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EDITORIAL

Export of Sugar. A press communique recently issued by the Government of India stated that the application made for the partial release from their obligations, under the International Sugar Agreement so as to enable India to export to the United Kingdom up to 200,000 tons of sugar during the year ending 31st December, 1940, has been granted. Early in the year, the Indian Sugar Syndicate carried out negotiations with the British Ministry of Food for exports of Indian Sugar to Britain but these negotiations failed owing to disagreement over the price. It was then stated that the industry was prepared to sell a portion of the surplus stock estimated at over two lakh tons at reduced prices, if the Government of India offered certain concessions in regard to railway freights and excise duty. As these concessions were not forthcoming the whole transaction fell through. We are, however, glad to learn that the Syndicate at an extra-ordinary meeting held on 22nd October, 1940 in view of the export facilities accorded, appointed a committee to meet the Government representatives and negotiate the terms of an agreement. We wish the forthcoming meeting the success it deserves. The United Kingdom, imports over two million tons of sugar annually from outside. It should be possible for her to buy at least a portion of her requirements from India, a member of the British Empire. This will certainly give an outlet for the surplus stock now available in India and place her sugar industry on a firm basis. It is our sincere hope that the special facility now extended to India will, in course of time, lead to a permanent agreement of mutual benefit to the countries.

Tobacco Marketing. The report issued by the Agricultural Marketing Adviser to the Government of India on the marketing of tobacco in India reveals several points of interest to the Indian grower. India produces about one fourth of the world's tobacco and further many well known brands of cigarettes are manufactured in India for which large quantities of locally grown tobacco are used. More than half the Indian production is concentrated in five clearly defined zones viz., the North Bengal and North Bihar for production of *hookah* and other types of tobacco, the *charotar* area in Gujaret along with that of Nipani in the South of the Bombay Presidency have a special reputation for their *bidi* tobaccos, while Guntur is outstanding for the production of high class cigarette leaf. The wholesale value of all tobacco products in India is estimated to be about 37 crores of rupees. It

constitutes, therefore, an important source of ready cash to the cultivators. In the Guntur district about two-thirds of the area is now under Virginia types of tobacco which yield on an average about 750 lbs. of raw leaf or about 400—500 lbs. of processed leaf per acre.

The largest volume of the international trade consists of flue-cured tobacco for which the demand is steadily increasing. The total production of this type in India, is reported to be only about 2 per cent of the total.

There is a certain amount of satisfaction to be found in the fact that imports of cigarettes into India have shown a more than corresponding decrease. The *per capita* consumption in Madras is reckoned to be only 10 cigarettes per annum. The general trend of tobacco consumption in India is upward particularly in the case of cigarettes. It is essential that in those areas considered suitable for the production of Virginia cigarette tobacco, the growers should realise the great importance of quality and continue their efforts to improve it. That there is ample scope for expanding the market for high quality Indian tobacco is clear from the progress made in recent years in the Guntur district. The high quality of the cured Virginia produced there, is continuing to displace American leaf imported for cigarette making. Statutory grades for cigarette leaf have already been prescribed under the Agricultural produce (grading and Marking) Act, 1937, which define the grades on the basis of colour, texture and freedom from blemish. It is interesting to note that although standard grades have only been in operation for cigarette tobacco in the Guntur area for less than two years, there is already a large body of opinion amongst growers, merchants, exporters and manufacturers that it would be to the advantage of all if steps could be taken to ensure that all cigarette tobacco grown and exported from that area could be graded and marked in accordance with the provisions of the Agricultural Produce (Grading and marking) Act. On an average, of the prices realised for Virginia flue-cured tobacco (stripped) in the United Kingdom markets, the grower from Guntur is estimated to get about 42·3 per cent for his leaf, while the exporter's margin amounts to 16 per cent. The balance viz. 41·7 per cent represents loss in moisture, stripping charges on grading, packing, transport, insurance, landing charges, rent, brokerage, marketting etc. In 1923, there were only 11 cigarette factories in India while in 1935 the number increased to 22. The annual production of cigarettes in India, is estimated at about 7,500 million cigarettes valued at nearly six crores of rupees. It is clear from the report that there is still considerable scope for increasing the cultivation of the Virginian type of tobacco. We hope the cultivators will take advantage of the situation and extend the area. Like sugar, cotton and cement industry, considerable progress can be expected from tobacco industry in the course of a few years, provided the crop is tackled in the right direction in all stages, cultivation, marketing and manufacture.

Rock Bee Honey, its Extraction and Preservation.

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Introduction. The Rock bee *(Apis dorsata,)* has been the main source of honey in India from time immemorial, though the quality of the material available to the public was poor. The recent introduction of modern methods of beekeeping and their rapid spread in this presidency have revolutionised the popular notion about pure honey. Machine-extracted honey from the domesticated Indian bee *(Apis indica,)* always fetches a good price, while Rock bee honey is not so popular on account of its impure and sometimes fermented condition when it reaches the consumer. A study of the existing methods of honey extraction and preservation was therefore taken up and the possibilities of improvement explored. The present paper contains a short account of the trials conducted and the results obtained, therefrom.

The Rock bee. Before giving the details of these trials, a short description of the Rock bee and its peculiar habits will not be out of place here. Of the four indigenous honey bees, viz., the Rock bee, the Indian bee, the Little bee and the Dammar bee, the first one is the biggest in size. Its favourite haunts are hilly and forest areas, mostly above 2000 feet elevation, but stray colonies are often found on the plains also. Swarms of this bee establish themselves in the open in inaccessible places such as precipitous cliffs and over-hanging rocks, branches of tall trees, etc. Occasionally 50 to 60 colonies are found on a single tree. The combs are built singly and very often reach three feet in length and about two feet in breadth. The top portion of the comb is about nine inches where honey and pollen are stored bulges out to a width of about six inches. The brood is reared in the lower portion. This bee is a very good honey-gatherer and a strong colony may yield up to 40 lbs. In spite of its good honey-gathering qualities, this bee has, unfortunately, a few undesirable traits which render it unfit for domestication. The single comb building habit, necessitates the destruction of the brood while extracting honey. This unnecessary destruction of life and crushing of the comb is against the very fundamentals of scientific beekeeping. On the other hand the Indian bee constructs a series of parellel combs and invariably stores honey separately from the brood. Under domesticated conditions the honey combs can be easily taken out for extraction of honey and the empty combs given back without disturbing the normal working of the colony. Secondly the Rock bee is easily irritable and vindictive when provoked. It has been reported that men and domestic animals are sometimes stung to death. Lastly this bee is migratory in habits; visiting the hills during the summer months and moving down to the lower elevations after the outbreak of the

monsoon. The domestication of this bee, therefore, seems to be out of question and only better methods of extraction and preservation of honey can be suggested.

Existing methods of honey extraction and preservation. The handling of these bees and the collection of honey and wax are exclusively done by the jungle tribes. They know by experience the seasons of honey flow and the combs are taken only when they are sure that a good quantity of honey has been stocked in them. As a general rule the colonies are handled only after night fall. The ingenuity, coolness and daring exhibited by these "children of the forest" while approaching colonies of these dangerous insects are simply amazing. Before beginning the work, they fortify themselves against any accident or attack by the bees by a preliminary "puja" to propitiate the jungle dieties. In cases where colonies of the bees have established themselves under overhanging rocks, the approach often extends to a few hundred feet over the steep precipices, a slip from which would mean loss of life. The equipments required for approaching the colonies and collecting the honey are a few lengths of forest canes tied together with jungle fibre or a sufficient length or strong fibre rope, a kerosine tin open at the side and slung to a long rope and the inevitable smoking torch. One end of the cane or rope is well secured to a tree at the top and the man gets down to the work spot with the help of this improvised ladder. The task appears to be comparatively easier, in cases where the colonies are found on trees; as the men easily climb up even to the dizzy heights at which the colonies are found. When there are a number of colonies on different branches of the same tree, they move from branch to branch with the help of bamboos tied across them. The crowning feat of their admirable skill and daring lies in the fact that all this work is done in pitch darkness. When they have to tackle a larger number of colonies they are able to camp the whole night either under the rocks or on the top of the trees.

Regarding the collection of the honey, the bees are first brushed aside with the smoking torch. The brood portion is then broken off and sent down in the kerosine tin. The empty tin is sent up again to get the honey comb. It takes only about 5 to 10 minutes to tackle each colony.

The brood combs are sometimes boiled and eaten by the jungle tribes but the bulk of them is kept for wax extraction. The honey combs are then taken and the small bits of brood that may be still adhering to them are removed. The honey is then squeezed out with the hand and is either handed over to the contractors immediately or sold locally. No attempts are made to store the honey. It is needless to add here that the methods are thoroughly unclean and the quality of honey very poor on account of the admixture of considerable quantities of pollen and possibly some brood-juice as well. Till recently the Forest Department were leasing out the right of collecting honey and wax. Realising the possibilities of improving

the methods of collecting this very useful forest produce, the Department has now taken up the work under its own supervision in certain centres. According to the figures kindly furnished by the Forest Utilisation Officer, about 45,000 lbs. of honey are said to be available from the few centres where they carry on the honey collection departmentally. Cleaner methods are adopted in getting the combs and squeezing out the honey. The squeezed honey is filtered, then boiled directly over fire and filtered again before storing in kerosine tins. These methods, though they are an improvement over the existing crude ones, are still far from being perfect. There is always a possibility of large quantities of pollen getting forced out along with the honey when it is squeezed out by the hand. The presence of the extraneous matter as well as the contamination by hand cause rapid fermentation of the honey. The direct boiling over fire will ruin the essential qualities of honey, as the enzymes contained therein are destroyed at this high temperature. But recently the Department appears to have taken up the scientific ripening of honey.

Trials of honey extraction and preservation. Trials were, therefore, started to improve the existing method of extraction and preservation of honey. The main principles underlying the trials were (a) clean and hygienic extraction of honey and (b) its proper preservation. Three appliances viz., the honey press, the honey strainer and the centrifugal honey extractor were designed for the extraction of honey and tried at different places. Trials were also conducted on the preservatoin of honey by (a) artificial ripening and (b) proper storing.

Appliances for extraction of honey: *The honey press.* This machine was designed after the model of the Scottish heather honey press. The honey is squeezed out by the pressure exerted by a vertical screw-rod with a metal plate attached to its free end. It was tried at Top slip (Thunaccadavu Range) and Onnaithittu (Talamalai Range) and found quite efficient as it was able to squeeze out the last drop of honey from the combs. But the quality was not satisfactory since considerable quantities of pollen, bits of wax and other extraneous matter got forced out along with the honey, thus impairing its flavour, purity and clarity.

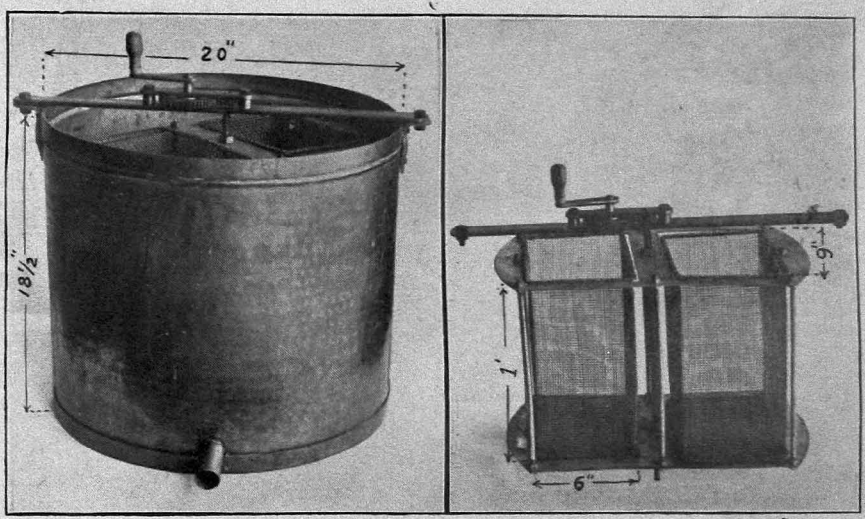
The honey strainer. This consists of two vessels kept one over the other with a thick wire-net (4 meshes for 1") partition between the two. The honey combs were first cut into small bits with a clean knife, scrupulously eliminating the brood portions and as far as possible the pollen bearing cells also. The pieces were then tied in a cloth bag and the bag was kept inside the upper vessel of the strainer, so that the honey may gradually ooze out by mere gravitation. The appliance was used at Top slip and Onnaithittu. At the former place nearly 90 per cent of the honey drained in 3 hours and at the latter 81·5 per cent in 18 hours. The period taken for the honey to drain out obviously depends on its density, which again varies according to the source from which the nectar is collected. Apart from the long time taken appreciable quantities of pollen also came out through the meshes of the

cloth and thus spoiled the quality of the honey. The latter factor is not, however, constant since the degree of admixture depends on the quantity of pollen stored in the combs.

