring the original homes of plant species and making greater use of the wild forms obtained therefrom in breeding; particularly in the vegetatively propagated species have come to be well recognised. Professor Tanaka of the Imperial University, Formosa, who is a world authority on citrus species and who is now on a visit to India points out that India is the original home of several of the citrus species and varieties, many of the forms which are at present under cultivation in the country or imported from outside being improved forms obtained by breeding from the wild types to be found in India. Professor Tanaka opines that an intensive study of the wild forms of citrus occurring in India should prove extremely valuable as it might lead to the obtaining of forms even more useful than what are already being cultivated in different parts of the world. We are glad to note that Mr. Nayak who has been appointed the Superintendent of this Fruit Research station, has had wide experience in fruit growing both in England and in several provinces of India—Bombay, Punjab and Bihar.

One difficulty that already exists and is bound to assume greater proportions with the extension of fruit growing in the country is the want of adequate transport and marketing facilities. The only fruits that are produced to any large extent in Madras and which find a place in markets outside, are the plantains and the mangoes, the latter only during particular seasons of the year. There is a great scope for improvement in the organisation and marketing of these fruits. Considering what has been done in more advanced countries, the fruit grower in South India in particular has yet to learn a lot concerning the method of harvesting the fruits, grading, and packing for transport. Probably the formation of associations and societies interested in particular fruits as for instance the Plantain Grower's Association of Trichinopoly, the District Fruit Growers' Association of Cuddapah, would be of help in taking joint action either in adopting an improved agricultural practice or making representations to get particular disabilities removed. The Provincial Marketing Officer, Madras, has made a survey of the present state of fruit industry in Madras and puts forward some constructive suggestions to develop the industry. We will be publishing his paper on the subject in the next issue of this journal.

THE TILLERS OF THE PEARL MILLET—*PENNISETUM TYPHOIDEUM* (RICH)

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and
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Pennisetum Typhoideum, the pearl millet, is the second important millet in India. This millet is primarily the cereal of light loams in areas of low rainfall. Whereas *Sorghum* is mainly single-stalked and single-headed, the pearl millet is the very opposite of sorghum in being many-stalked and many-headed. In addition to this the plant is protogynous.

The details of the tillering habit of this plant were studied especially with a view to assay the economic aspect of this equipment. The study was made in two years and four seasons, two of them rainfed and two irrigated. The system of branching and the order of flowering were observed in 46 plants, both rainfed and irrigated. The yield of the various kinds of tiller heads was taken in a total population of 278 plants, 78 of which were of the dry land type and 200 of the irrigated—all chosen at random from some of the typical local varieties.

The first subject of study was the internodal lengths of the main stalk of the plant. This stalk is the one that grows right from the seed. The number of internodes above the ground level on this main stalk varies from 6 to 12, nine being the commonest. The next frequent are those with 8 and 10. These exclude the group of very closely disposed internodes which are underground and which give rise to the Primary Tillers. On this main stalk, measurements of the internodes were made in the 9 internoded plants and the trend of the internodal lengths could be expressed graphically by the following numbers representing segments in a thousand—unit length from base upward :— 30, 70, 95, 115, 120, 125, 120, 110 and 215 (Fig. ix). It will be noticed that the bottom-most internode is the shortest in length. The next upper one is a little over twice the first. The third, fourth, fifth and sixth internodes show a progressive increase in length, the seventh and eighth ones a slight decrease, and the ninth and final one, viz., the peduncle, is the longest, being about a fifth of the stalk. In odd instances the fifth or the sixth internode may be shorter in length than the ones immediately below and above it.

The main stalk gives rise to one or more primary tillers arising at or below ground level. These tillers may be a little more or less in height than the main stalk. In internodal lengths they conform

Fig. 1

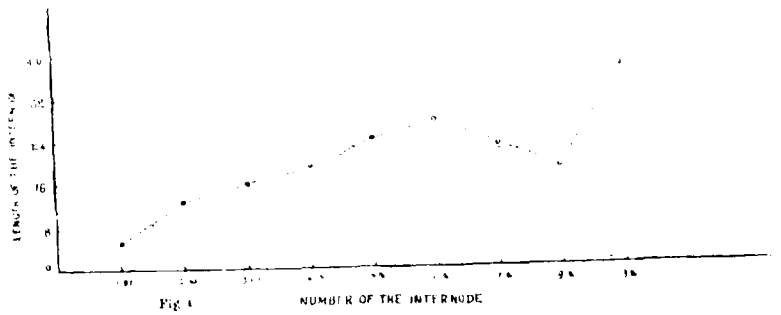


Fig. 2

THE PEARL MILLET—A TYPICAL PLANT

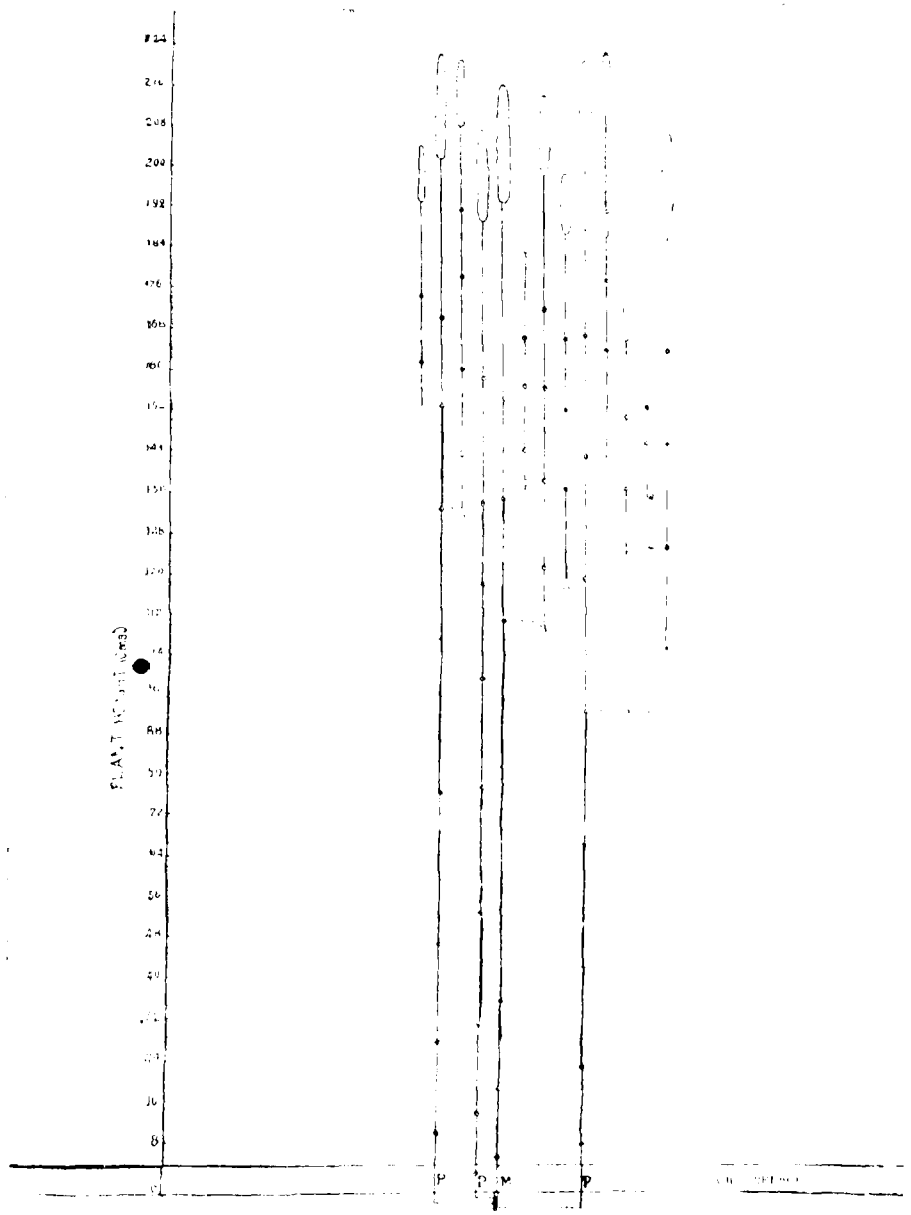


Fig. 3. BRANCHES OF A TYPICAL PLANT IN PENNISETUM TYPHOIDEUM (RICH.) — THE PEARL MILLET

M-main stalk P-primary tiller, S-secondary branch, T-tertiary branch & Q quaternary branch.

to the general trend indicated for the main stalk. This general resemblance to the main stalk makes the group of principal heads, both the main and the primary, the chief source of grain yield in this millet.

Arising both from the main stalk and the primary tillers are the secondary branches. These branches are found to arise from the nodes (leaf axils) in the aerial portions of the main stalk or of the primary tillers. Usually they arise from about half the height of these main and primary shoots (Fig. 2). These secondary tillers are 3 to 5 noded (leaved). Their internodal lengths, when five, tend to a distribution similar to that noted in the main stalk and primary tillers. This repetition on the part of the secondary tiller, the progenitor of another earhead, is very interesting The secondary earheads are naturally smaller than those of the first group but tend to shoot up and keep more or less the same heading zone.

In abnormal seasons or untimely opulence the secondary branches may make a feeble effort at producing branches. These tertiary branches produce very small heads and are borne on thin stalks which are 3 to 4 noded (leaved). In the 4 noded of these, the general tendency for a shorter internode to intervene between the peduncle and the longer internode below, is indicated. The contribution of these tertiary branch heads to the total grain yield of a plant is negligible. They are merely in the nature of an outlet for untimely facilities for growth. Tertiary branches may occasionally give rise to a feeble quaternary branch. This endeavour at the production of such late and weak branches on the part of the secondary and tertiary branches, is the unavoidable sequence of the stimulation of axillary buds so very necessary for the production of secondary branches, whose contribution to grain yield, especially in times of adversity in which there is a diminution in the due output of grain on the part of the main or primary heads, is appreciable.

In figure 2 is sketched a typical *Bajri* plant with its various classes of tillers described above. In figure 3 is given a graphic presentation of the same plant teased up to a parallel disposition of the component parts. It will be noticed that the main stalk is not alone but that there is an endeavour at producing more than one tiller from the ground level. Each of these stalks arising from the ground produces a branch or branches with earheads that are in the nature of a reserve in case of adversity.

This pearl millet is primarily the cereal for areas of precarious rainfall and of sandy soils with poor retentiveness of moisture. Big leaves are unsuited to such conditions. Many small leaves are a necessity. A one-stalked effort may end in disaster as the plant lacks the reserve moisture present in soils suited to the sorghums. Therefore

a first output of primary tillers, and a second gush of secondary branches with their earheads of decreasing size (with an average surface area of 115, 90, 50 and 20 sq. cm. per main, primary, secondary and tertiary head), ensure a many noded, and therefore many leaved condition, (usually up to 60, with a range of about 35 to 90), and serves admirably the needs imposed by its habitat.

The demands of protogyny are met by a compacting of the earhead zone. The branches contribute to this object by an undue elongation of their peduncles which in these are about a fourth to a third of their length as against the fifth of the peduncle length in stalks arising from the ground.

The observations recorded above apply generally to both rainfed and irrigated varieties. There is this difference however between them, viz., a comparatively less incidence of secondary branches and a total absence of tertiaries in the irrigated (see table below).

This difference in the tillering habit between the rainfed and irrigated varieties is reflected in the duration of their flowering. In irrigated varieties the first flush of anthesis is finished in a week. After this, heads from the branches may open their flowers and linger on up to a maximum of three weeks after the first flush. In rainfed varieties the duration of the main flush of flowering is spread out over a period of about 12 days and the last of the tertiaries may be found to have its anthers extruded well after the seeds in the preceding group of heads have set and the crop is ready for harvest.

The order of flowering in a plant was also studied in all the classes of earheads and it could be set down broadly to be as follows:- The head of the main stalk flowers first. Next to it is that of the primary tiller from the lowest node among the ones underground. Next in order is the one arising from the node immediately above it and so on until the primaries finish. In the case of the secondary branch heads the order is generally reversed. Should there be more than one secondary head on the main stalk or any of the primary tillers, the one above flowers earlier than the one below. Similarly in the case of the tertiary branch heads.

The number, surface area and grain yield of these earheads were evaluated by taking counts, head measurements and grain weights on the 78 type plants belonging to the rainfed group and the 200 of the irrigated group. The very late and immature quaternary heads were founded to be negligible both in number and yield and are omitted. Keeping one hundred as the unit, the centages in number, surface area of the major kinds of earheads and of yield per plant were arrived at and are given in the table below.

Season and population.	Number of Earheads.				Surface area of Earheads.				Grain Yield.			
	1 Main stalk head.	2 Primary tiller heads.	3 Secondary branch heads.	4 Tertiary branch heads.	1	2	3	4	1	2	3	4
Main. (Rainfed) 78 plants.	7	32	55	6	20	40	35	5	10	35	50	5
Summer. (Irrigated) 200 plants.	20	60	20	–	25	65	10	–	30	55	15	–

The substantial contribution of the heads from the secondary branches in rainfed varieties and the marked contribution of both the main and primary heads in irrigated varieties is prominently brought out.

Germination tests made on seeds gathered from the various classes of earheads did not show any appreciable differences in their sprouting energy. On an average 90 to 100 per cent. of the seeds from the main stalk and primary tiller heads and 88 to 95 per cent. of the secondary and tertiary branch-head seeds germinated.

It was also noticed that the size of the seed showed a progressive decline with the lateness of the earhead. An estimate of the size of the various classes of seeds was made by counting the number of seeds required to weigh two grammes. About fifty such readings were made in each kind of seed and it was observed that those from the main stalk head numbered from 300 to 400, those from the primary tiller heads 400 to 460, those from the secondary branch heads 500 to 680 and those from the tertiary branch heads 800 to 1500.

These studies reveal how eminently the tillering habit, the flowering sequence of the tiller and branch heads and the general organization of the vegetative and the reproductive phases fit the pearl millet for its role among the cereals.

THE SUGAR INDUSTRY OF AUSTRALIA.

The world congress of sugar-cane technologists that met at Brisbane in Australia towards the end of August this year was the fifth of its kind. The above Society meets once in three years and alternately in the Western and Eastern hemispheres. The last or the fourth session met at Porto Rico in 1932 and the next one is programmed to meet at Lousiana in the United States of America in 1938.

The Indian delegates to the above congress who reached back to India between the middle and the third week of last month consisted of Seth Lalchand Hirachand—owner of a sugar factory and plantation

in Bombay and brother of the well known Seth Walchand Hirachand, Rao Saheb Kasanjee D'Naik sent by the Kesar Sugar Factory, Bareilly in the United Provinces and Rao Bahadur T. S. Venkatraman, the Sugarcane Expert to the Government of India stationed at Coimbatore.

Through one of the Coimbatore canes—viz. Co. 290—India was already known to the Australian Sugar Industry chiefly of the Southern regions. This Indian cane has proved useful to the Australian industry owing to its great resistance to frost and to many of the cane diseases prevalent in Australia. The Hon'ble the Minister for Agriculture, Queensland, made a special reference to the work of the Indian Sugarcane Expert and Sir Leslie Wilson, once the Governor of Bombay and now of Queensland showed a special interest in the delegates from India.

Sugarcanes are used for feeding cattle and horses in Australia. For this purpose they are chopped to 1/8th inch in the case of horses and to 3/8th inch in the case of cattle, mixed with wheat bran, molasses etc. and fed. The animals are said to relish and thrive on such mixed feed.

It was interesting to see in Australia the various ways in which molasses was being utilized. Recently there has been a glut in India and many factories found themselves with stocks of molasses which they were unable to dispose of. It is applied directly to fields as manure at 5 to 8 tons to the acre, mixed in cattle food and used in the manufacture of power alchohol. This molasses-power alchohol is mixed with Benzene in a certain proportion and all Government vehicles are enjoined to use this mixture.

The Sugar Industry in Australia has certain features of special interest to those engaged in sugar. For one thing, Australia grows the sweetest cane in the world—the peculiar set of climatic conditions, obtaining in that country contributing to this happy result. The dominant cane in the Australian industry is Badila, a cane which has proved useful—under the name of Fiji B—in one of the sugar estates in South India.

Secondly the wages for labour in Australia are very high - the field labourer in that country having to be paid by law per day as much as a labourer in India or Java receives for almost half a month. At the time of the Congress this worked to almost Rs. 9 a day. This has resulted in a marked development in that country of labour saving machinery which is employed all through the life of the crop from the planting to the harvest. The output per man hour is therefore much higher in Australia than in most of the other cane countries of the world.

Thirdly, though it is comparatively more costly to produce sugar in Australia because of the 'white Australia' policy, the industry is kept going so as to provide the Australians with home sugar, to secure

employment for the people and to colonize and populate the North part of Queensland which is considered to be rather a vulnerable point in that country. It is only the sugar industry there that is keeping the people on that land. The higher cost of production is largely due to the higher wages for labour in that country which again is due to the higher standard of living that is maintained therein. Cheap black Kanaka labour was once employed in the sugar plantations but this has all been steadily substituted by white labour.

The sugar industry in Australia is artificially nurtured, controlled and protected in all stages—the area of supply being assigned to each factory, wages of labour and hours of working fixed, compulsory holiday enforced in the factory on Sundays, and the price to be paid to the grower fixed as also the price at which sugar is to be sold in the Australian market. The peculiar basis on which the Australian Industry is run will be evident from the fact that at the time of the Congress the price of sugar in the home market was 4 pence a lb though its selling price in London market was only about 1½ pence (both in Australian currency). In spite of this obvious loss on every ton of sugar exported—this was roughly computed at about 6 to 18 pounds (Australian)—that country finds it necessary and worthwhile to keep the Industry going for the reasons already indicated.

The obvious lesson to India is that it is necessary to keep the ancient industry of cane growing in India going and develop it in all ways in the interests of the agricultural prosperity and well being of the country as a whole. The Government of our country was therefore fully justified in affording the sugar industry of India the tariff protection it is receiving at present.

"*A Delegate*".

THE IMPORTANT INSECT PESTS OF THE CASTOR OIL PLANT IN S. INDIA WITH SUGGESTIONS FOR THEIR CONTROL.

By Dr. T. V. RAMAKRISHNA AYYAR, B. A., Ph. D.,
Retired Government Entomologist.