The honey extractor : (plate). This was designed after the model of the honey extractor commonly used for the Indian bee (*A. indica*) with certain modifications. The machine consists of a cylindrical metal drum $1\frac{1}{2}$ ft. in height and 2 ft. in diameter and a box to hold the honey combs. The box is fixed to a rotating rod at its centre and the revolution is affected by the action of a set of gear wheels on the central rod. Two movable wire-gauze cages each 6" × 9" × 1" are provided in the comb box for holding the honey-combs. Whole pieces of honey-combs each measuring about 9" × 9" × 6" and weighing about 4 lbs. each were uncapped, kept inside these cages and the box rotated. The machine was tried at Onnaithittu and Begur (Wynaad) and found quite efficient. Combs weighing about 10 lbs. were worked at a time in the machine and almost the last drop of honey was thrown out in about 10 minutes. The machine was also found capable of extracting the honey even from small pieces of combs. In this connection mention has to be made of the possibility of an admixture of pollen in the honey. The Rock bee does not appear to be clean and regular in its food-storing habits. Considerable quantities of pollen are often found stored in the midst of the honey-bearing portions and in many cases both honey and pollen are found stocked in one and the same cell. In such cases a few pellets of the powdery material also get thrown out along with the drops of honey. Though this defect is inevitable, the undesirable matter can be skimmed off when it generally collects at the top in the form of a scummy layer within about a fortnight after storing. But this difficulty is not met with in cases where there is not much pollen stored in the combs. Of the three appliances tried, the centrifugal honey extractor is considered to be the most efficient for the following reasons:—

1. The honey extracted is untouched by hand.
2. There is no chance of contamination by the grubs and other extraneous matter.
3. Chances for admixture of pollen are much less
4. The process of extraction is much quicker.
5. Honey can be easily extracted from all sizes of combs varying from the biggest pieces to the smallest bit.

Preservation of honey: Ripening. A good sample of honey generally contains about 15 per cent of moisture and any quantity in excess of it may induce fermentation. In nature, when the honey reaches this optimum condition the cells are generally sealed by the bees and the honey inside these cells is said to be "ripe". In the case of the honey combs of the Indian bee the sealed condition or otherwise can be fonud out by frequent examination, but in the case of the rock bee, it can be known only when the bees are driven off and the combs removed. All the honey obtained from the Rock bee



The Honey Extractor and its parts.

colonies cannot therefore, be said to be ripe and under such circumstances the elimination of the moisture by artificial ripening becomes an absolute necessity. The process consists of keeping the honey with the container in hot water for about half an hour, taking care to maintain the temperature of the water steadily at 80° C. Apart from pasteurising the honey and eliminating the superfluous moisture, the process also clears the honey of the undesirable matter contained in it. Only some samples appear to contain the latter material, and in such cases, it collects itself as a scummy layer at the top when the honey is heated and this can be easily removed. Samples of honey collected from the forests were ripened and kept under observation with appropriate controls of untreated material. In all these cases, the latter material began to ferment very soon, thereby indicating that the artificial ripening ensures the keeping qualites of honey.

Storing honey. Honey, whether ripened or not, will absorb moisture from the air and ferment if it is kept carelessly. Due attention should, therefore, be paid to the proper storing of the material. Only scrupulously clean receptacles should be used and those containing honey should be kept properly sealed. In cases where large quantities are handled, honey can be stocked in clean kerosine tins, but care should be taken to seal the lids. Frequent opening of the containers is not desirable and in cases where small quantities of honey have to be taken out frequently, it is better to stock the material in smaller containers such as jam jars.

Drained honey. A certain amount of bad handling and crushing of the combs is inevitable when they are collected. A considerable quantity of the honey drains out in the vessel itself during transit, partly due to the bad handling but mostly due to the pressure exerted by the weight of the combs and this cannot be avoided under any circumstances. An appreciable quantity of brood, bees, as well as other undesirable matter such as lumps of pollen, broken bits of twigs, leaves, pieces of burnt sticks etc. are invariably found floating in this honey. There was nothing wrong with it except for the temporary contamination. It was, therefore collected and *filtered immediately*, ripened and bottled. Special attention should be paid to the promptness with which this honey is filtered and treated, since the dead grubs, pupae and bees that may be floating in the honey are likely to decompose and ruin its quality, if there is any undue delay.

Summary. Of the three machines tried for the extraction of honey the centrifugal honey extractor appears to be the most efficient on account of the thoroughness and quickness of the work and purity of the honey.

Drained honey, also is of good quality, provided all the undesirable, material is removed immediately as suggested already. If, in spite of these precautions, the quality is not as satisfactory as that of the extracted honey, the material may be graded as No. II.

Artificial ripening of honey is an absolute necessity, as it is the only method to prevent fermentation and subsequent deterioration of the material.

Equal attention should be paid to the proper preservation of honey.

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The Cultivation and Marketing of Roses at Iquaripalayam village.

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Introduction. It is a known fact that there is a continuous and growing demand in all urban areas for roses among other flowers, throughout the Presidency. Many villages near such areas grow this crop on a field scale and Iquaripalayam is one such village. Roses fetch to its producers, the ready money to meet their house-hold and other day-to-day expenses. This village consists of nearly 100 homes and is situated about six miles, from Gummidipundi R. S. on the Madras—Culcutta line and is about 36 miles, from Madras by road. The total area of the village is about 1,000 acres, of which only 500 acres, are cultivable. The village has a tank with a very good water supply lasting for 6 to 9 months in a year, from August till April following. The ryots who cultivate roses belong chiefly to the Kshatriya caste, though a few Vysias and Adi-Dravidas also grow them.

The Land. There are nearly 40 acres now under roses in this village. It is cultivated in both wet and garden lands but more in the wet lands. The soil is light red, sandy loam to clay loam and homogeneous to a depth of 8 to 10 feet. It is surprising to see a rose garden coming up well between plots of wet paddy, with stagnant water all round. Even though the fields round about are wet, the plots where roses are grown, are not at all miry. I was told that even in rainy season water does not stagnate in these plots and that it could be easily drained if necessary, within a few hours. The water table is nearly 4 feet from the ground level during the wet months and 10 to 12 feet in summer. Even so, the plants in garden lands produce more flowers than in wet lands during the rainy months as the wet plots do not dry up soon; and again the plants in loamy soils produce more flowers than plants in light sandy or clay loams. But much depends upon the care that is bestowed on the plants.

Season. The usual season when roses are planted in this village is etween September and January, but plantings in September and December,

when rainfall is not heavy, come up better than October and November plantings.

Preparation of Land. Ryots begin preparatory cultivation by about the beginning of August with the help of the early showers, and usually four ploughings are given with a country plough. Lines are marked with the help of ropes at intervals of $4\frac{1}{2}$ feet each way.

Seeds and Planting. Well rooted layers about 2,000 for an acre, are planted at the junctions of these lines. A few extra cuttings are planted in a nursery to replace the failures. About 5 per cent. of the plants might fail to establish if the planting is done in September or December, while in the other two months, the casualities are much more. The plants are pot-watered as soon as they are planted. Thereafter, they are irrigated once in three days till they establish, i. e., for about a fortnight. Subsequent irrigations are given once a week if no rain is received. About 60 days after planting, the well-established plants begin to flower, and it is not unusual that from 100 to 200 flowers are got from a plot of one acre in the first picking. From this time onwards, a few hundreds of flowers are got almost every day depending upon the amount of care put in.

Manures and Manuring. The first manuring is done about a month after planting and for this, about 2 cartloads of farm-yard manure are considered sufficient. After this, 10 cartloads of farm yard manure are applied once in every six months. Each plant receives nearly 5 lb. of manure at the base of the plants close and round it. The manure is not applied to the entire field. After the first year, the plants receive two manurings, once in August and again in November at 10 cartloads of farm yard manure per acre.

After cultivation. This is very important in the cultivation of roses. Almost once in 40 days the fields receive a good hoeing with mammaties and weeds are removed. No labour-saving implement is used for the purpose owing to the thorny nature of the plants. About 10 to 12 men working for a day, easily cover an acre, hoeing with mammaties. About 7 to 8 hoeings in a year on an average per acre are not unusual. Soon after manuring in November, a good weeding is done and the matured branches are layered. After the layering, new shoots sprout up from the bent branches, which take nearly 40 days to come to flower. This is done in the middle of November so as to get the new shoots into full bearing by the end of December when the price of flowers at Madras city is high.

Irrigation. The plants receive nearly 4 to 5 irrigations per month in the hot months and less during the rainy months so that about 35 to 40 irrigations are given per year. The tank which supplies water for nearly nine months in the year is very handy to the ryots and no difficulty is felt by any to let in the tank water. Water is freely used and fields are often flooded. Those who have wells, irrigate their rose garden during May, June and July when the tank is empty, but others leave the plants to nature.

The crop so left does not die as it is sustained by the light showers received during these months. In fields left dry during the summer months, layers made previously fail to come up successfully and naturally the owners lose some part of their income from the extra flush resulting from new shoots and the sale of rooted cuttings.

Yields. As already said, planting is usually done in September. The plants strike roots and come to flowers in about 60 days and yield as much as 100 to 200 flowers per acre daily. There is a gradual increase in the number of flowers as the plants begin to grow and put on new shoots. During the first year from January to December, as much as 80,000 flowers are obtained from an acre and in the second, third and subsequent years, the yield increases to about 3 to 5 times that of the first year. By the 7th or the 8th year the plants would have become too stumpy and old and the yield of flowers goes down.

TABLE I. Statement showing the number of flowers obtained and amount realised by a ryot from a plot of 75 cents during the first year from January to December.

Month	No. of flowers 0·75 ac.	Calculated to an acre.	Amount realised by sale (0·75 ac.)			Calculated amount for an acre.		
			Rs.	a.	p.	Rs.	a.	p.
January	650	867	1	3	7	1	10	1
February	1,845	2,460	0	13	10	1	2	5
March	6,095	8,127	4	2	10	5	9	1
April	11,630	15,507	12	3	4	16	4	5
May	4,225	5,633	5	0	3	6	11	0
June	—	—	—	—	—	—	—	—
July	1,285	1,713	1	6	2	1	13	7
August	11,015	14,687	7	10	7	10	3	5
September	4,340	5,787	9	4	1	12	5	5
October	5,255	7,007	5	6	5	7	3	3
November	3,630	4,840	3	9	1	4	12	1
December	9,250	12,333	10	2	10	13	9	1
Total	59,220	78,960	60	15	0	81	3	10

The amount shown as realised by the ryot is after deducting all expenses in marketing, i. e., the actual amount received by him at the end of every month. The above statement shows in round figures that about 80,000 flowers worth about Rs. 80 per acre would be the average production and income in the first year of the rose cultivation. From the cost of cultivation of which details are appended it is clear that the ryots do not gain anything in the first year as the income is less than the expenses. It is only from the second year when the plants begin to yield more flowers and the cultivation expenses are low that the ryot gets more profit which ranges from Rs. 150 to Rs. 200 per acre. Actual study of production made in a separate garden is given in Table II.

Marketing. This is the most important item in the cultivation of roses. Quick despatch, ready market and co-operation among the growers in marketing are very essential as the flowers cannot last longer than 12 hours after harvest. A ready market is found in Madras city which is only

36 miles from this village. Flowers like this could be cultivated only in villages which are within quick reach of big city markets and where the flowers could be sold without difficulty. Otherwise there is every likelihood of the ryots losing a great amount unless other means of disposal like manufacture of *Gulkandu*, rose water etc. are found. The following details will be of some help to persons who intend growing roses near big cities.