Among the different oil seed crops cultivated in India, the castor plant (*Ricinus communis*) appears to be one of the most important and extensively grown ones. Recent statistics* indicate that among the well-known castor growing areas of the world, such as Brazil, Russia, India and Egypt, India stands not only as the foremost grower but is also responsible for over 90 per cent of the world's export trade in castor. Inside India though the crop is cultivated in small areas in parts of Berar, Baroda, Behar and the United Provinces, we find that

* The writer is indebted to Dr. Patel, the Oil Seed Specialist for information on this point.

the largest area under castor is to be found in Peninsular India including the Nizam's dominions, Mysore and the Madras Presidency; in fact, the area under this crop is greatest in the Nizam's dominions, the ceded districts and Mysore coming next in order. It is also well known that apart from its use as an oil seed producing plant, the castor plant is also utilised in many parts of India to feed the eri silk-worm—the rearing of which is becoming a popular and important cottage industry; in fact, the eri silk-worm is so named after its food plant (*Erandi* or *Eri*—castor). In view of such importance, it is up to South India to do everything in its power to hold its own superior position as the premier castor growing area in the world. One of the duties of the South Indian Castor grower, therefore, is to have sufficient knowledge of the insect pests, which cause serious damage to the growing crop, which often results in substantial loss to him.

It is the writer's idea in this paper to give the South Indian castor grower some general ideas of the more important insect enemies of that plant in this province with some suggestions in controlling them, so that they might be able to grow as far as possible a pest free crop.

Insects found on Castor. Of the several insects which levy their seasonal toll on the castor crop in the different areas of this province the more important and the more numerous are those which feed on the foliage and the great majority of these are what are known as leaf eating cater-pillars. Among the others which possess other habits such as boring into the plant tissue or sucking the plant juice, we have a shoot and capsule boring caterpillar, a stem boring beetle and some bugs including what are known as leaf hoppers, scale insects, stink bugs and mealy bugs. The important insects so far noted as more or less injurious to the castor plant can be grouped conveniently as below showing the general habits and the insect group to which each belongs.

Table of Castor Insects.

A. **Caterpillars.** (Biting insects).
- I. Feeding exposed on the foliage.
  - (a) Smooth caterpillars (both moths).
    - i. Semilooper *Achoea janata*, L.
    - ii. Ordinary *Prodenia litura*, F (known as the Tobacco caterpillar).
  - (b) Hairy caterpillars (all moths).
    - i. Uniformly hairy — Black—*Pericallia ricini*, F; Yellowish—*Diacrisia obliqua*, W
    - ii. Hairs with tussocks also — Reddish—*Euproctis fraterna*, M; Greyish—*Olene mendosa*, H; Yellowish brown—*Orgyia postica*, W.
  - (c) Case bearing caterpillar (moth)
    - Bagworm—*Clania crameri*, W.
  - (d) Spiny or slug caterpillars
    - Spiny—*Ergolis merione*, Cr. (Butterfly)
    - Sluglike—*Parasa lepida*, Cr. (Moth).
- II. Boring caterpillar—The shoot and capsule borer—*Dichocrocis punctiferalis*, G. (moth).

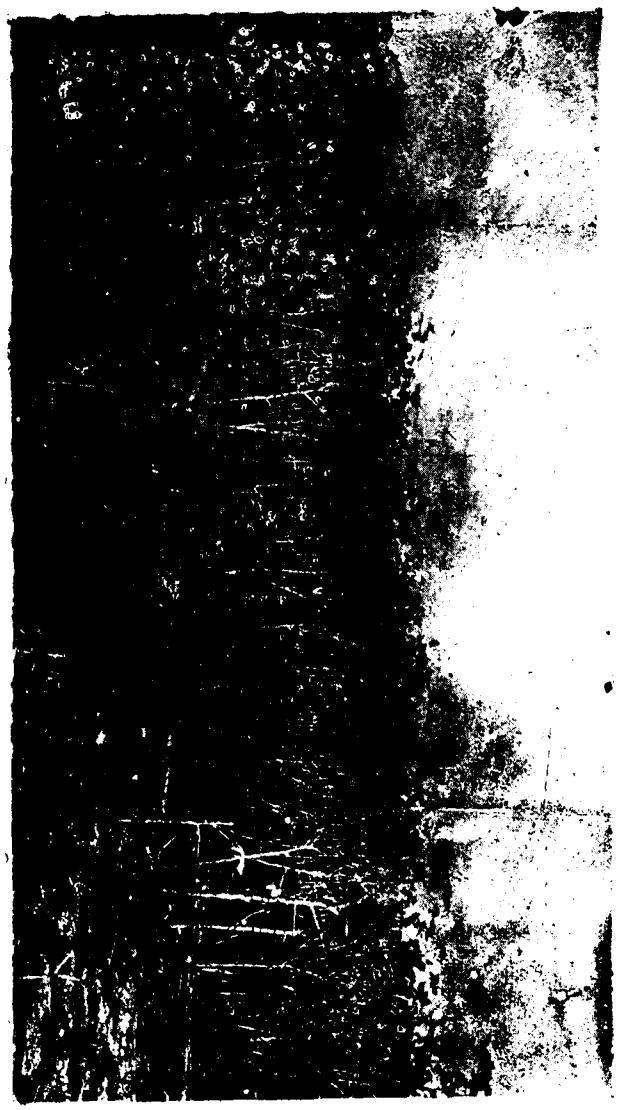
B. **Beetles.** (Biting insects).
- I. Leaf eating—Flea beetle—*Hermacophaga ruficollis*, L.
- II. Boring beetle—shot hole borer—*Xyleborus fornicatus*, E.

C. **Bugs.** (Sap sucking insects).
1. Stink bugs—The green plant bug—*Nezara viridula*, L.
2. Leaf hoppers—the green jassid—*Empoasca flavescens*, F.
3. Scales and mealy bugs—Black scale—*Saissetia nigra*, N.
4. Mealy wings—castor mealy wing—*Trialeurodes ricini*, M.

Major and Minor Pests. From the above it is evident that about twenty forms pay their attentions to the castor crop to a smaller or greater extent now and then. However, the castor grower need not be frightened at this fairly long list of insect guests, since it is generally found that neither do all these insects appear as regular pests season after season, nor does any one of them cause equally serious damage. Some of them are of minor importance and some others only appear rarely as sporadic pests while only a few are of real importance. The above list is given however to give the cultivator a general idea of castor insects to help him to make them out when they appear on the crop. The really serious or major pests of castor which appear more or less regularly and cause appreciable injury to the crop are caterpillars including some of the leaf eating forms and the seed and shoot boring caterpillar.

Leaf-eating Caterpillars. It is hardly necessary to state at the outset that these caterpillars are the young ones or larval stages either of moths or butterflies and these latter which are the adults do not cause any direct harm to the growing crop. Among the ten leaf-eating forms noted above under this category the semi looper *Achoea janata*, L. is the most important and is a specific pest of castor found very rarely on other cultivated plants. It enjoys a very wide distribution being found all over India. The adult insect is a stout built dark greyish brown moth with the fore-wing showing wavy brownish transverse lines and the hind wing having black and white patches. (Fig. 4 plate). The full grown caterpillar which injures the foliage is about 2 to 2½ inches in length, smooth and having a greyish to dark brown colour (occasionally different shades of brown colouring are noted often with dark and brown markings also). Unlike the great majority of caterpillars which crawl about like worms, this insect is a semi looper the first pair of pro-legs becoming functionless. The insect starts its active life from young caterpillars hatching out of bluish green round beautifully sculptured eggs laid singly on the tender portions of the castor plant. Young caterpillars pass through the usual moults and in about two weeks assume the full grown condition described above. It is during this period that the damage is done to the foliage and this is often so serious that a whole plot is completely

stripped of the foliage in the plants which are practically skeletonised. (Fig.) When fully fed the caterpillar changes into the pupa condition either under the soil or inside folds of leaf on the plant itself and emerges as the adult moth in about another two weeks. The whole life cycle from egg laying to adult condition generally occupies about four weeks; this period varies according to weather conditions in different localities. As stated above this insect is found very rarely and only in small numbers on other plants and these include the Rose, the Pomegranate and one or two species of *Euphorbia*. For details on the bionomics of this insect reference may be made to Lefroy (1). All the leaf eating caterpillars of castor have more or less the same life histories with, of course, some differences, in the manner of egg laying, pupation and other minor characteristics. Next in importance to the castor semilooper comes the smooth cylindrical stout caterpillar (*Prodenia litura* F. fig 3 Pl.). This insect, the adult of which is also a stout built brown moth, is a very common insect found in a number of other plants besides castor and is a specific pest of tobacco; hence popularly known as the tobacco caterpillar (4). The eggs of this moth are laid in batches of many, each batch being hidden under a covering of felted hairs. The young caterpillars feed together gregariously during the earlier stages and separate gradually as they reach the full grown period; at this latter stage the caterpillar is about an inch and a half in length, cylindrical and of a dark to blackish brown colour with yellowish and dark patches on the segments. The pupation takes place underground in an earthern case; in a week or ten days the adult emerges from the pupa. The other caterpillars feeding on castor foliage are not of general occurrence, but occasionally appear as sporadic, and sometimes cause serious damage. The commonest of these are the different hairy larva of which the tussock caterpillars are the ones more frequently noted. These are all larvae of moths and among these the yellowish brown form (*Orgyia postica* W. *Fig* 8. *Pl.*) now and then assumes destructive proportions as may be found from the author's paper [3] on this insect and his colour plate in another paper [5]. The other two tussock caterpillars and the hairy caterpillars are *Euproctis fraterna*, *Olene mendosa*, *Pericalla ricini and Diacrisia obliqua* having the same habits as *Orgyia*; these are occasionally found in company at the same time. The last two are however very rarely seen in serious form. *Pericallia* (Fig. 7 pl.) is a more common pest of banana and lablab and *Diacrisia* is generally found on the hills and in North India as a general feeder. The bag worms which move about often enclosed in bags or cases made of thorns and sticks are not serious on castor in S. India. The slug caterpillar (*Parasa lepida*, C. fig. 1 Pl.) which is apple green and covered with irritating spines and hairs is occasionally found as a pest on castor. The pupal cases of the creature are found as hard shell like objects attached to the plant stem (see fig. pl.) The spiny caterpillar (*Ergolis*) is the only one among these numerous



Castor Crop defoliated by Leaf eating Caterpillars

INSECT PESTS OF CASTOR

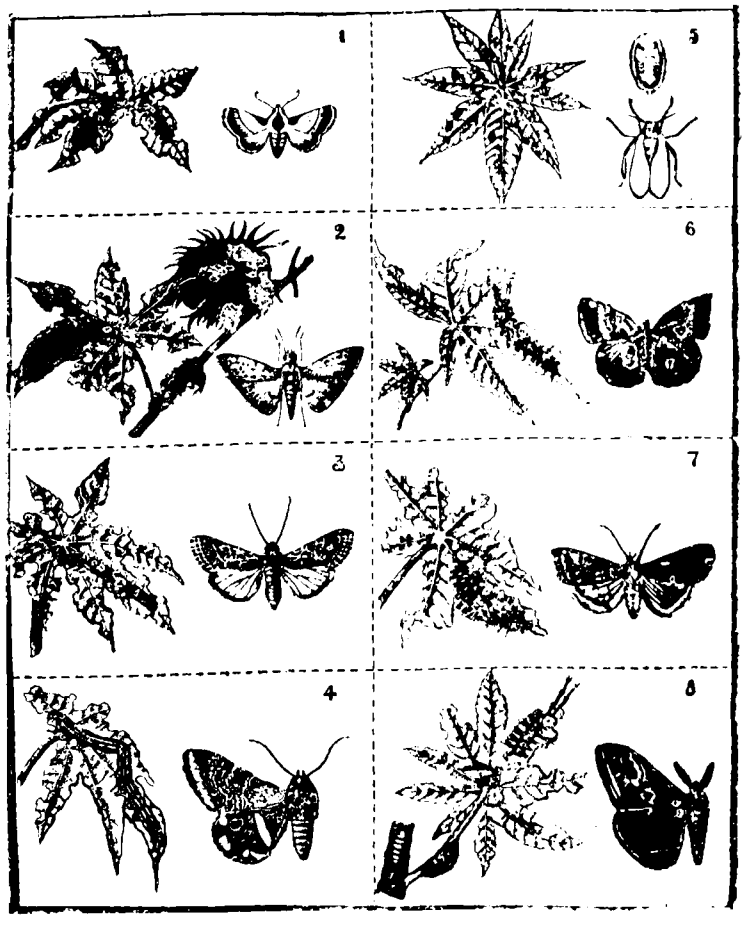


Fig. 1. Castor Slug. *Parasa lepida.*
Fig. 2. Boring caterpillar. *Dichocrocis punctiferalis.*
Fig. 3. Leaf eating caterpillar. *Prodenia litura.*
Fig. 4. Castor Semilooper. *Achoea janata.*
Fig. 5. Castor mealy wing. *Trialeurodes ricini.*
Fig. 6. Spiny caterpillar. *Ergolis merione.*
Fig. 7. Black hairy caterpillar. *Pericalia ricini.*
Fig. 8. Brown hairy caterpillar. *Orgyia postica.*

caterpillars which is the larva of a butterfly instead of a moth; the insect is a uniform snuff brown creature found flying about during day time unlike the moths (fig. 6 Pl.)

Borers. We now come to the borers which include (a) a caterpillar (*Dichocrocis punctiferalis*, G.) which is in fact a somewhat important pest more or less with a status equal to the semilooper or the commoner leaf caterpillars and another (b) a small dark brown stem boring beetle (*Xyleborus*). The former is a short stout pinkish brown caterpillar with dark spots. It bores into the shoots especially at the junction of the main stem and the side shoots or leaves and in addition it also attacks the ripening fruits or seed capsules. The incidence of this insect on the plant is indicated by the presence of black excrementatious matter and webbing covering infested shoots and seed capsules. This broing caterpillar is often noted as a pest of Turmeric, Ginger and Cardamom also in different parts of S. India. The adult insect is a medium sized moth with yellow wings, spotted in dark (Fig. 2 pl.).

Beetles. Coming to beetles and bug pests of castor, most of them are of minor importance and are very rarely found as serious. The boring beetle (*Xyleborus fornicatus*, E) is a small reddish brown creature found usually boring into the stem and producing numerous holes just as is found on bamboo and other posts in buildings throwing out powdery matter from the stem. This was found serious on a species of the red variety of castor in Bangalore and has been recorded by the author in a previous paper [5] with a plate. It is an insect found on Tea and other hill plants in Ceylon and South India. Tender leaves of castor are occasionally found attacked by a very small greenish flea beetle (*Hermacophaga ruficollis*, L); numbers of this creature often bite small round holes on the leaves and thus injure the foliage. These are very active creatures and leap like fleas.

Bugs. Among sucking insects found on castor the commonest is the mealy wing (*Trialeurodes ricini*, M. fig 5 pl.) which has a wide distribution all over India. It is a very small snow white winged moth like creature, often found in thousands on the under surface of castor leaves, especially on the foliage of fairly well grown plants. Hundreds of small yellowish seed like eggs are laid by this bug and from these emerge practically stationary larvae which are the real pests sucking the nutrition from the foliage. These larvae are more or less fixed to the leaves like scales, and in bad infestations the whole field appears pale ashy white and sickly and sticky to the touch due to the sweet secretion thrown out by thousands of these larvae. Scales and mealy bugs are rarely found and the species usually found among scales are the common black scale (*Saissetia nigra*, N.) the one generally found on various plants like cotton, coffee, Guava, *Thespesia* etc. and among the mealy bugs the common tomato and croton mealy bug

(*Preudococcus virgatus*, C.) is sometimes found. Both these are very rare and hardly cause any injury to the plants.

During the younger stages of the crop a small green leaf hopper (*Empoasca flavescens* F.), almost similar to the one that attacks cotton, sometimes appears in swarms on the folige, suck up the juice from the leaves and make them fade and curl up; but very rarely is serious harm caused. From the above brief account we find that the only important insects the activities of which the castor grower in South India will do well to watch are a few of the leaf eating caterpillars and the borer caterpillar.

Control Measures. As in the case of most pests, both preventive and curative methods can be adopted in the case of castor pests also. For the leaf infesting caterpillars both preventive and curative measures can be adopted; the former consists chiefly of cultural operations which will make the plants vigorous and keep away or withstand pest attacks, and the latter of mechanical and insecticidal operations. Among mechanical operations, the picking of egg masses and clipping off of and destruction of leaves containing numerous young caterpillars feeding together will be found very useful in the case of the tobacco caterpillar and the hairy larvae, all of which lay eggs in masses and the young caterpillars of which are gregarious in habits. In the case of the castor semi-looper and frequently with the tobacco caterpillar prompt hand picking of the smooth caterpillar will be found effective and economical. When, however, the caterpillars are noted late at a time when they have already multiplied and increased in numbers and may not be amenable to any of the above measures, insecticidal methods can be used with advantage. The insecticides in this case where the creatures are all biting insects stomach insecticides (viz. those which cover the plant surface which when eaten will poison the insects) are to be used. These usually include arsenical preparations. Lead arsenate and Calcium arsenate are the ones which can be used either in the powder form or as a spray liquid mixed with water. In those localities, however, where water cannot be easily got, dusting the insecticide as a powder is certainly more effective and economic; dusting should however be done where there are no strong winds in the field or if the winds persist, then it is better to use the material as a spray. Dusting will be very effective if done early in the morning when there will be dew drops on the foliage which will make the poison dust stick to the leaf surface. These insecticides and the necessary appliances such as dusters and sprayers can be easily got from wholesale chemists or through the officers of the Agricultural Department.

For the shoot and capsule boring larva only preventive measures can be adopted since the creature feeds from inside and no external applications of insecticides will have any effect on it. The measures suggested are the prompt cutting off and burning of infested shoots and capsules and preventing their multiplication. The same is the case with the stem boring small beetle (*Xyleborus*). Very rarely do any of the sucking insects (bugs) found on castor call for any serious attention. If and when they do appear serious a spray with crude oil emulsion or tobacco decoction will check them easily. The mealy wing and any mealy bugs will also be easily controlled by such a spray. For the leaf hopper, when it becomes serious the waving of boards or winnows smeared with gum or some sticky material will trap hundreds of the hoppers and appreciably reduce their number on the crop.