At Iquaripalayam there are as many as 106 cultivators who grow rose in nearly 40 acres. They have formed themselves into 10 groups, each with a chief of its own, and with membership consisting of 20, 25, 17, 19, 10, 2, 4, 3, 1 and 5 ryots respectively.

Picking commences by 4 a. m in good flowering season and by 5 a. m. in other seasons and the flowers are delivered to the chiefs before 6 a. m. each day. The flowers supplied by each ryot are counted by the chief rejecting a few insect-attacked or otherwise damaged ones and the total number accepted is noted by him in his accounts and also in the daily supply book of the ryot.

A man is engaged to carry the flowers to Gummidipundi R. S. on a monthly wage of Rs 4. He is expected to carry 10,000 flowers in light baskets made of coconut leaves. Anything over this number is packed separately and sent through a casual labourer. Similarly, all the chiefs arrange for the despatch of their flowers from the village by 6 a. m. to the railway station where they are received by 7-30 a. m.

Two men are collectively engaged by the 18 chiefs to take the flowers to Madras city for sale. These two persons are provided with season tickets to Madras and they are paid Rs. 4 per month. These men receive the baskets delivered by the chiefs at the railway station and they are counted and weighed and a receipt is taken from the railway authorities for transit to Basin Bridge Junction where the baskets are unloaded and taken to Flower Bazaar. Extra labour is engaged when the total number of flowers exceeds 20,000 on any day. These two persons have each a standing permanent advance of Rs. 2 with them. Railway freight, cooly charges, etc. paid by them on any day is met from this money and recouped from the middlemen merchants at Madras city.

There are four middlemen in Madras city who arrange for the sale of flowers received from Iquaripalayam village All the flowers received from the village are not given to one middleman. The baskets from the various chiefs are handed over to their respective middlemen who arrange for the disposal of the flowers at the prevailing market price. A certain portion of the flowers is rejected by them as by the time they receive the baskets, i. e. 10 a. m., some flowers would have withered, got damaged or shed their petals. On an average about 10 per cent of the flowers received get rejected in this manner. These middlemen hand over a chit each day showing the details of flowers received, quantity rejected, quantity sold, price at which the flowers were sold, the amount due to the chief from them and also the empty baskets of the previous day. The two men return to the

village by 4 p. m. and hand over the chits of the middlemen to the respective chiefs, who make entries in their books. A specimen copy of the chit is given below :—

Dated 8—3—38.

Duplicate copy of chit retained with middlemen.

Name : Muthunagaraja.
Flowers received : 2805
Details of sale :—

400	@	Rs. 0—2—0	...	Rs. 0—8—0
1900	@	,, 0—1—6	...	,, 1—12—6
505	Rejected			2—4—6
2805				

Cooly charges, railway freight paid ...
Amount due ... ... Rs. 2—4—6

The total amount due to the chiefs, is paid before the 10th of every month deducting a commission of Rs. 0—1—6 in every rupee. The common expenses of the 10 chiefs, viz., the value of two season tickets, railway freight paid and cooly charges from Basin Bridge to Flower Bazaar, are proportionately divided according to income derived for the month on the sale of flowers.

The chief is paid a small remuneration of Rs 4 a month for maintaining accounts and organising the sales. He has to work out at the end of the month the total quantity of flowers despatched, the percentage of reduction, the rate per 100 flowers for the month after deducting all expenses and also calculate the amount due to every ryot supplying flowers to him. Sometimes advances of Rs. 100 or more are got from middlemen for household or other expenses without interest. This guarantees the middlemen a continuous supply of flowers for sale through him till the advances are recouped.

Prices. The daily market rate varies according to supply and demand. The prices, for example, in December and January, are much higher than those during other months ; on the New Year's Day especially flowers are sold at even Re. 1 to Rs. 1—8—0 per 100.

The statement below shows the average monthly price of 100 flowers from January 1932 to December 1937.

Month.	1932	1933	1934	1935	1936	1937
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
January	0 4 0	0 3 6	0 2 8	0 3 3	0 2 6	0 3 3
February	0 4 0	0 3 9	0 3 0	0 1 1	0 1 8	0 0 10
March	0 4 6	0 3 0	0 1 9	0 1 11	0 1 9	0 1 2
April	0 4 0	0 2 0	0 1 8	0 1 3	0 1 2	0 1 9
May	0 2 6	0 2 0	0 2 1	0 2 2	0 1 11	0 2 0
June	0 3 6	0 3 0	0 3 0	– – –	0 2 3	0 3 8
July	0 3 6	0 2 6	0 1 11	0 2 3	0 1 8	0 1 10
August	0 5 0	0 2 3	0 2 6	0 3 9	0 2 7	0 1 2
September	0 4 3	0 3 0	0 3 0	0 1 2	0 3 4	0 3 9
October	0 6 6	0 3 0	0 5 0	0 3 1	0 2 6	0 1 9
November	0 3 6	0 2 6	0 2 5	0 3 0	0 2 2	0 1 9
December	0 7 5	0 3 2	0 2 3	0 2 0	0 1 8	0 2 0
Average	0 4 5	0 2 10	0 2 8	0 2 4	0 2 1	0 2 1

TABLE II. Statement showing the number of flowers obtained and the net income of Mr. Lakshmana Raja from 1½ acres of roses for six years.

Month	1932		1933		1934		1935		1936		1937	
	No. of flowers.	Net income.	No. of flowers.	Net income.	No. of flowers.	Net income.	No. of flowers.	Net income.	No. of flowers.	Net income.	No. of flowers.	Net income.
		Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.
January ...	1600	4 0 3	13600	24 11 0	30670	42 15 0	12245	21 10 2	10690	13 5 9	9570	17 14 2
February ...	2850	7 2 0	6367	15 8 5	26650	41 7 8	68445	40 12 6	11055	9 10 9	75560	35 6 8
March ...	4974	12 3 6	20280	33 13 6	55090	53 0 4	30720	33 7 9	18616	17 8 10	26445	18 2 0
April ...	9150	18 8 3	20565	22 8 0	37115	36 5 6	57560	41 13 2	20365	13 15 4	31885	33 7 8
May ...	4400	5 8 0	16975	16 12 0	16910	20 7 7	24985	31 2 0	15695	17 13 9	25760	30 9 6
June ...	1092	2 6 0	2665	4 4 3	1610	3 0 10	—	—	4780	6 1 10	3765	7 5 4
July ...	671	1 4 8	800	1 4 0	14885	16 6 6	13835	18 7 9	11435	9 9 9	4500	4 13 6
August ...	3405	10 7 6	23220	27 0 10	11930	17 6 0	5155	10 15 11	11745	17 7 1	50955	35 4 9
September ...	3195	8 7 9	19145	30 8 3	18280	31 8 0	70490	47 4 7	3070	5 14 2	5385	11 7 9
October ...	568	2 4 10	4795	7 10 3	5850	16 1 5	19920	34 8 8	16035	23 8 10	8725	8 15 6
November ...	5213	11 6 5	9840	13 1 0	27715	38 8 3	2565	4 5 3	25680	31 15 10	34180	33 10 3
December ...	2837	11 9 1	31530	50 11 4	33090	40 15 2	34200	38 14 5	18740	18 2 6	16970	18 10 8
Total for 1½ Ac.	39955	95 4 3	169782	247 12 9	279795	358 2 3	340120	323 6 2	167906	185 2 5	293700	255 11 6
No. of flowers and income per acre by sale of flowers.	26627	63 8 2	113188	165 3 2	186517	238 12 2	226746	215 9 5	111967	123 6 11	195800	170 7 10
Approximate amt. by sale of layers per acre.		25 0 0		25 0 0		25 0 0		25 0 0		25 0 0		25 0 0
Total income per acre		88 8 2		190 3 2		263 12 2		240 9 5		248 6 11		195 7 10
Cost of cultivation per acre*		90 0 0		50 0 0		50 0 0		50 0 0		50 0 0		50 0 0
Net gain per acre		−1 7 10		140 3 2		213 12 2		190 9 5		198 6 11		145 7 10

* Kist excluded. Maximum return is obtained in the third year of planting.

From the above table it could be seen that the prices at Madras city have been going down every year and that the price during 1937 is not even half of what it was in 1932.

Cost of cultivation of one acre of Roses.

First Year :—Preparatory Cultivation :—	Rs.	a.	p
4 ploughings with country ploughs @ 8 annas per plough and man ..... 8 pairs of animals and 8 men.	4	0	0
Seeds and Plants :—			
Cost of 2000 well-layered plants @ Rs. 2 per 100.	40	0	0
Marking out, digging with mammatties and planting the layers at 4½ feet apart each way and pot-watering ..... 10 men @ 4 annas	2	8	0
Manures and Manuring :—			
First manuring at 2 cart-loads and second with 10 cart-loads of farm yard manure after six months, i. e., 12 c. l. at 8 annas.	6	0	0
Carting manure to the field—2 men and 2 pairs of animals.	1	0	0
Digging around plants, applying manure and covering up. 16 men @ 4 annas (6 for the first, and 10 for the second).	4	0	0
After Cultivation :—			
Seven hoeings with mammaties at 12 men per acre each time.	21	0	0
Irrigation :—			
Irrigating with tank water 40 times in the year—10 men at 4 annas.	2	8	0
Harvesting :—			
Picking of flowers (done by the owner himself).	3	0	0
Miscellaneous :—			
Kist on land.	6	0	0
	90	0	0

Second and subsequent years—Charges for each year.

Seven hoeings—12 men each time.	21	0	0
Manuring twice with 10 c. l. of F. Y. M. each time at 8 annas per c. l.	10	0	0
Carting manure and distributing—2 pairs and 4 men.	1	8	0
Digging round the plants, manuring and covering—24 men.	6	0	0
Layering the plants—8 men.	2	0	0
Irrigating with tank water—10 men at 4 annas.	2	8	0
Kist on land.	6	0	0
Picking of flowers.	3	0	0
Total.	52	0	0

The writer is greatly indebted to Sri V. Satagopan, L. Ag., Secretary South Arcot Groundnut Market Committee, Cuddalore for reading through his manuscripts and making very valuable suggestions in preparing this note. He is also grateful to Messrs. N. Muthunagaraja and K. Lakshmanaraja of Iquaripalayam village for providing him with the necessary statistics with regard to the cultivation of roses.

Two Exotic Weeds—How best to use them.

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When Mr. S V. Ramamurty, I. C. S., was the Director of Agriculture, Madras, he drew the attention of the Departmental Officers to the problem of utilisation of weeds that cannot be prevented from growing. In 1938 the writer observed two such weeds viz., *Croton sparsiflorus*, Morong, and *Tridax procumbens*, Linn., which have been growing not only in Coimbatore but all over the Presidency in so rank a fashion that it struck him that the potentialities of these two weeds must be discovered. In Coimbatore the writer has often found buffaloes grazing on *T. procumbens*, Linn. which led him to think that this weed must possess fodder value and in the case of *C. sparsiflorus*, Morong, he was very much struck with its luxuriant growth and its dark green leaves that it set him thinking that it should serve as a very good green manure. Independent of the writer, enquiries were being made by the District Agricultural Officers regarding this latter weed and its suitability as a green manure. Advantage was taken of this also and both these weeds were sent to the Government Agricultural Chemist for analysis. In this is given a brief botanical description of each of these weeds along with the chemical analysis as it was done by the Chemist.

Croton sparsiflorus Morong *Family : Euphorbiaceae.* (*Tamil :* Milagai pundu; *Telugu :* Seema mirappa.)

From the Tamil and Telugu names given to the plant, one can easily understand that the ordinary layman's eye has been caught by the close resemblance which this plant bears to the chilly—*Capsicum annuum*, Linn. There are however certain very broad characters in the vegetative parts of the croton weed which leads the lay man to mix it up with the chilly and these are the sympodial habit of its branching and the narrow lanceolate dark green leaves. It is here that one has to stop and think how important floral characters are in the determination of a species and its family. The plant is a native of Paraguay (South America) and is said to have first arrived in Bengal, in 1910. It is found today all along the East Coast from Assam down to Tinnevelly, chiefly confined to railway embankments. From the coastal areas, the plant is spreading into the central districts and at Coimbatore it is the commonest and most luxuriantly growing weed not only on road sides, but all along the tanks, streams and river bed. In South India, the plant is said to have been first collected at Tirukarrangudi (Tinnevelly District), 17 miles away from the nearest railway station.

The plant is an erect diffusely much branched annual herb growing to a height of 1 to 3 feet. The root system is shallow and surface-feeding. The main stem is green, woody at base and has sympodial growth after flowering. The plant is rough to the touch due to stellate hairs present all over it. The leaves are simple, alternate, exstipulate and crowded towards the tips of branches. The inflorescence is an erect androgynous spike

3—5" long with a few female flowers at its base and small sparsely set clusters of male flowers above. The fruit is a 3-lobed capsule dehiscing into 3 bits each enclosing a seed which is about 1/4" long, oblong, polished and mottled on the round back. There is a caruncle, a cushiony out growth on the tip of each seed as in castor.

Chemical Analysis.

Moisture.	8·42%
Loss on ignition.	80 81%
Insoluble mineral matter.	0·35%
Nitrogen (N)	2·32%
Potash (K_2O)	3·71%
Phosphoric acid (P_2O_5)	0·38%

"This contains fair amounts of potash and nitrogen and can be very well used as a manure, after composting"

Tridax procumbens, Linn. *Family* —*Compositae*. (*Tamil* : Kallipundu, Gayavettu thalai; *Telugu* : Bokuvulu aku).

The plant is a native of South America and must have been introduced long ago as it has been with us for several years now, and has found a place in the Madras Flora (2). It is commonly met with on road sides and waste places in all dry districts and on all the low hills of South India up to an elevation of 2,000 feet or more. It is a straggler and a hispid perennial herb of 1 —2 feet or more high with a few branches spreading on all sides. Leaves simple, exstipulate, short stalked and very much cut. The flowers are yellow and borne on long terminal heads, the stalk of the head being 10 inches or more. The plants in flower look very much like small *Chrysanthemums* from a distance. Florets are yellow and of two kinds, the outer ligulate and female, the corolla being 3 lobed and the inner disc florets tubular, hermaphrodite, the corolla being 5 lobed. The achenes have a feathery pappus. The plant produces seeds in abundance, as many as 500 to 1,500 per plant.

Chemical analysis.

Heads of analysis.	On dry basis.	On original moisture basis.
	%	%
Moisture ...	...	81·11
Ash ...	23 16	4·38
Crude proteins ...	9 97	1·88
Ether extractive ...	3·15	0·59
Crude fibre ...	29 83	5·64
Carbohydrates (by difference.)	26·83	6·40
	100·00	100·00
Albuminoids ..	8·13	1·54
Insoluble mineral matter	8 35	1 58
Iron (Fe_2O_3) ...	0·85	0·16
Alumina (Al_2O_3) ...	1 00	0·19
Lime (CaO) ...	4 80	0·91
Magnesia (MgO) ...	Traces	Traces
Potash (K_2O) ...	3·76	0·71
Phosphoric acid (P_2O_5)	0 68	0·13
Nitrogen (N) ...	1·60	0·30

"The sample contains fairly good amounts of food ingredients, but the fibre content is a little too high. Probably, it is this factor that makes it more favoured by buffaloes than by cows. The weed is particularly rich in lime content".

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Cardamom Cultivation in the Bodi Hills.

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During 1937 there was a severe infestation of *Taenothrips cardamomi* on most of the cardamom estates in the Bodi Hills. The planters suffered a heavy loss. Some of them appealed to the Deputy Director of Agriculture, Madura for help early in 1938 In response to their request, the author was deputed to investigate this pest. This opportunity was taken to study cardamom cultivation as practised in these areas and the study continued as and when opportunities occurred. The materials gathered are summarised below.

Cardamom—(*Elettaria Cardamomum*, Maton) is a valuable spice. The plants are found growing luxuriantly in a wild state in elevated sheltered areas, scattered in the thick humid ever green shola regions of the Western ghats, with an annual rainfall ranging from 100 to 150 inches. There are only limited areas satisfying the above conditions and these are confined to the Western ghats in parts of Mysore, Coorg, Cochin, Travancore and Madras Presidency. According to an official estimate the total area under cardamoms in South India is about 86,134 acres but there are reasons to believe that the area is at least 100,000 acres.

The description of the plant *Elettaria Cardamomum*, as given by Fischer[1] is given below,--

Elettaria Cardamomum, **Maton.** Western ghats, wild and cultivated, 2500—4500 ft. The Cardamom.

Leafy stem 6—10 ft. high; leaves linear—lanceolate acuminate, sessile or very shortly petioled, glabrous above, softly pubescent beneath, 1—2 ft. long, 2—3 in. wide; panicles several. upto about 2 ft. long, erect or prostrate; bracts 6—7 flowered, linear oblong. obtuse, about 1·5 in. long, corolla tube shortly exserted, lobes 0·5 in. long, lip longer, white striped with violet; capsule subtrigonous, about 0·4 in. long, striate.

Var. *major*, more robust, leaves broader bracts more distant, 2—4 flowered; capsules 1" or more long. In the same localities.

The seeds of both used as condiments and medicinally.

There are 2 cultivated varieties, the Mysores and the Malabars. The chief characteristics of these varieties are given below :

	Malabar.	Mysore.
Suitable elevation :	2000 to 5000 ft.	3000 to 4000 ft.
Rainfall :	60 to 100 in.	Withstands heavier rainfall and wind
Height—leafy stems.	6 to 9 ft. light green.	More robust and taller darker green.
Tillering :	10 to 30 tillers in well grown mature clumps.	Tillers more profusely.
Leaves :	2 to 2½ in. broad, 1—1½ ft long, tips pointed upper surface smooth and the lower surface velvetty or smooth.	3 to 6 in. broad. 2 to 3 ft. long. Smooth on the upper surface and glabrous below.
Racemes :	1 to 2 ft. long trailing along the ground.	2 to 3½ ft. long, erect.
Spikelets :	11 to 22 on each of the racemes.	22 to 48 on each of the racemes.
Fruits :	Light green 1/5 to 9/10 inches long, angular with 18 to 23 black seeds closely packed. Fruit coat thin.	Darker green, bigger in size globose with 22 to 32 seeds. This gives about double the yield of Malabars.
	The floral racemes and the flower bearing shoots die, soon after the season's pickings are over.	The racemes continue to live and bear fruits in the succeeding season also.

Cardamoms may be propagated either by rhizomes popularly called "bulbs" or by seeds. The common method of propagation is through 'bulbs'. Bulbs 1½ to 2 years old with at least two tillers from individual clumps which are healthy, high yielding and regular bearing. These are forked out and separated from the mother plants, taking care to see that the rhizomes are intact and uninjured. The roots are clipped leaving a length of about 6 inches before planting. Five such bulb plants are planted in each of the pits in the field. Bulb plants begin to yield earlier. Hence it is easier to start and maintain a plantation with bulbs. But these are said to be short-lived and less vigorous and hence have to be replanted after about 15 years. Of late, owing to the difficulty in getting mosaic-free bulbs for planting, some of the more experienced growers are raising seedlings for planting. The seedlings being free from mosaic to start with, yield better and remain healthy for a longer period; hence seedling planting has come into vogue, and is extensively practiced in some of the important estates in the area.

Selection of seeds. Well ripe plump fruits from healthy robust and disease-free clumps are gathered in September and air-dried in the shade. A few days before sowing, the seeds are separated. These seeds are soaked in water over night, rubbed gently between the hands to remove the sugary coating on them ; else, ants are likely to invade the nursery and remove the seeds causing gaps and uneven germination.

Nursery. During February—March seed nurseries are prepared near channels or springs to facilitate watering. Raised beds 1 yd. × 15 yds. are formed from the top soil, which is usually very rich in humus. Stems, broken twigs and other hard materials found there are removed. These beds are watered once a fortnight. Weeds are removed as soon as observed so that they are eliminated to a great extent before sowing. On such carefully prepared beds, good seeds are sown in August. About half a pound of seeds is sown in three beds, to get enough seedlings to plant one acre. After sowing, fine sand is sprinkled over and the beds gently stirred or worked with hands to cover the seeds. A layer of straw or dry grass is spread over these beds to prevent erosion of the soil particles and to hasten germination. These beds are gently watered twice a day with rose-cans, till the seeds begin to germinate i. e., 30 to 40 days, care being taken to see that the surface soil is moistened and wetted and no water stagnates on the surface even for a short time. Nurseries are usually located in open areas near dwelling quarters for proper supervision and maintenance of the tender seedlings. The beds are protected from the direct sun by wicker *pandals* erected over them. Growers believe that the morning sun is injurious and the mild evening sun beneficial to the growth of the seedlings. As such the beds are usually given a western aspect. When the seeds have germinated and the seedlings are two inches or so high, the covering over the pandals is reduced, so that the seedlings receive just a little of the sun. As the seedlings grow older, the top of the pandal is gradually cleared so as to allow more sun on them and thus become hardened under natural field conditions.

First transplanting Seeds sown in August germinate by the middle of October. By the following May i. e., 8 to 9 months after sowing, the seedlings grow about one foot. These tender seedlings are then carefully forked out and transplanted in singles 6 to 8" apart in fine nursery beds, prepared in shady parts. The transplanting is finished by the end of June before the Monsoon sets in If planted during the rains, the rhizomes may rot and the seedlings die out. Hence the transplanting is done before the rains.

Second transplanting. By the following April—May i. e., 1 year and 9 months after sowing, when the seedlings have grown to a height of 2 to $2\frac{1}{2}$ feet with 2 or 3 tillers, they are replanted in the field 3 feet apart.

Third transplanting. During the next pre-Monsoon season, they are again replanted in the field 5 to 6 feet apart (2 year 9 months). By the following May—June, these transplants being 3 year and 9 months old, some of the vigorous ones begin to flower. Now these are ready for final planting.

Fourth and final planting. These seedlings are planted in the field finally during the succeeding April—May in pits that are previously prepared and kept ready for planting. At the time of each planting, the seed

lings are carefully examined and the diseased ones discarded choosing only the healthy plants for replanting. As the age of the seedlings advances, the height of the plant and the number of tillers increase and hence the distance between plants is increased at every successive replanting to allow room for the tillers that grow. These seedling plants are planted in singles with all the tillers intact. In some of the estates, the seedlings are planted 10 feet apart in the field at the time of second planting when they are $1\frac{1}{2}$ to 2 years old to save another transplanting charges the expenditure in maintaining a larger area properly is heavier.

Transplanting in the field. The area to be planted is carefully surveyed and roads traced according to the contour of the land.

Planting distance. The distance between plants varies according to the natural fertility of the soil and the variety. In richer soils the average spread of each Mysore-clump is about 6 feet. On such rich soils, they may be planted 12 feet apart. In poorer soils they may be planted closer. Similarly the Malabars may be planted 10 feet apart in richer soils and closer in poorer soils. But usually in most of the plantations they are planted 11 feet apart which is the average distance irrespective of the variety and soil.

Lining. Lines are marked along convenient angles 11 feet apart, both lengthwise and cross-wise, and stakes driven at the intersection of these lines. On the marked spots, pits are dug 2 feet square and 1 foot deep on the lower slope. The bottom of the pits should be level and even. The depth on the lower slope alone is to be considered when measuring the depth of individual pits. The dug out soil is heaped over on one side of the pit, so that when the pits are to be filled up before planting, only good rich surface soil around the pits may be used. The pits are dug out in February – March, allowed to weather for about two months and then filled up with surface soil. About 360 pits are dug to an acre.

Filling pits. The rich surface soil on the top and two adjacent sides to a depth of about six inches together with the accumulated leaf mold is gathered and the pits filled up. When the pits are filled up, the rich soil is heaped on the top, to allow for sinking later on. Then the surface is made even by spreading the dug out soil from deeper layers. After a month these pits are reopened, undecomposed twigs, small stones etc., are removed, the whole soil is thoroughly mixed, and refilled. A stake is fixed in the centre of the top margin of these pits to indicate where the seedlings are to be planted. By the middle of May, these operations are finished and the pits kept ready for planting. The seedlings are finally transplanted during April—May.