In speaking of control measures it is possible that with some gradual observation and experience the cultivator can adopt in certain cases the method known as the Biological control of pests; this chiefly consists in the discovery of the enemies, especially insect enemies of the plant pest and artificially make use of them to destroy the pests. Different insect pests have different kinds of enemies and these have to be discovered and their habits and pest controlling capacity tried. In the case of castor caterpillars—the castor semilooper has been found subject to three or four parasitic insects which destroy it, very appreciably during certain seasons. The commonest of these parasites is a small dark braconid wasp (*Microplitis ophiusae*, R) described by the writer in his paper in 1921[3]. The presence of this parasite is easily found out by the peculiar position occupied by the parasite cocoon under the tail end of the dying semilooper caterpillar. Other wasps have also been noted recently on this and some on the castor boring caterpillar among the Ichneumonid and chalcid wasps. When the presence of such parasites is noted in the field it is better to collect these and keep them in a wire gauze cage near the field so that the wasps which emerge can pass out through the meshes of the gauze cage while the moths if any from the cage cannot emerge through the small meshes of the gauze. The beneficial wasps will go into the fields and do their good work on other caterpillars.

In conclusion it may be stated, that though the castor crop suffers less from insect pests compared to other crops like cotton, cholam or paddy, the damage it occasionally suffers from caterpillar plagues is often wholesale and very serious. The castor cultivator cannot therefore afford to ignore the insect pests of his crop and allow them to levy their heavy toll during certain seasons. A general knowledge of these pests will certainly be of advantage to him to save his crops from the clutches of insect pests and it is hoped this paper might help him to some extent in that direction.

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THE WAY OUT

BY J. RAGHOTHAMA REDDY—STUDENT (B.Sc., III.)

The complexity of the Indian situation, as it exists to day is so immense and the causes so complicated that it is wellnigh impossible to think of any one aspect as divorced from the other. Yet two problems, the unemployment of the educated and the agricultural backwardness of the masses do loom large on our socio-economic horizon. These two problems have during the past few years defied all attempts at solution and continue to make a demand on the constructive statesmanship of the greatest of us. And therefore any scheme or any course of action which combines in itself the solution entire or partial of these two important issues merits not only careful consideration but a bold trial, and it would be ideal if a solution of either problem can be achieved as a direct or indirect result of the other being tackled. Of the two issues, the unemployment of the educated middle class being considerably smaller in magnitude, can be tackled first and the enormous energies of educated youth can be liberated and harnessed to the advantage of "greater India". When sure enough we will be nearer the solution of the rural problem with the field of scientific agriculture being so vast and so pregnant with potentialities, that it affords a promising field for the absorption of the energetic youth. If during the last so many years no considerable number of the educated classes has gone back to the land, it is due to no fault of theirs. Students from arts colleges found themselves unfit for the task, and even the graduates of agriculture lacked push and courage to fall back on their own resources. Above all, a secure and comfortable berth in Governmennt service as against the hazardous profession of agriculture held out more temptations. Circumstances have thus conspired to make the Indian youth develop a lethargic outlook with the result that he would rather remain unemployed than resort to an independent though risky profession, as agriculture is at the present day. Whatever may be the reasons for this deplorable state, the tragic fact has to be boldly faced and unless he is put on the land with all conveniences provided, even a graduate in agriculture is not likely to take to his profession in near future.

There are in all parts of the country vast stretches of land which can be profitably reclaimed to advantage and brought under scientific farming. Educated unemployed youths may be allowed to start farms on such areas with the financial aid and active inspiration of the Government. If any thing substantial is to be done these farms ought to be worked even as the Government farms are, only with this difference, that the responsibility of profits and losses is transferred to the individuals.

The graduates as they emerge in large numbers annually from the Colleges of agriculture should be absorbed into the system and should be promised a small allowance for a limited period of 3 years. During this period they should for some time be put on some farm to undergo practical training and later should be left with separate blocks of fields to work them out to an economic success. Once this is done the young graduate will begin to have confidence in himself and then a certain number (about 20 or 25) should be made to colonise in a readily accessible part of the country with separate areas of about 50 acres each but all situated near one another. Lands should be provided by the Government. Implements and livestock should be purchased on a co-operative basis. Large machinery like threshers, cane crushers, oil expellers, cotton gins, sprayers and other rarely used machinery should be common to them. All common articles like the above machinery should be under the control of a committee from amongst them and should be supplied to one or the other according to the urgency of the work to be done.

Permanent improvemets on the land like levelling, provision of drainage, construction of permanent irrigation channels, residential houses and coolie quarters, sinking of wells etc. should be financed by the Government to be recovered, in easy instalments. The marketing etc. should be done together and the whole concern must be like that of a single closely knit family. An organisation like the above stands the risk of being condemned as one calculated to perpetrate the dominance of the educated middle classes unless demands of labour interest are adequately met. To get over this the colony in return to the Government aid may be required to be controlled by special laws and legislation for the regulation of labour charges. A share of $\frac{1}{2}$ to $\frac{2}{3}$ of net profit after deducting expenses on livestock machinery interest on certain items of capital expenditure etc. if divided among the labourers would easily satisfy them. This division of profits should not be carried out either for every crop or for every year, but should only serve as a guiding principle for fixing wages. From time to time a committee of labour leaders, officials, non-officials and representatives of proprietors may be appointed to go into the question more fully and fix up reasonable wages to be paid, subject of course to the fluctuations in commodity values.

It may be contended that for a collective practical farming scheme like the above the advanced knowledge of agriculture and its allied sciences afforded by the degree in agriculture is not necessary. But it can readily be seen that such an advanced state of knowledge is not only useful for the immediate purposes but will also give the small scale proprietor a fuller grasp of ultimate problems, economic, agricultural and political.

Culturally also they may form a single highly organised and efficient unit. They may be brought together not only for recreation but

for discussing kindred problems and arriving at solutions. Given facilities, such a colony will easily form the most efficient centre from which will emanate valuable literature in the form of bulletins and pamphlets now prepared solely by Government agencies. Moreover, the conclusions arrived at by these young pioneers will have the backing of actual field conditions and will embody in themselves a type of popular appeal which the Government literature is ever bound to lack in.

If these are to be of maximum use and educative value, they should be spread out all over the country and more particularly in densely populated areas, where intensive agriculture is the crying need of the hour. It may be difficult to get large tracts of lands in early stages but in course of time a popular organisation can easily buy up lands, where ever necessary, either in bits from peasants or in large areas from declining zamindaries or others in the grip of money lenders.

A colony of a thousand or less acres for every taluk will cause a stir in the agricultural consciousness of the masses and will achieve useful results the magnitude of which it is difficult to imagine today. Once this is done the department can relax its attention as regards agricultural propaganda to a considerable extent and can more elaborately and exhaustively turn its efforts to scientific research and general organisation. These centres of modern agriculture will soon grow in importance and will become seats of agricultural pilgirimage to the ryots, from where they will derive hope and inspiration for future. The scheme thus solves at one stroke, two knotty problems the employment of the uneducated middle class youth and propaganda for the betterment of the peasant. The question will now arise, what happens to the labourers? The influence on them will be of a more far-reaching nature. When wages are to be regulated by an impartial agency they are bound to rise to decent height and the competition will increase, as regarding employment in these colonies resulting in higher efficiencies. The proprietors having no way open to them to reduce wages as a result of competition will naturally resort to selection of better and more efficient men and hence as the demand for efficiency rises the general standard among the labouring class is bound to rise.

Thus within the folds of a single scheme on the lines indicated we solve to a considerable extent the rural and the urban problems and also greatly increase the national wealth of the land.

What is wanted is a bold policy and initiative by the Government, which if forthcoming is bound to bring in its train the solution of these great problems. And the scheme is so flexible as regards magnitude that there is absolutely no reason why our well to do zamindars should not rise to the occasion and become the torch bearers of the emancipation of rural India.

Will it be too much to hope that they will realise the gravity of the situation, and not only help their country but cover themselves with glory by their statesmanlike attitude, as worthy descendants of the aristocracy of the land, by readily agreeing to be pioneers in this scheme of rural development.

Whatever be the difficulties in the way a definite plan of action as outlined briefly above has to be done and that too quickly if the country is to be saved from the throes of an economic revolution. Will the facts be faced?

ORIGIN OF CITRUS SPECIES

Under the auspices of the Association of Economic Biologists, Coimbatore, Dr. Tanaka, Professor of Botany and Horticulture at the Imperial University, Foremosa gave a lecture on the origin of citrus species and varieties on the 14th evening. Dr. Tanaka who has been making systematic studies of the citrusses of the world for the last 25 years is an authority on the subject. In his very interesting lecture, he explained how the earlier classifications of the citrus group into genera and species were very defective and referred to a much more satisfactory classification adopted by him and the characters on which such classification was based. He described the geographical distribution of each species in various parts of the world and pointed out that N. E. India was the original home of several of the species. Evidently these have been taken abroad in early times and many of the forms which are now either locally produced or imported from outside are improved types of these wild forms. He stressed the great importance of studying intensively these original homes of citrus varieties, as such studies might easily result in obtaining forms more valuable than what exist today. He hoped that such studies will be taken up in India which should benefit not only India but several other countries of the world interested in citrus.

ABSTRACTS

The protection of Barley-seed through post harvest pollination. By Merrit N. Pope. (*The Jour. of Her.* Vol. 26 No. 10 October 1935. P. 411.) A record of a remarkably unique experiment, Four spikes of a barley variety (Hanncher C. 1. No. 531) with unripe pollen, were harvested, emasculated, and kept in distilled water; two days later, when most of the stigmas were receptive, these spikes were dusted with pollen from 2 other varieties. Fertilisation was evidenced in a few days and the seeds produced were sown in the next season and they produced spikes which showed their hybrid character, proving that viable seed can be produced by pollinating flower even after harvest. M. R. B.