Planting. The seedlings are forked up carefully, the individual clumps separated and the roots pruned to 3 or 4 inches, care being taken not to injure the rhizomes. Healthy plants are gathered and taken to the area where they are required for planting. The seedlings are placed on the

right of the indvidual pits, the bulbs on the lower side and the shoots above, with the upper surface of the leaves facing the Sun.

A central line is drawn along the middle of the pits from side to side a small trench 6 inches deep is made above this line, and the earth collected on the right margin. Either seedlings or bulbs, whichever is selected are planted in these pits, the tallest tiller is arranged in the centre with the small ones on the sides so as to form a sort of symmetry. These are made to lean on the soil. If planted erect, they are likely to be uprooted by the strong Monsoon winds that follow closely the planting season. The soil around is pressed down and leaves and leaf moulds are spread over the pits so as to form a thick mulch.

Shade regulation. Planting over, the area is surveyed with a view to regulate shade. The Mysores are hardier and can withstand a little more sunning than the Malabars. The Mysores require about four hours of sun and the Malabars about three hours of sun every day. During the sunny part of the day, the more shady trees are marked and these are confirmed or modified after subsequent observations and the marked trees felled or the branches lopped off, so as to get the optimum amount of sun-light for the plants beneath. If too shady, the central branches are removed to have open crowns and the lateral branches induced to grow better.

While thinning, the following species of trees and shrubs are eliminated as they are unsuited either being thorny, or in some cases the Cardamoms are observed not to thrive well under the shades of these trees:— Eriodendron sp. Grewia tiliaefolia. Symphorema involucratum, Salix tetrasperma, Kydia calycina, Macaranga Roxburghii, Acacia lucophloea, Wrightia tinctoria, Semicarpus, sp. Solanum pubescens.

As far as possible the following trees are not to be removed while thinning, even though some of these may be mere saplings.

Chuckrasia sp. Vateria indica, Jak, Acrocarpus fraxinifolius, Cullenia excelsa, Pithecolobium subcoriaceum, Mango, Mesua ferrea, Nephelium longana.

If more shade is required, some of the quick growing trees such as *Acrocarpus fraxinifolius, Nephelium longana* and *Mesua ferrea* may be planted. The thinning out of the existing plants and the planting of fresh ones is adjusted to suit the variety planted. The leaves from the felled trees are carefully conserved for forming mulch over the newly planted area.

Time of felling trees. For shade regulation, trees and branches in the denser parts are removed in April. By May—June, plantings may be over and shade regulation work commenced immediately and finished by September. If the shade is not regulated within two years after planting, the plants will not yield properly at the end of the third year.

After-cultivation. The newly planted field is weeded as often as is necessary to keep the pits free from weeds. During the first two weedings, the weak and dead plants are replaced. About four weedings are necessary during the first year, three in the second year and two in the succeeding years between July and November. During weeding, the dead leaves and shoots are cut and scattered around the plants to provide mulch. The dead leaf sheaths, shoots and flower stalks are not to be pruned too close to the root, as the rhizomes are likely to dry up if done so.

Flowering, fruiting and picking. By the following pre-Monsoon season i. e., 5th year from sowing—the plants will begin to flower here and there. More plants will flower in the sixth year i. e , two years after final planting and regular yields may be expected from the third year onwards. Simultaneous with the development of a flowering raceme, at the base of each mother shoot, two more ordinary leafy shoots develop. When the mother shoots die out after the season's picking, these secondary shoots take their place and when two years old, in their turn develop the flowering racemes. Increased yields are obtained as the plantation gets older, as more tillers and racemes are formed with the age of the plants. But the clumps get displaced, every year and the regular lines on which they were originally planted get obliterated So, in general the planting is renewed every 15 years or so according to the condition of the plantation and the displacement of the shoots from the original place of planting.

In a plantation flowers and fruits may be observed almost throughout the year. But the optimum flowering period is during the dry pre-Monsoon period i. e., May to July. It takes about four to four and a half months for the flowers to develop into fruits ready for picking and consequently the peak of harvesting is from September to November.

Well ripe fruits are light green and the seeds inside are hard, greyish black and very fragrant In a spikelet, fruits of different maturity may be observed to develop at a time. Only ripe fruits must be picked. While curing, the unripe fruits shrink considerably as the seeds inside are juicy and not hard. If fruits are not picked in time, these are shed and lost or greedily devoured by animals. The over ripe fruits get split while curing and the seeds which are shed from the capsules are not much valued in the market Hence the fruits must be picked at the right time. During the heavy picking season, coolies are sent round the estate once in about ten days and the ripe fruits are collected.

Curing and grading. The fruits when picked are juicy. These are cured—dried—before they are ready for the market. Formerly they were cured by a tedious process of bleaching with sulphur, washing and drying until the required colour is obtained and the fruits dried sufficiently. This is now replaced by flue-curing which process is easier and can be wellcontrolled irrespective of the prevailing weather conditions.

The cured fruits are cleaned. Flower stalks, immature and split fruits are separated along with those that are diseased or scabby. These are sold as "thakkolam." The seeds are collected and removed. Good entire fruits are graded and marketed separately.

Yield. The plants usually begin to yield from the third year of planting. During the third year 10 lbs. of cured fruits may be expected per acre. The yield increases year by year and from the fifth year onwards 120 to 200 lbs. of cured fruits may be obtained from an acre, according to the condition in which the plants are maintained, for about fifteen years. Then the yield decreases gradually. In well-maintained estates, in good localities and in favourable years, yields higher than 200 pounds are obtained. There are some plantations which are more than 25 years old giving an average yield of 200 lbs. per acre. But these are exceptional.

Pests and diseases. Some of the important pests and diseases of cardamoms are noted below :—

Nursery :	Cut worms Root grubs Grass-hoppers	} destroy seedlings and young plants.
Plantation :	Eupteroid.	Caterpillars descending in numbers by silken-threads from shade trees and attacking cardamom plants and destroying them completely in certain years.
	Dicocrocis.	Stem borer.
	Tineid.	Root borer.
	Taenothrips cardamomi :-	Sucking flowers and causing warts on fruits
	Rats, squirrels, frogs, elephants, wild boars, porcupines, and monkeys.	
Disease.	Mosaic or Marble disease.	

Of the above mentioned pests and diseases, thrips and mosaic are most dreaded and are present in most of the estates. Consequently the average yield in some of the estates has decreased considerably and in some of the estates the ill-effects of these are so bad, that they have been neglected in despair by the owners.

Trials were conducted in two estates :— (1) Sathurangapara estate and (2) Gandhipara estate to control thrips (*Taenothrips cardamomi*) during 1938 season, in consultation with the Government Entomologist, Coimbatore. The following observations were made regarding this pest :—

The extent of loss due to thrips havoc is estimated to be about fifty per cent. These insects live mostly inside the flower bracts and leaf sheaths. In badly infested spikes, the blossoms wither and are shed before the seeds set, and the fruits if developed are malformed and warts are developed.

Opportunity was taken to see whether this pest could be controlled by the use of the following methods :—

Dusting (1) Tobacco powder mixed with 4 times the quantity of road dust,

(2) Lime sulphur—4 of lime and 1 of sulphur.

Spraying (1) Tobacco decoction

(2) Phenyle—diluted to about 50 times with water.

The dustings were not satisfactory whereas the sprayings with tobacco decoction and phenyle proved to be effective and a large number of thrips were killed. The sprayings could not be carried on regularly, owing to the receipt of frequent rains but they were not sufficient to wash down the insects. In the case of sprayed plants, the shedding of buds and blossoms were greatly minimised and the fruits well developed without warts or malformations, whereas the reverse was the case among the untreated plants.

Economics. The cost of starting and maintaining an area of 50 acres till it begins to yield normally for seven years is given in the appendix.

A capital investment of about Rs. 25,000 is required to start and maintain a cardamom estate of 50 acres in a virgin area upto its seventh year when the yield becomes regular. From the seventh to the fifteenth year for about nine years, a high average is maintained, and from the sixteenth year onwards the yield gradually decreases until about the twentieth year or so when the plantation has to be renewed. From the third to the seventh year of planting, it yields about 33,500 lbs. of capsules valued at Rs. 41,875. Deducting the amount invested there is a net balance of Rs. 16,759 for the seven years From the 7th to the 15th year there is a net gain of Rs. 10,000 per year or Rs. 200 per acre.

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Appendix.

Economics of starting and maintaining a Cardamom Plantation of 50 acres upto its 7th year.

Particulars.	Units of labour.	Rate. Rs. a. p.	Total expenditure. Rs. a.	Yield in lbs.	Value Rs.
I Year.					
Clearing ...	2250	0 5 4	675 0		
Lining ...	400	0 4 0	100 0		
Marking pits and gathering leaves	400	0 4 0	100 0		
Digging pits (360 per acre) ...	725	0 6 0	261 14		
Shade regulation ...	150	0 6 0	56 4		
Filling pits ...	400	0 4 0	100 0		
Removal of twigs, stones, etc., from filled up pits and refilling ...	200	0 4 0	50 0		
Planting, carrying seedlings, etc. ...	550		200 0		
Trashing ...	200	0 4 0	50 0		
Felling trees, etc. ...	150	0 6 0	56 4		
Weeding 4 times ...	1600	0 4 0	400 0		
Cost of seedlings at Rs. 35 per 1000 at 5% for filling up gaps ... (21000) seedlings ... (If bulbs 100,000 @ Rs. 10 per 1000).			705 0		
II Year.					
Weeding 3 times ...	1200	0 4 0	300 0		
III Year.					
Weeding 2 times ...	800	0 4 0	200 0		
Pruning ...	200	0 4 0	50 0		
Picking @ 10 lbs. per acre at Rs 2 per 20 lbs. valued @ Rs. 1/4. ...	200	0 4 0	50 0	500	625
IV Year.					
Weeding 2 times ...	400	0 4 0	100 0		
Pruning ...	200	0 4 0	50 0		
Picking, curing, etc. @ Re. 1 per 10 lbs. yield 60 lbs per acre. ...				3000	3750
V Year.					
Weeding 2 times ...	300	0 4 0	75 0		
Pruning ...	400	0 4 0	100 0		
Picking, curing, etc @ Re 1 per 10 lbs. Yield 200 lbs. per acre ...			1000 0	10000	12500
VI Year.					
Weeding etc. as in the 5th year	700	0 4 0	175 0		
			1000 0	10000	12500
VII Year.					
Weeding etc., as in the 5th year	700	0 4 0	175 0		
			1000 0	10000	12500

Particulars.	Units of labour.	Rate. Rs. a. p.	Total expenditure. Rs. a.	Yield in lbs.	Value Rs.
Supervision charges for 7 years.					
1 Manager on Rs. 50 p. m.	...	50 0 0			
2 Fieldmen on Rs 25 ,,	...	50 0 0			
4 Maistries on Rs. 15 ,,	...	60 0 0			
Total per month Rs. 160					
For 7 years 160 × 84	...		13440 0		
Tools and sundries	...		1000 0		
Land tax @ Rs. 5 per acre per year			1750 0		
			23519 6 or		
			23600 0		
Interest on capital at 6%	...		1516 0		
			25116 0 or		41875
			500 0 per acre.		837
Net profit for 7 years for 50 acres. (Rs. 41875 less 25116)					16759 or 337 per acre.

Note. The cost of building quarters for the Manager, and his assistants and the erection of cooly lines have not been included.

SELECTED ARTICLE

Roots

By H. C. Sampson, C. I. E.

The study of the root systems of crops grown in the tropics and sup-tropics is a branch of agricultural research which has not received the attention which it deserves, in fact, so little information has been published on the subject that one is forced to fall back on inferences rather than to depend on concrete knowledge. This study is more important in the tropics than in temperate regions, because the range of environment is so much greater, and there is no doubt that environment has a considerable influence on the root development and root system of any particular species, or of any cultivated race of a species. For example, the work which has been done at East Malling in examining the root systems of different races of fruit stocks has shown clearly that these vary both with the stock and with the type of soil on which they are grown.

A striking example of the influence of environment on the root system of a species is the case of the Neem tree *(Azadirachta indica)*, which has been introduced into the Gold Coast within the last twenty years. Its native habitat is in India, where it is generally found growing in open country in the drier parts of the country. It is not exacting in the type of soil on which it grows except that it is not seen on deep black cotton soils. Under Indian conditions the tree makes a strong tap root which penetrates vertically into the ground for a considerable depth, and it shows little tendency to form strong branch roots near the surface. In the Gold Coast the tree is now a common feature in roadside, town and village planting, and it is not unusual to see trees where the root system has been exposed by erosion. The most striking feature shown is the tangled mass of stick surface branch roots extending laterally quite close to what must have at one time been the surface of the ground. In fact, one may say that all the common exotic species of trees which are grown in West Africa develop under that environment a shallow root system. This adaptation of the root system to suit a particular environment may explain why it is that trees found useful in

one country as shade for a particular plantation crop may prove quite unsuitable or even harmful in another environment. In some of the West Indian Islands one cannot help admiring the magnificent specimens of rain tree (*Pithecolobium Saman*) which are seen as avenue and savannah trees. In popular accounts of this tree one reads how it closes its leaves when it rains and thus allows the rain to fall on the ground beneath its shade. Certainly in this environment it does not seem to do harm to surrounding vegetation. The same species grown in the drier parts of Peninsular India is, however, a menace to arable agriculture, as there it develops a wide-spreading surface root system which robs the soil of moisture sometimes for a distance of sixty to seventy yards. This makes it impossible to grow rain-fed crops on the area of its root spread, and it is a common complaint of villagers that the tree when planted as a road avenue renders the adjacent land useless for agriculture.

Apparently little has been done to study the root systems of plantation crops in the tropics. If it has, very little literature is available on the subject, and such information as exists deals only with particular environments. The matter is of great importance, especially in the case of plantation crops which are interplanted with shade trees and cover crops; for it seems essential to appreciate what amount of root competition exists between the shade tree and the crop. Of course in some soils this is more important than in others. In heavy soils retentive of moisture and where the rainfall is heavy, such competition may be of actual value, because the roots of the shade tree may assist in draining the soil, thus providing a suitable environment for the roots of the crop. This may explain why it is that shade trees in cacao are advocated in Trinidad whereas in the nearby island of Grenada it is grown without shade.

Information regarding the root systems of plantation crops is often required when laying out experimental plots. A knowledge of the root-spread of individual trees, for example, is essential when laying manurial experiments, in order to decide how many guard rows are necessary between plots. It was a matter of surprise to be told the other day that when the root system of a mature oil palm was exposed, several of the roots extended over 100 feet, while the longest measured 127 feet. This was in a sandy soil with a fairly high water-table, and of course may not represent the root spread of a palm grown on a heavier, deeper and more fertile soil.

Various theories have been expressed on the action of the bush fallow, which is common throughout tropical Africa, where shifting cultivation is the rule, in restoring fertility to the land. The one which seems most important is the deeper root system of the natural tree vegetation which brings up from deeper levels to the surface soil additional amounts of plant food. A striking example of an artificial bush fallow is found in the densely populated region of the Eastern Province of Nigeria. Among the Ibo people, who inhabit the deep sandy soil country of the palm belt, each household has its compound land, but there is also an expanse of communal land. Among many of the clans, however, it is the custom that if one of its members plants up a portion of the common land with a small rosaceous tree called *Acioa Barteri*, he is allowed to crop that area for his own use. An opportunity was given to see the root system of this tree in an area where gully erosion was severe. The gully had been checked by a planted patch of this tree, and the roots of one or two were exposed at the edge of the gully. The tap root went vertically down for a great distance, and there is little doubt it is this deep root system that has established the reputation of this tree for restoring fertility to the surface soil.

In the case of arable tropical and sub-tropical crops little information is available. Weaver has described the root systems of several sub-tropical crops

which are grown in the United States, but it is felt that much more local research is necessary to gain knowledge regarding particular environments and particular races of cultivated crops.

The monocotyledons include all the cereal crops as well as such crops as onions, ginger, etc. The peculiarity of all such crops is that they do not form a tap root. Their roots are more or less ephemeral and if damaged they die, but can be rapidly replaced by freshly formed roots. All cereal crops are for this reason capable of being transplanted, and in some cases this is the normal agricultural practice, the seedlings being raised in a seed-bed and subsequently pulled out and transplanted. Swamp rice is generally grown in this way, at any rate in the more developed rice-growing areas. The seedlings are pulled out when they have reached a certain age and most of the roots formed in the seed-bed are broken. They are further damaged by beating the butts of the bundles of seedlings against a stake stuck in the ground. In some places the seedlings which are tied in bundles, are stacked in small heaps in the field with all the roots facing outwards, and they are left in this way for two or three days for the roots to wither. Thus the transplanted crop has to start and make an entirely new root system.

The sorghum crop in India is considered to be the most drought-resistant of all cereals, and one presumes therefore that it has a deeper root system than other grain crops. There is however, a considerable difference in this repect between varieties. One variety known to the writer, it is claimed, can mature its crop provided there is sufficient moisture in the ground for the crop to germinate and form a *braird*. For the rest of its moisture requirements it is dependent on dew and on moisture in the deeper soil. The question of drought resistance in West Africa is not so clear, because, though there are numerous varieties they all appear to be long duration ones occupying the ground for six to seven months, while in India the time of maturity is considerably less than this, and there are also short duration varieties to suit districts having a short rainy season. The root systems, however, of the Indian and the West African varieties appear to be different, though this may be due to environment, since the rains are generally heavier in West Africa and the soils as a rule have a lower pH value. Local agricultural practice in the black cotton soils of India spaces the plants about 6 inches apart in rows about 14 inches apart. In West Africa the crop is grown on ridges 3 to 3½ feet wide, and the plants are spaced about 1½ feet apart in the row. Thus in West Africa each plant has nearly ten times the surface area that the plants have in India. This certainly seems to point to a difference in the root systems of the cultivated races of sorghums in these two regions.

In the drier parts of West Africa, where the rainfall is less and the rainy season shorter, the grain Pennisetums form the most important cereal crop whereas in India these are not considered to be as drought-resistant as sorghum. This again may point to a difference in the root system, though it must be remembered that many of the early sown West African Pennisetums are comparatively short-duration crops.

In the case of sugarcane, both Venkataraman and the workers at the East Indian Sugar-cane Station at Barbados have shown that there exist marked differences in the root system of different seedling varieties of sugar-cane, and it is on such differences that new varieties are selected for trials in other environments. These differences in seedling cane varieties are, however, on rather a different footing from races of cereals owing to the complex hybrid origin of the present-day seedling canes.

Apart from cultivated grass crops, recent work in Uganda has shown the value of a grass fallow where elephant grass (*Pennisetum purpureum*) is deliberately planted prior to allowing the land to go out of cultivation. It is claimed that this not only restores the texture of the soil but also its fertility, and one wonders how deep the roots of this grass penetrate to bring up from below fresh supplies of plant food. In Northern Nigeria experiments of a similar nature are being made with *Andropogon gayanus*, which judging by the way the grass can remain green in the dry season, has, one suspects, a deep root system, thus enabling it to restore fertility to the surface soil.

The principal dicotyledonous crops of the tropics belong to the family of the Leguminosae. The value of such crops in mixed croping and in rotations has often been stressed on account of their being able to fix atmospheric nitrogen with the aid of symbiotic bacteria living in their roots. With few exceptions tropical pulse crops are grown as mixed crops. Recent work in this country has shown, in the case of pastures, that the grasses among which legumes are grown can make use of the nitrogen from the roots of the legumes, and it is probable that tropical cereals, among which pulses are grown can do likewise. It is not clear whether, in the tropics, the nitrogen fixed by a leguminous crop in one season will remain available in the soil for the benefit of cereal and other crops of the next season. Experiments conducted by the Nigerian Department of Agriculture where *Mucuna aterrima* has been grown as a green manure show that there is no appreciable difference in the yield of the succeeding maize crop on plots where Mucuna crop has been ploughed in and on plots where this has been burnt on the ground. One imagines therefore, that value of the green manure crop largely lies in the fact that it has brought up from below supplies of mineral plant food, which are thus available for the succeeding crop. This is partly borne out by the fact that the pH of the plots where the Mucuna was burnt is higher than that of the plots where it was turned in. The fact that Mucuna has been most successful in areas where the lateritic subsoil is fairly near the surface suggests that its root system is comparatively shallow. In Northern Nigeria experiments are being carried out in restoring fertility with pigeon pea (*Cajanus cajan*) grown as a biennial. The fact that the plant can survive through the intensely dry season suggests that it has a deep root system. Ducker, in Nyasaland, states that the roots of the pigeon pea will penetrate a lateritic pan. In the Sudan several leguminous crops have been tried as rotation crops for cotton, and *Dolichos lablab*, agriculturally has been found to be most suitable, though, owing to its harbouring pests which damage cotton, its use has had to be restricted. This suggests that its roots can tolerate, even if they cannot penetrate, the alkaline subsoil. Another leguminous plant whose roots can penetrate an alkaline pan is *Sesbania aculeata*, and possibly other species of Sesbania may behave in the same way.

The groundnut is a legume which is generally grown as a pure crop, though sometimes it is interplanted among cereals. It is extremely drought-resistant, remaining green and fresh till it commences to ripen its pods. It is a crop suited to lighter classes of land, and its drought resistant qualities have made it a valuable asset to the light red soil districts of tropical India. On such soils it is generally considered an exhaustive crop, and yields decrease rapidly after three or four years' cropping unless the land is manured. In West Africa the crop has been extensively grown for many years and recently it has been reported that the older groundnut areas are not giving the yields that they formerly did. Considering that manuring is hardly known in West Africa, it is rather surprising that the land has not shown signs of exhaustion before this, and one can only suggest that this is due to the type of subsoil commonly found and the depth to which the roots penetrate. The red soils of India generally lie

directly on the parent rock and thus have no reserves on which to draw, while in West Africa a lateritic subsoil usually occurs.

The root system of Asiatic cottons is quite different from that of the upland cotton of the New World. The former are much more slender and penetrate much more deeply into the soil, and the tap roots of seedlings which have made only one leaf have been traced to a depth of 18 inches in black cotton soils. It is possibly because of this deeper and therefore more drought resistant root system that in French West Africa Indian cottons have been introduced into the dry north as a rain-fed crop. The variety is known as Budi and is stated to be a cross between two Indian cottons—Karunganni of the Tinnevelly district and the Garo Hills cotton. But even the Upland cotton has a much deeper root system than some other crops, and in Nyasaland it is generally stated that tobacco always does well after a cotton crop, presumably because the latter has replenished the supplies of mineral plant food near the surface.

It is unfortunate that there have been several years of low prices for tropical primary products; for at such times agricultural departments are expected to produce quick results, and no one can say that the study of root systems is not a tedious and often an expensive business. It is hoped, therefore, that when and if the prices of primary products improve more attention may be given to the study of the root systems of crops in the colonies. *The Empire Cotton Growing Review*, 16: (1939) 165—170).

ABSTRACTS

Value of Refined Coconut Oil and Butter Fat. R S. Harris and L. M. Mosher *Food Research* 5: 183.

Experimental rats were maintained on a diet consisting of extracted skimmilk powder (72 percent), extracted brewer's yeast (three percent) supplemented with vitamin A, vitamin D, and iron. These diets were abnormal in only one respect, that is, they contained an abnormally large proportion of fat. The animals were observed as to the effects of these two diets on weight increase and food consumption. Groups were guillotined after 15, 30, 60 and 90 days on the diets, and body tissues were studied histologically. Results were compared with those on rats maintained on a standard stock ration which served as control. Animals on the butter fat diet consumed a slightly larger but possibly insignificant, amount of diet but increased in weight much less rapidly than the animals on the coconut oil diet. The superior weight increase of the rats on the coconut oil diet was not adipose tissue, for the body and liver tissues of the groups contained essentially the same amount of fat (alcohol—ether extract) and true lipid (petroleum ether extract of the alcohol—ether extract). The investigation is being extended to determine whether the weight increase was due to increase in muscle tissue. The animals on both the butter fat and the coconut oil diets developed a slight fatty infiltration of the body and liver cytoplasm. This was shown by the increased amounts of fat and of true lipids and by histological examination. This fatty infiltration was equally intense in the coconut oil and butter fat groups. There was no evidence of pathological tissue changes in any animal in any group. These results indicate that butter fat and coconut oil even when fed at rather high levels in a complete diet, are equally harmless to rats and presumably to man. (Author's abstract).