The Etiolation Shoot method of Fruit Propagation. By J. Lambourne. (*Mal. Agri. Jour.* Nov. 1935 P. 514-) The paper is a progress report of work done up to September 1935, on propagation of fruit trees, at the Central Experimental Station, Serdang, Malaya. Many of the trees experimented with, are familiar to us, including citron, guava, mango, jack, *Eugenia*, lemon, lime, orange, and even tamarind. Incomplete as the investigation up to the present stage is, the results are interesting as it has been found possible to propagate by the etiolation method, (Vide M. A. J. July 1935) a large number of plants. Among those which root freely, making it practicable to raise a large number of them from small plants, are the lime, the lemon, the guava, the Mandarin orange and the *Eugenias*. For the mango, the method appears to be too slow, but the author

is hopeful that with modifications of the existing method, better results will be obtained in the future.

Besides orchard plants, other economic plants like, coffee, tea, cinnamon and gambier, have also been experimented with, and some success has been attained with coffee and tea. Further investigations will be watched with interest, as results obtained would go a great step forward in the vegetative propagation of many plants which are now raised only from seed M. R. B.

Ascorbic acid (Vitamim C) content of some Indian plant materials. By M. Damodaran and M. Srinivasan. *Pro. Ind. Acad. Science Section B.* Vol. ii. No. 4; Oct. 1935. Pp. 377 to 387) The article is an extremely welcome and valuable contribution to our knowledge of the nutritional values of Indian plant materials, analytical data on the vitamin contents of which, are rather meagre. The authors, have by employing the Tillmans–Harris technique, determined for various plant materials, their Ascorbic acid content. Ascorbic acid is vitamin C, the anti-Scorbutic food essential. The following table, wherein food materials familiar to us, are divided into three groups, will be of great interest. It will be seen that oranges, chillies, drumsticks and *agathi* are high in this vitamin, while amaranthus, pepper, sugarcane, and snakegourd are deviod of it.

SOME PLANT MATERIALS

Rich in Ascorbic Acid.	Poor in Ascorbic Acid.	With no Ascorbic Acid.
1. Gooseberry	1. Margosa.	1. Amaranthus.
2. Drumstick leaves and pods.	2. Papaya.	2. Jackfruit.
3. *Agathi.*	3. Cluster beans.	3. Cucumber.
4. Cashew apple.	4. Sword bean.	4. Wood apple.
5. Custard apple.	5. Betel leaf.	5. Sweet potato.
6. Jujube.	6. Dolichos lablab.	6. Plantain stem.
7. Chillies.	7. Lady's finger.	7. Green pepper.
8. Limes.	8. Pomegranate. Juice,	8. Sugarcane.
9. Oranges.	9. Melon.	9. Snakegourd.
	10. Bringal.	10. Ginger.
	11. Tender coconut Juice.	

Chillies are actually very rich in vitamin C content but the stalk and the seeds are extremely poor, and this constituting a good portion of the material lower the ascorbic acid value of the whole fruit. Among the oranges, the vitamin content varies with the variety, the *Sathgudhi* being the highest the *Kamala* and the *sour Lime* being the lowest. M. R. B.

Gleanings.

Manufacture of Golden-Syrup. Golden syrup is now made from clarified juice, to which raw sugar may be added to increase its density. The process is simple and can be carried out by any factory; the syrup prepared with cane juice has a better aroma than one prepared from refinery molasses. The solution is heated in a double bottom defecator (cast iron outer bottom and inner copper bottom), skimmed, and evaporated to a density of 20° *Banme* The syrup is allowed to cool to 58° Centrigrade; it is next treated with invertase at the rate of 0·25 gram per litre (dissolved in water). The action of invertase is to invert part of the sucrose and also to prevent sucrose from crystallising out from the final product. Invertase can be obtained as a yellowish powder from any drug house.

After adding the invertase, the syrup is allowed to stand twelve hours at the temperature of about 55° C. It is then decanted, concentrated to 40° Be., and finally run through a cooling coil to a storage tank from which it is filled into suitable tins. The reason for using open evaporators is to preserve the aroma which if treated under various vacum would be destroyed. Abstract in *Facts about Sugar*, Vol. 30, No. 10, October, 1935).

Value of Organic Manures to Indian Soils. Experiences in other parts of the world lend support to the results and findings from Indian experiments. The average nitrogen content of Indian soils is 0·05 per cent and the organic carbon content is 0·6 per cent. Similar figures for European soils are 0·15 per cent nitrogen and 3·0 per cent organic carbon so that European soils are thrice as rich as ours in nitrogen and five times as rich in humus and still the demand is for organic matter. The needs of Indian soils are patent, and the manurial data portray the requirements correctly. Cattle, green and other organic manures are valuable to soils because they supply what is popularly known as *humus*, which is so essential to maintain soil ferlility. Organic manures supply "body", "substance" or "heart" to the soil and this artificial mineral fertilisers cannot do. The need for organic matter for Indian soils is more imperative because the destruction of organic matter is more rapid under the high temperatures obtaining in India. The rate of destruction will be appreciated when it is stated that a soil receiving cattle manure at 10 tons per annum continuously for twenty years contained at the end of the period only 0·74 per cent of organic carbon as against 0·59 per cent of organic carbon in a soil that received no organic manure at all.

Though the point does not arise directly from the data for yields, mention may be made of the newer knowledge of the functions of organic manures. There is increasing evidence in India and elsewhere that organic manures influence for the better the quality of the crop. Thus seed obtained from a crop manured continuously with farmyard manure has been found to give a better crop than the seed from a plot manured continuously with mineral manures alone, or without any manure. Likewise, the crop raised with cattle manure possessed a higher nutritive value than the crop grown with artificial fertilizers alone or without this means that artificial fertilizers, valuable as they are as supplements, cannot altogether replace organic manures. It is thus evident, that if we neglect organic manures and endeavour to depend on artificial fertilisers, we shall be doing three things:

Firstly—we shall not be able to maintain the fertility of the soil;

Secondly—we may be failing to keep up the inherent cropping power of our seed thus nullifying the good results of plant-breeding;

Thirdly—we run the risk of producing food lacking in normal nutritive value.

Fortunately, there is now, a wide spread recognition of the need for devising means of improving the ryots' resources in respect of original manures by better conservation of manures and by the preparation of composts. (*Agriculture and Livestock in India*, Vol. V, pt. 5, pp. 603–604.)

Bamboo Honey. The first reference to sugar obtained from cane was made by Theophrastus in the third century B. C. He mentioned it as "honey which came from the Bamboo". (*Amer. Bee Journal*, November 1935, p. 512.)

Champion Milk Yielder. The champion butter-fat and milk test at the recent show of the Royal Agricultural Society of Victoria, Australia, was won by a Friesian cow Ingolston Inka Josie, with an average of 68·58 lb. milk and 2·09 lb. butter-fat per day. (*Jour. Agri. Victoria* November 1935, p. 561).

Abyssinia and the Origin of Coffee. Coffee drinking has been discussed since the time of its accidental discovery in Abyssinia, many hundreds of years ago. It

is stated that a certain man was banished into the wilderness. As many others before him had died of starvation, the populace was amazed to find him in good health, a year later. He brought back with him the discovery of a new berry which *would sustain life*, and that was the coffee ! (*Rice, Sugar and Coffee Journal*, August 1935; Vol 38; No. 8 p. 14).

Review.

A Study of Economic Depression in Rural Kistna. By Ch. Sitarama Sastry, M.A., L T. and C. Sriramanarasimham, M. A. Published by the *Madras Provincial Co-operative Union.*

This Brochure is the result of investigations made by the authors in Kistna District with the aid of a grant of Rs. 600 made by the Andhra University for conducting the rural survey with the object of giving some practical training to research students in carrying such work. The land selected for the study is a Delta in which paddy naturally the most important crop occupying 50% of the total area of the District while in some of the villages in the Delta paddy occupies a very much higher percentage of area on the net cultivated area. Paddy is thus a commercial product of the tract. The costs of production have not very much changed, while the prices have fallen to a third of the prices that ruled in 1919-20. Being a fertile tract with a steady high income the standard of living of the agriculturists has been comparatively much higher than in other parts of the Presidency and when the prices went down precipitously, the agriculturists of this and similar delta tracts have been more severely hit than those in parts where dry or mixed famine prevails. It is not also possible to expect people who have long been accustomed to a high standard of living to suddenly change their habits, therefore the suffering is very much greater.

The authors suggest system and planning based on a detailed study of the various facts involved according to the unit of organisation and are of opinion that a start should be made with the villages as a unit and then extend the process of co-ordination to longer spheres and include various branches of production, agricultural and industrial.

Due to exceptional condition of irrigation and drainage the system of crop planning is most difficult in delta tracts, where the selection of crops is very largely restricted to paddy only in stiff soils with very little facilities for drainage, while in more favoured situations there is the possibility of raising crops like sugarcane, plantains and turmeric whose area cannot be very largely increased.

There are large areas of land in several districts like Salem, Coimbatore, N. Arcot, Chingleput etc., where paddy is cultivated at considerable expense, where other crops can be grown more profitably than paddy. If these tracts are not altered to compete in production and if the foreign import of rice is restricted, we hope that the price of paddy will increase and thus alleviate the sufferings of the delta ryots. The improvements effected by the introduction of better seed and methods of manuring and introduction of superior types of sugarcane all at the instance of the Agricultural Department have largely helped to increase the cultivators' margin of profit in this tract, which the authors do not seem to have noticed.