Rice and Beri-Beri. It is over twenty-five years since Eijkman and his coworkers clearly demonstrated the connection between the consumption of highly milled rice and beri-beri, but, according to statistics collected by the League of Nations, the habit of using highly milled rice is increasing, and in 1937 the intergovernmental committee pointed out that the economic and other factors

underlying this tendency had not been fully studied in any country. The Coonoor Laboratories of the Indian Research Fund have now undertaken a comprehensive investigation and issued a report (*Indian Medical Research Memoirs*, No. 32, 1940). Rice is the staple diet in India, and hence the nutritive value of the Indian's food depends mainly on rice Dr. Aykroyd and his colleagues suggest that agricultural research should aim at the production of high-yielding strains of rice, and that any tendency to abandon parboiled rice in favour of raw should be checked. It is recommended that public health propaganda should include instruction about vitamin losses during the washing and cooking of rice, and that the minimum amount of water be used for cooking and the water drunk, not discarded. *Food manufacture*, 15. (1940) 170.

War time Agriculture and food control in Germany. H. L. Franklin, *Foreign Agriculture*, 4 (1940) 207.

Under the present textile goods rationing system each individual is issued a Reich clothing card allowing the purchase of rationed goods on a quota basis of 100 "points" per year, with a spacified point value for each article. For example, a man's suit is valued at 60 points, a shirt at 20 points, a pair of socks at 5 points, a hand kerchief at 2 points, a woman's woollen dress at 40 points, other dresses at 30 points, stockings for women are the only articles for which a quantitative restriction is definitely listed each woman being allowed to purchase only six pairs a year. Not covered by the point system are over-coats, bed and household linens, and certain other rationed items for which special purchasing certificates are still required. Purchasing certificates for over-coats will be issued only against the surrender of an old coat. It is difficult to determine how the present clothing rationing under the "point" system compares with normal peace time requirements, but the best estimates available are that the permitted purchases for a middle class family are scarcely more than 30 or 40 percent of the peace time level, and for a worker's family possibly 40 or 50 percent.

Hybridisation of American 26-Chromosome and Asiatic 13-Chromosome species of Gossypium. Beasley J. O. *Jou. Agr. Res.* 60: (1940) 175—181.

In reciprocal crosses of American 26—chromosome x Asiatic 13—chromosome cotton the pollen germinates and pollen tubes enter more than *half* the embryo sacs. Embryo and endosperm development is initiated but soon becomes aberrent. By using the American 26—chromosome type as female and a few grains of pollen from a 26—chromosome type along with an excess of Asiatic 13—chromosome pollen it is possible to produce minute hybrid seeds. Plants can be produced from the seeds by germinating them on sterile culture media. Hybrids involving six combinations of American 26—chromosome x Asiatic 13—chromosome cottons were produced. This dependable method of producing hybirds between American and Asiatic cottons will be useful in producing numerous hybrids from which polyploids can be produced—Author's Summary.

EXTRACTS

Proper Proportioning and Timing of Nitrogen Applications.

A study was designed to determine the relation between the time of applying varying amounts of nitrogen fertilizer and the resulting cane and sugar yields, in connection with controlled pot culture procedure for sugar cane.

Single-eye cuttings of the variety 31-1939 were planted on November, 1, 1938, in Mitscherlich pots filled with Makiki soil. Adequate phosphate and potash, and ample irrigation water were supplied. Nitrogen differentials consisted of three levels: (L) *low*, or an inadequate amount for good growth of cane in the

small containers which were used; (M) *medium*, or an amount which previous experience had indicated to be approximately optimum, and (H) *high*, which probably furnished a luxury supply. Each nitrogen level (total) was applied in six different ways: (1) all in one application at 1 month (2) $\frac{2}{3}$ at 1 month and $\frac{1}{3}$ at 3 months (3) $\frac{1}{3}$ at 1 month and $\frac{1}{2}$ at 5 months, (4) $\frac{1}{4}$ at 1 month and $\frac{3}{4}$ at 3 months, (5) $\frac{1}{4}$ at 1, $\frac{1}{4}$ at 3, $\frac{1}{4}$ at 5, and $\frac{1}{4}$ at 7 months; (6) $\frac{1}{4}$ at one month, $\frac{3}{4}$ at 3 months and $\frac{1}{4}$ at 7 months. The cane was harvested at 12 months.

There were significant yield and quality differences between the three levels at which the nitrogen was supplied. It is apparent that too much nitrogen can be harmful to cane yields as well as to cane quality, more especially when heavy applications are made to young cane in such a way that the soluble fertilizer salt creates a highly concentrated soil solution within the root zone of young plants.

Several significant interactions between the amounts of nitrogen and the time of its application were indicated.

With a low level of nitrogen, its efficiency was best when the total amount was split $\frac{1}{4}$ and $\frac{3}{4}$ and applied at 1 and 3 months. In fact, when the low nitrogen level was applied in this manner, it produced more than five of the times of application that were used with the high nitrogen level.

(b) With the medium amount of nitrogen, the poorest result was secured when the total application was made at one month. The best sugar yield was made when the total amount was split into four equal amounts and applied at 2 month intervals.

(c) With the high level of nitrogen that was used, its total application either at one month, or one half each at one and at three months, definitely reduced the amount of sugar obtained, especially since it greatly depressed the cane growth. Applied in either 3 or 4 doses, the cane yields were satisfatctory but the juice quality was poorer and the recoverable sugar considerably below that secured from the medium level.

Of incidental interest are the facts that the percentages of nitrogen in the crusher juice, green leaves at harvest, reflect the amounts of nitrogen which were supplied for this cane. R. C. M. analyses, made on soil samples taken after harvest, show that but little available nitrogen remained in the soil from any of the amounts which were supplied. *Hawaiian planter's Record* 44: (1940) 15—18).

The Mycorrhizal habit in crop plants, with a reference to Cotton.

Whether by reason of the unsatisfactory treatment in botanical textbooks or the technical difficulties presented by experimental studies in the laboratory, the subject of mycorrhizal association in vascular plants has been almost ignored in the literature of soil science.

The microbiological activities in general play a critical and even decisive part in promoting soil conditions favourable or otherwise to growth of the higher plants is not in dispute. Much of the vast and impressive literature dealing with soil humus is directly or indirectly concerned with these activities. Certain of them, as, for example, those immediatley involved in the various phases of what is commonly known as the "nitrogen cycle", have been exhaustively studied and have yielded substantial advances in knowledge.

For the plant physiologist, however, there remain serious gaps in the way to a correct understanding of the relation between the biological and chemical changes occurring in humus on the one hand and the nutritive processes of the higher plants on the other. The rule played by mycotrophy as a consequence of the mycorrhizal habit is one such gap, and there are others less easy of

definition. May it be assumed, for example, that the regular and intimate association of the soil fungi with plant roots shown in mycorrhizal relationships is closely interrelated with and conditioned by other phases of biological activity in soil? If so, can variation in mycorrhizal behaviour be used as an index of soil conditions favourable or otherwise to the growth and health of the host plants? Answers to these and related questions are of concern, not only because of the biological interest of the facts and the ending of a controversy that has long disfigured their study, but also, as it seems to the writer, because the fruits of such knowledge would contribute to better understanding of the relations of plants with the soil and the crop requirements of such as are known to be mycorrhiza-formers.

Mycorrhiza occur in wild and cultivated plants; in those growing in tropical forests and within the Arctic Circle; inhabitats so different as the high Alps and the salt marsh. Affecting an immense number of species of diverse families and occurring regularly under the most varied conditions of climate and soil, the habit challenges attention as a factor of significant potential importance to practical growers. The history of the subject goes back nearly one hundred years, from the time Nageli identified certain inclusions in the root cells of *iris* (1842) as fungal growths. Frank in 1885 first gave the name "Mykorrhiza" to describe the dual structure formed by the tree root with its associated mycelium, the phenomenon was already comparitively well-known especially to foresters. Early views ranged from that of Robert Hartig, to whom the root fungi of these were mischievous parasite hindering root action and conferring no benefit of any kind upon the hosts, to those theories of beneficial symbiosis associated especially with the names of Frank and Stahl.

It is still convenient to classify mycorrhiza into two groups, the extreme types in which show marked structural differences, correlated with the distribution and character of fungus infection. The *ectotrophic* mycorrhizas of most trees and shrubs are readily recognisable as distinct from ordinary rootlets: a sheath of mycelium is formed about the tip and younger part of the emerging rootlet and the hyphae composing it extend inward, forming an intercellular net between the cortical cells known as the 'Hartig net'. In *endotropic* mycorrhizas a more or less extensive distribuion of intercellular mycelium within the root is associated with a variable but usually scanty development of hyphae on the surface. In general, endotrophic mycorrhizas resemble ordinary roots in external appearance, although slight modifications such as irregularities of diameter or differences in opacity of the tissues may betray their character to the experienced observer. Broadly considered the endotropic mycorrhizas belong to two groups: 1. *Rhizoctonia* type form intracellular coils or "pelotons" which ultimately suffer digestion. The mycelium is septate and are believed to belong to higher fungi. 2. The second group includes a number of closely allied species or strains of widely distributed soil fungi known to form endotrophic associations with many flowering plants and also with certain ferns, club-mosses, and other cryptogam The mycelium is not septate or very sparingly so and they possess special structural features.

Modern work has not confirmed the older view that the ectotrophic and endotrophic types of structures are sharply marked off from one another. It is known that the fungi responsible for the production of typical ectotrophic mycorrhizas may cause, under certain environmental or cultural conditions, more or less extensive intracellular invasion of the tissues resulting in mycorrhizas of modified structure. The details of mycorrhizal structure are delicately adjusted and show extreme susceptibility to modification in relation with the soil environment. It may be stated with some confidence, however, that they are often directly related with qualitative differences in the organic soil constituents

and probably also with variations in the supply of available nutrients and the forms in which these occur.

Much of the modern work has been done on groups in which the mycorrhizal relations are obviously highly specialized—e.g. orchids, heath and forest trees. Some practical knowledge, for example, in the orchid growing and in relation to problems of afforestation and the acclimatization of exotic plants, has been derived but much of it is still controversial. Apart from these specialised and critically studied groups there remain an immense and constantly growing list of plants known to form endotrophic mycorrhizas of a characteristic kind, concerning the behaviour of which under experimental conditions little or nothing is known. Many of the hosts are important crop plants, and for this reason the matter is of practical as well as theoretical interest. Both groups of soil fungi mentioned above appear to be concerned, and there is some evidence that representatives of both may be present in the same plant. The mycelium of the second type of endotrophic mycorrhiza mentioned above, is widely distributed in natural and cultivated soils all over the world; it forms characteristic organs in the root tissues, thus giving rise to a definite and easily recognized type of endotrophic structure. Much of the knowledge has been summarized and critically reviewed by Butler. The mycorrhizal-formers are believed to be a group of closely allied species of soil fungi belonging to a single genus for which the generic name *Rhizactophagus* is provisionally accepted by Butler. Although not highly specialized these root fungi resist isolation and for this reason experimental evidence of their behaviour in pure culture or of the host plants under fully controlled conditions with and without infection is scanty or lacking.

Of crop plants of temperate climates known to form mycorrhizas of this kind, wheat and other cereals, hops and strawberry are typical examples. Of tropical and subtropical crops may be mentioned sugar-cane, rubber, coffee, citrus, oil palm (*Elaeis* sp.) coconut, cacao and cotton. The impression derived from the observations on cotton was as follows: The cotton plant is a regular mycorrhiza-former, infection taking place under favourable conditions at an early stage. The incidence and character of infection are closely correlated with the nature of the rooting medium and in the same soil vary markedly with different manurial treatments. Differential behaviour on the part of the endophyte was particularly well-marked in respect to applications of inorganic as compared with organic manures and a response was also apparent following the use of different forms of organic manures Coincidence of vigorous growth of the host with maximum infection may be observed in cotton as in other plants showing the same type of association, and this together with the histological evidence available supports the view that there is a substantial balance in favour of the vascular partner.