K. R'chary.

College & Estate Notes.

Students' Corner. Examinations. The second terminal examinations were held between 9th and 11th December, practical examinations having been conducted during the previous week.

Tennis. The finals of Doubles handicap Tournament was played, between Moncy Joseph and Abdul Gaffoor *vs.* Herbert Adiseshiah and Sayeed which resulted in a victory for the former.

Cricket. In the Inter Collegiate cricket Tournament we played our first round against Government College on 20th November. Entering first the College piled up 214 for 7 and declared (Dinkar Rao 103 not out). Subsequently Government College made 56 the match ending in a victory for us.

The finals were played against Maharaja's College, Ernakulam on our grounds on 14th December. Visitors entering first fared badly and were all out for 29. Our College replied with 81 for 2, Albuquerque and Ramanadha Rao remaining unbeaten with 35 and 28. Thus the College won the Tournament for the south Zone. On 30th November Mr. K. Ramiah's wards met Mr. Sundararaman's and won by an innings and 41 runs.

The finals between Mr. K. Ramiah's wards and Mr. Narasimha Iyangar's ended in a victory for the former by 9 wickets and 14 runs. In both the innings D. V. Rajagopal the College bowler was responsible for 12 wickets thus passing his 100 wickets for the season.

Hockey. In the Inter Collegiate tournament our College won over Victoria College, Palghat in the first round by 6—1. The finals were played against Maharaja's College, Ernakulam at Alwaye which resulted in a victory for us (3—2) Rajagopal 2 and Sampath 1. First Hockey match for the victory cup was played between 1st and 2nd years, 1st years winning qualified for the finals and subsequently won the finals.

Foot-ball. The first match was played between second and third years former winning 1 to nil. In the finals first years won over the second years by 1 to nil. Thus the first years having won foot-ball and hockey qualified themselves as the holders of the cup.

Literary. Dr. C. Narasimhachary gave a talk on 'Rothamstead' to the members of the students club on the 18th inst.

Burma Agriculture. Under the auspices of the Union Mr. K. Ramiah, Paddy Specialist delivered an interesting lecture on Agriculture in Burma. Mr. R. C. Broadfoot, Principal, Agricultural College, presided on the occasion. A full report of the lecture will be published later.

The Officers' Club. The opening ceremony of the building extension and the celebration of the Annual Club Day, came off on the 23rd December. Rao Sahib C. V. Venugopal Pillai performed the opening ceremony. Mr. K. Krishnamurti Rao the President in his welcome address traced the history of the club from 1908, and gave an account of its steady progress from small beginnings to its present state. Mr. V. Gomatinayagam who was in charge of the construction, read the report of the building committee. A number of interesting items of Sports were gone through, and the function was a grand success, finishing off late at night after a dinner and variety entertainment.

Retirement. Mr. T. L. Lakshmana Rao, Asst. Agri. Chemist, retired from service on Monday the 16th inst. The Officer's Club gave him a farewell tea on that date.

Visitors. Prof. Tanaka, of the Imperial University of Punna visited the College and Research Institute during the meeting. An account of the lecture he delivered at the College appears elsewhere.

Obituary. We regret to record the death of Mr K S. Viswanatha Iyer, Retired Assistant Agricultural Chemist, at his residence at R. S. Puram, Coimbatore on Thursday the 5th inst.

Weather Review (NOVEMBER 1935).

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	0·0	- 4·0	42·7	South	Negapatam	25·4	+8·7	54·8
	Berhampore *	0·0	- 3·6	34·1		Aduthurai *	11·3	+1·7	33·2
	Calingapatam	0·0	- 3·9	29·3		Madura	3·8	+1·1	25·1
	Vizagapatam	0·9	- 2·9	18·6		Pamban	12·7	+0·7	33·3
	Anakapalli *	0·1	- 3·5	22·2		Koilpatti *	3·2	- 3·6	18·5
	Samalkota*	0·0	- 3·3	36·3		Palamkottah	5·9	- 1·5	27·2
	Maruteru *	0·0	- 5·1	33·6					
	Cocanada	0·0	- 5·4	23·9	West				
	Masulipatam	0·3	- 5·4	32·7	Coast	Trivandrum	8·4	+1·9	56·6
	Guntur	0·0	- 3·6	29·8		Cochin	4·3	- 2·2	82·7
						Calicut	1·7	- 3·7	102·5
Ceded Dists.	Kurnool	0·0	- 1·1	26·1		Pattambi *			
	Nandyal *	0·0	- 1·5	31·4		Taliparamba *			
	Hagari *	0·3	- 1·4	22·0		Kasargode *	1·5	2·6	145·6
	Bellary	0·0	- 2·2	20·0		Nileshwar *	2·0	- 0·9	127·4
	Anantapur					Mangalore	0·1	- 3·0	122·2
	Cuddapah								
					Mysore				
Carnatic	Nellore	1·4	- 9·8	24·4	and	Chitaldrug	0·0	- 2·3	25·8
	Madras	6·4	- 7·9	37·9	Coorg	Bangalore	0·3	- 2·6	42·8
	Palur *					Mysore	0·6	- 1·9	39·5
	Palakuppam *	4·5	- 5·6	29·7		Mercara	0·4	- 2·8	121·0
	Cuddalore	6·9	- 8·2	33·6					
					Hills.				
Central	Vellore	3·5	- 3·4	38·1		Kodaikanal	18·9	+10·0	73·1
	Hosur cattle farm*					Coonoor	9·4	...	49·1
						Ootacamund *	3·7	- 0·6	34·7
	Salem	2·1	- 1·7	30·6		Nanjanad *	2·1	- 1·7	43·5
	Coimbatore	2·7	- 1·1	14·5					
	Coimbatore Res. Inst.*								
	Trichinopoly	6·5	+0·9	33·5					

* Meteorological Stations of the Madras Agricultural Department.

Summary of Weather Conditions. Two Bay depression appeared during the month. The first one formed in the North Andaman sea on the 2nd with its centre near Lat. 14°N, Long. 94°E. This caused widespread rain in Lower Burma and moving to the Arakan coast, it began to weaken by the 4th November. Thunderstorms occurred during this period in Malabar and South East Madras.

A second Bay depression formed on the 11th east of Ceylon near Lat. 9½°N, Long. 87½°E which intensified into a storm off the Coromandal coast with its centre near Lat. 10°N, Long. 85 E on the 13th. Crossing the coast near Negapatam on the 15th, the storm traversed the Cauvery valley and moved into South-east Arabian sea off Malabar, on the 16th. Thereafter, moving away westwards, the depression became unimportant towards the 20th November The storm caused widespread rain on November 14th, 15th and 16th in the South of Peninsula with locally heavy falls in South East Madras. Kodaikanal registering 13·6″ of rain during the 24 hours ending at 8 hours on the 16th.

A few falls of rain occurred in South East Madras and Malabar during the rest of the month. Dry weather set in by the end of the month.

Rainfall was locally in excess at some places in South Madras and in large defect in all other parts of the Presidency.

Chief falls reported were :—

Negapatam	6·0″	on the 15th.
Kodaikanal	13·6″	on the 16th.
Dindigul	7·2″	on the 16th.
Palani (Madura)	6·2″	on the 16th.
Tirupattur (Ramnad)	6·2″	on the 16th.
Viralimalai (Pudukkottah)	5·7″	on the 16th.
Tattamangalam (Palghat)	10·3″	on the 17th.
Negapatam	8·0″	on the 22nd.

Weather Report for the Research Institute Observatory.

Report No. 11/35.

Absolute Maximum in shade	91·0°F.
Absolute Minimum in shade	59·8°F.
Mean Maximum in shade	86·1°F.
Departure from normal	+ 1·4°F.
Mean Minimum in shade	68·1°F.
Departure from normal	- 0·6°F.
Total Rainfall	32·27 inches.
Departure from normal	- 1·26 inches.
Heaviest fall in 24 hours	2·09 (Recorded on 16-11-35).
Total number of rainy days	3
Mean daily wind velocity	2·8 M. P. H.
Mean Humidity at 8 hours	74·2%
Departure from normal	- 7·1%
Total hours of Bright sunshine	194·3
Mean daily hours of Bright sunshine	6·5

Summary. Rainfall was in defect. The storm which moved over the South of the Peninsula caused a rainfall of 3 inches on the 16th and 17th instants.

A. S. R. & D. V. K.

Departmental Notifications.

Gazette Notifications. Mr. Y. G. Krishna Rao Naidu to be Deputy Director of Agriculture VI circle, Madura, Mr. Sadatullakhan to be Deputy Director IV circle, St. Thomas Mount, and Mr. K. Unnikrishna Menon to be Deputy Director III circle, Bellary; Mr. K T. Bhandary to be Assistant Director of Agriculture VIII circle, Salem.

New appointments :—The following officiating appointments of Upper Subordinates—III Grade on Rs. 75 in the scale of Rs. 75—7½/2—105 in Class I, Madras Agricultural Subordinate Service are ordered with effect *from 27th November 1935* : M. Kandaswamy, B. Sc. Ag. VIII circle, Coimbatore ; A. Shanmugasundaram, B. Sc. Ag., Livestock Research Station, Hosur; R. Alagiamanavalan, B. Sc. Ag., A. R. S, Palur; N. Sobhanadri, B. Sc. Ag.. A. R. S. Guntur; P. Govinda Rao, B Sc. Ag., as Assistant in Mycology, Coimbatore ; T.Ramanujulu Nayudu B. Sc. Ag., I circle, K. V. Chelapathi Rao, B. Sc. Ag., A.R.S. Samalkota; G. Venkatarathnam, B. Sc. Ag. Narasannapeta, for District work ; P. Sitharamaiah, B. Sc. Ag., Bhimavaram for training ; G. Doraiswamy, B. Sc. Ag., as assistant in Paddy Section, A. R. S. Maruteru ; K. V. Gaurangamurthi, B. Sc. Ag., Nellore for training in District, work ; S. Venkataramanappa, Officiating Farm Manager to officiate as Upper

Subordinate, Agricultural Section in the A. R S. Kalahasti; K. Krishnamurthi, B. Sc. Ag., Narasipatam for District work; M. Srinivasa Rao, B. Sc. Ag., as Upper Subordinate, Agricultural Section to Anantapur for District work; K. Venkata Reddi Nayudu, B, Sc. Ag., to Tanuku for District work; C. Vadamalai, B. Sc. Ag. A R. S., Palur; B. G. Narayana Menon, B. Sc. Ag., Asst. in Chemistry, Coimbatore; T. S. Dakshinamurthi, B. Sc. Ag., Fruit Research Station, Anantarajupet, Cuddapah District; S. Ananthan, B. Sc. Ag., Fieldman, Cotton Section as Assistant, Pempheres and Physiological Scheme (Botany Section)—under the Cotton Specialist, Coimbatore; A. Subrahmanyam, B. Sc. Ag., A. R. S. Samalkota; R Subbayya Pillai, B. Sc. Ag., as Assistant in Millets, Coimbatore. B. Ramakrishna Reddi, B Sc. Ag., to A. R. S. Nandyal; S. Krishnamurthi Rao, B. Sc., Dry Farming Station, Hagari: V. Srinivasan, B. Sc. Ag., to A. R. S., Aduturai, S. Muttuswami, B. Sc. Ag, VI circle, Madura; K. Govinda Kurup, B. Sc. Ag. A. R. S. Nanjanad; D. Srinivasa Rao, B. Sc. Ag. A. R. S. Guntur; S. Krishnamurthi, B. Sc. Ag., Central Farm; G. C. Balanna, B. Sc. Ag. A. R. S. Nandyal; D. C. Hanumanta Rao, B. Sc. Ag., II Circle, Guntur.

Posting and transfers. Mr. A. M. Muthiah Nattan, A. D. Dindigal to Aruppukottai. Mr. S. P Fernando, A. A D. Aruppakottai to Dindigal. Mr. M. V. Kondala Rao, A. A. D. Chodavaram to ii circle to be A. A. D. Vinukonda. Mr. G. Sitharam Sastri, A. D. Vinukonda on return from leave to be F. M., A. R. S. Guntur. Mr. R. Guruswami Naidu offg. Assistant in the Millet Section, Coimbatore to iv Circle as A. D. Mr. S. Ramachandran, Assistant Maruteru to be Assistant, Paddy Section, Coimbatore. Mr. S. Narayaniah on reversion from the Madras Agricultural Service to be Assistant Lecturer in Agriculture, Agricultural College, Coimbatore. Mr. B. Shiva Rao, F. M. Guntur, to be A. D. i Circle. Mr. V. T. Subbiah Mudaliar, Assistant Lecturer, Agricultural College, Coimbatore to be F. M. Central Farm, Coimbatore. Mr. K. K. Raghavan F. M. Central Farm, Coimbatore to be A. D. Cuddalore. Mr. M. Ratnavelu, A. F. M. Central Farm Coimbatore to be A. A. D. St. Thomas Mount.

Leave. M. K. Ramanujachari A. D. Kandukur l. a. p. on M. C. for two months from 25—11—35.

ADDITIONS TO THE LIBRARY, NOVEMBER 1935

A. Books.

1. The Soya Bean. *Bowdidge, E.* 2. 9th International Horticultural Congress of 1930. 2(a). Proceedings of the American Society for Horticultural Science for 1933. 3 Apples and Pears. *Royal Horti. Soc. Pubn.* 4. The Pine Apple. *Johnson, M. O.* 5. Weeds. *Muenscher, W. C.* 6. The Cattle of the World. *Sanders, A. H.* 7. The Bombay Grasses. *Blatter, E. & McCann, C.* 8. Gymnosperms: Structure and Evolution. *Chamberlain, C. J.* 9. Plant Physiology. *Thomas, M.* 10. Translocation in Plants. *Curtis O. F.* 11. The Mechanism of Creative Evolution. *Hurst, C. C.* 12. Symposia on Quantitative Biology—2 volumes. 13. Biochemical Laboratory Methods. *Morrow, C. A. & Sandstrom, W. M.* 14. Colloid Chemistry. *Thomas, A. W.* 15. The Carbohydrates. *Armstrong, E. F. & Armstrong, A. F.* 16. Manual of Biochemistry. *McClendon, J. F.* 17. Principles involved in Chemical Reactivity (Text Book of Physical Chemistry, Vol 2). *Friend, J. N.* 18. Controlled Humidity in Industry. *Marsh, M. C.* 19. A Veterinary Dictionary, 2nd Edn. *Miller, W. C.*, Ed. 20. Helminth Parasites of the Domesticated Animals in India. *Bhale Rao, G. D.* 21. A Manual of Library Organisation. *Headicar, B. M.*

B. Reports.

1. Report of the Botanical Survey of India for 1933—1934. 2. Reports of the Research, Economic and Agricultural Education Branches of the Agri. Deptt.—S. S. & F. M. S. 3. North Borneo Agri. Deptt. Annual Report, 1934. 4. Gambia Agri. Deptt. Annual Report, 1934—1935.

C. Special Publications.

5. Notes on Tube Well Strainers used in the Punjab. *Punjab Agri. Deptt. Pubn., 1928.* 6. Immature Stages of Indian Coleoptera. *Indian Forest Records, Vol. I, Nos. I & IV, 1935.* 7. On the Biology of the Psyllidae. *Indian Forest Records, Vol. I, No. II, 1935.* 8. A Guide to the Cultivation of Bananas for Export. *St. Lucia Agri. Deptt. Pubn., 1934.*

D. Bulletins, Memoirs, Etc.

9. Field Experiments with Sugarcane, IV. *Br. Guiana Agri. Deptt. Sugar Bull. No. 4.* 10. Hardy Roses—Their Culture in Canada. *Canada Agri. Deptt. Bull. 17 (N. S), Rev.* 11. Tobacco Growing in Canada. 12. Goat Husbandry in Canada. 13. Varietal Studies of Flue-cured, Burley and Dark Tobaccos. *Canada Agri. Deptt. Bull. Nos. 176, 177, 178 (N. S.).* 14. Effect of Alfalfa and Farm Manure on Yields of Irrigated Crops in the Great Plains. *U. S. Agri. Deptt. Tech. Bull. 483.* 15. Recommendations for the Control and Reclamation of Gullies. *Iowa Eng. Exp. Stn. Bull. No. 121.* 16. Pruning Bearing Apple Trees. *Masachusetts Agri. Exp. Stn. Bull No. 320.* 17. Investigations on Downy Mildew of Tobacco. *South Carolina Agri. Exp. Stn. Bull. No. 303.*

E. Circulars, Leaflets, Etc.

18. List of Publications on Indian Entomology, 1933. *I. C. A. R. Misc. Bull. No. 5.* 19. Agricultural Implements. *Punjab Agri. Dep. Leaf. No. 1.* 20. Insurance of Farming Stock against Fire. 21. Green Manuring. *Eng. Min. Agri. & Fish. Adv. Leaf. Nos. 101, 257.* 22. The Vegetable Garden. *Canada Agri. Deptt. Pamphlet No. 166 (N. S.).* 23. A Device for Separating Different Lengths of Fibres from Seed Cotton. 24. Safflower, A Possible New Oil Seed Crop for the Northern

Great Plains and the Far Western States. *U. S. Agri. Deptt. Cir. Nos. 360, 366.* The Processing Tax. 26. Facing the Facts in the Agricultural Situation. 2, World Cotton Markets. 28. Industry's Production Policies and the Farmer. 29. America Must Choose Its Course in Foreign Trade. 30. Opportunities Ahead for Rural Youth. *U. S. Agri. Dep. (A. A. A.) G-41, G-42, G-43, G-44, G-45, G-46.* Federal Land Bank Loans and Land Bank Commissioner's Loans,—How & Where to Apply? 32. Agricultural Financing through the Farm Credit Administration. *U. S. Agri. Dep. Farm Credit Admn. Cir. Nos. 2, 5.* 33. Production of Quality Milk and Cream on the Farm. *South Dakota Agri. Exp. Stn. Cir. No. 1935.* 34. Indian Central Cotton Committee—Its Objects, Activities and Achievement. (2nd Edn.) *I. C. C. C. Pubn.*

Manager's Notice.

Members, and subscribers, whose subscription expires by 31st December 1935, are kindly requested to remit their subscription before the end of January. The M. O. form with particulars filled in is enclosed for their convenience.