It is the author's deliberate opinion, that variations in mycorrhizal response can be used as an index of health and growth, and that correct interpretation of these responses is an essential move towards better control of the soil conditions promoting health, vigour and maximum resistance to disease. For species growing in nature the mycorrhizal condition in a healthy plant represents one of physiological equilibrium. Mycorrhizal association, often ignored or treated as an accidental and casual phenomenon, is a manifestation of biological soil activity, and as such cannot be profitably overlooked in the study of soil factors likely to promote healthy growth and maximum resistance to disease.

Except in certain cases, notably in those directly associated with the 'nitrogen cycle' the interrelations of biological soil activities are of great importance in attempting to relate plant growth with soil conditions. No true picture of the soil as an environment in which the root system of vascular plants passes its

life can be formed if there is omitted a biological component so frequently present and often so abundantly developed as the mycorrhizal system. For e. g. although there may be at present no information as to the interaction of this habit with the organisms and soil factors operative in root diseases, yet it would appear dangerous to assume none to exist. Nevertheless instances are not wanting in recent researches in which the normal condition of the root tissues in respect to mycorrhizal infection, even in well-known and admitted mycorrhizal-formers is completely ignored in pathological investigations. (*Empire Cotton Growing Review*, 16: (1939), 171.)

Gleanings.

Powdery Mildew of the Rose. Black Spot and powdery mildew are the two most common diseases affecting rose bushes. Each is caused by a distinct type of parasitic fungus, and growers may be interested to know that the fungicide recommended for control of black spot is also effective against powdery mildew. Plants affected with powdery mildew show characteristic light grey or whitish patches on the leaves, shoots, thorns and buds. Some varieties are highly resistant (e. g., Cecile Brunner), but in the susceptible types (of which the Dorothy Perkins is an example) the disease may be so pronounced that leaf distortion and leaf fall commonly result. When these features do not develop, the disease is generally unwelcome on account of its unsightliness. Powdery mildew is favoured by warm, muggy weather and is generally more severe in bushes grown near fences or walls where air movement within the plants is restricted. The most satisfactory measure of control is to treat the plants with finely divided dusting sulphur. Tests have shown that a mixture of 9 parts of sulphur to 1 of lead arsenate is most satisfactory, the arsenate fulfilling the dual function of preventing lumping of the sulphur and of keeping down chewing insects. The first applications should be made as soon as mildew appears, and then at fortnightly intervals during the time that weather conditions favour disease development. It is important to dust before rain and, as far as possible, applications should be made when the air is calm, either early or late in the day, as burning of the foliage may occur during hot periods. Colloidal sulphur or Bordeaux mixture sprays are satisfactory for control of both powdery mildew and black spot, and may be used where spray discolouration of the foliage is not a consideration. Dusting with sulphur, however, is a very convenient method and usually can be done in a quarter of the time taken to apply the wet treatments.

(*Agr. Gaz. N. S. Wales*, 51: (1940) 384.

Soil conservation increases income. Our studies revealed that farmers following the soil conservation programme made a greater increase in their labour incomes over the 4 year period than the non-cooperators. The net increase in labour income in favour of the soil conservation service cooperators, after deducting the agricultural conservation programme payments and a fair charge for materials furnished by the Government, was; large dairy farms, 228; small dairy farms, 107; poultry farms, 75; and general farms 11. Very little, if any, of this increase in income can be attributed to saving the soil over such a short period but must be credited primarily to the change in land use and farm management practices on these farms. (*Extension Service Review* 2: (1940) 47).

Nitrogen Fixation by Blue-Green algae in Rice Fields. The role of the blue-green algae in Nitrogen fixation has been further studied particularly in relation to rice fields. From an Indian soil three species of algae of the genus Anabaena were isolated and shown to be capable of fixing nitrogen. The experimenter concluded that algae can grow and fix nitrogen in the soil independently of bacteria or fungi, and that they are the main agents of nitrogen fixation in rice field. (*Agri. Gaz. N. S. Wales.* 51: (1940), 464).

Crop & Trade Reports.

Cotton—1940—41 Second Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1938—39 has represented 9·7 per cent of the total area under cotton in India. The area under cotton up to 25th September 1940 is estimated at 913,700 acres. When compared with the area of 776,900 acres estimated for the corresponding period of last year, it reveals an increase of 17·6 per cent. The increase in area occurs in most of the important cotton growing districts owing mainly to early receipt of sowing rains. The area in the Central districts and the South relates partly to the last year's crop and partly to the current year's sowings which have commenced in parts. The condition of the standing crop is generally satisfactory. The average wholesale price of cotton lint per imperial maund of 82, 2/7 lb. as reported from important markets on 30th September 1940 was Rs. 15—10—0 for Cocanadas, Rs. 17—6—0 for White-Northerns, Rs. 18—2—0 for Red-Northerns, Rs. 14—4—0 for Westerns (*mungari*), Rs. 17—13—0 for Westerns (*jowari*), Rs. 29—2—0 for Coimbatore cambodia, Rs. 26—13—0 for Coimbatore Karunganni and Rs. 22—5—0 for Nadam Cotton. When compared with the prices published in the last report, i. e., those which prevailed on 2nd September 1940, the prices reveal a rise of about five per cent in the case of Cocanadas, Northerns (White and Red), Westerns (*mungari*) and Nadam, four per cent in the case of Coimbatore Cambodia and three per cent in the case of Westerns (*jowari*) and Coimbatore Karunganai. (*From the Director of Industries and Commerce*).

Groundnut—1940-3rd forecast report The average of the areas under groundnut in the Madras Province during the five years ending 1938-39 has represented 48·6 cent of the total area under groundnut in India The area sown with groundnut up to 25th September 1940 is estimated at 3,142,900 acres. When compared with the area of 2,863,200 acres estimated for the corresponding period of the previous year, it reveals an increase of 9·8 per cent.

The estimated area is the same as that of last year Tinnevelly; a decrease in area is revealed in Guntur, Cuddapah, Nellore, South Arcot, Trichinopoly and the South (Tinnevelly excepted) and it is more than counterbalanced by an increase in area in the rest of the Province. The variations are marked in Guntur (−30,000 acres), Kurnool (+90,000 acres), Bellary (+66,000 acres), North Arcot (+55,000 acres), Salem (+27,000 acres) and Coimbatore (+80,000 acres). The summer crop throughout has been harvested. The yield was normal except in Chingleput where it was below normal owing to scarcity of water in the growing period. The yield of the early crop was below normal in Salem owing to drought, and normal in Coimbatore. The condition of the main crop is reported to be satisfactory outside Anantapur, South Arcot, Chittoor, North Arcot, Salem. Coimbatore and Tanjore where it was affected by drought to some extent. The wholesale price of groundnut (shelled) per imperial maund of 82⅔ lb. (equivalent to 3,200 tolas) as reported from important markets on 7th October 1940 was Rs. 4--2—0 in Vizagapatam, Rs. 4—0—0 in Vizianagram, Rs. 3—15—0 in Guntur, Rs. 3—14—0 in Cuddalore, Rs. 3—12—0 in Cuddapah and Salem, Rs. 3—10—0 in Nandyal, Rs. 3—9—0 in Hindupur, Rs. 3—8—0 in Tadpatri, Rs. 3—5—0 in Bellary, Rs. 3—4—0 in Adoni and Rs. 3—3—0 in Coimbatore. When compared with the prices published in the last report i.e. those which prevailed on 12th August 1940, these prices reveal a rise of approximately 10 per cent in Tadpatri and seven per cent in Cuddapah and a fall of approximately 13 per cent in Vizagapatam, 11 per cent in Vizianagaram, 10 per cent in Bellary and Hindupur, 7 per cent in Adoni, 6 per cent in Guntur and Nandyal, the prices remaining stationary in Cuddalore. (*From the Director of Industries and Commerce*).

Gingelly 1940-41. Second report. The average of the areas under gingelly in the Madras Province during the five years ending 1938-39 has represented 16·2 per cent of the total area under gingelly in India. The area sown with gingelly up to 25th September 1940 is estimated at 437,100 acres. When compared with the area of 525,400 acres estimated for the corresponding period of last year, it reveals a decrease of 16·8 per cent. The estimated area is the same as that of last year in Cuddapah and Coimbatore; an increase in area is revealed in Vizagapatam (+13,000 acres), East Godavari (+12,000 acres), Kurnool, Tinnevelly and Malabar but it is more than counterbalanced by a decrease in area in the rest of the Province owing to want of timely sowing rains, especially in Salem (-35,000 acres), Trichinopoly (-28,500 acres), Anantapur (-13,500 acres), Chingleput (-12,000 acres) and North Arcot (-10,000 acres). The yearly crop of gingelly has been harvested in parts. The yield was generally normal except in Vizagapatam where the crop was affected by heavy rains to some extent. The main crop of gingelly has been affected to some extent by drought in Anantapur, Nellore, Coimbatore and Tinnevelly and by heavy rains in South Kanara. The condition of the crop is fairly satisfactory in the rest of the Province. The wholesale price of gingelly per imperial maund of 82⅔lb. (equivalent to 3,200 tolas) as reported from important markets on 7th October 1940 was Rs. 7—4—0 in Tinnevelly, Rs. 6—9—0 in Trichinopoly, Rs. 6—7—0 in Cuddalore, Rs 6—4—0 in Vizianagaram and Cocanada, Rs. 5—13—0 in Rajahmundry, Rs. 5—12—0 in Salem, Rs, 5—11—0 in Ellore, Rs. 5—6—0 in Vizagapatam and Rs. 5—5—0 in Tuticorin. When compared with the prices published in the last report i. e. those which prevailed on 5th August 1940, these prices reveal a fall of approximately 27 per cent in Tuticorin, 18 per cent in Ellore, 11 per cent in Cocanada, 10 per cent in Vizagapatam, Rajahmundry and Cuddalore, nine per cent in Trichinopoly and seven per cent in Vizianagaram, the prices remaining stationary in Salem and Tinnevelly. (*From the Director of Industries and Commerce.*)

Paddy—1940-41—First report. The average of the areas under paddy in the Madras Province during the five years ending 1938-39 has represented 13·2 per cent of the total area under paddy in India. The area sown with paddy up to the 25th September 1940 is estimated at 6,437,000 acres. When compared with the area of 5,469,000 acres estimated for the corresponding period of last year, it reveals an increase of 17 7 per cent. The estimated area is the same as that of last year in Trichinopoly; a decrease in area is revealed in Guntur (-30,000 acres) Kurnool, Tinnevelly, Malabar and the Nilgiris but it is more than counter-balanced by an increase in area in the rest of the Province owing to the advent of timely sowing rains. The increase in area is marked in Chingleput (+2250,00 acres), Tanjore (+148,000 acres), Nellore (+134,000 acres), South Arcot (+95,000 acres), Vizagapatam (+90,000 acres), North Arcot (+63,000 acres) Salem (+56,000 acres) and Kistna (+54,000 acres). The first crop of paddy is being harvested in parts of the districts of Chingleput, South Arcot, Chittoor, North Arcot, Salem, Coimbatore, Tanjore, Malabar and South Kanara. The yield is expected to be generally normal The condition of the standing crop is generally satisfactory. The wholesale price of paddy, second sort, per imperial maund of 82.2/7 lbs. as reported from important markets on 7th October 1940 was Rs. 3—5 -0 in Madura, Rs. 3—4—0 in Rajahmundry and Guntur, Rs. 3—3—0 in Cocanada, Ellore and Masulipatam, Rs. 3—2—0 in Bezwada and Vellore, Rs. 3—1—0 in Trichinopoly and Virudhunagar, Rs. 3—0—0 in Vizianagaram and Tinnevelly, Rs. 2—14—0 in Chittoor, Rs, 2—12—0 in Hindupur, Rs. 2—10—0 in Kumbakonam, Rs. 2—9—0 in Negapatam, Rs. 2—8—0 in Cuddalore and Rs. 2—4—0 in Conjeevaram, When compared with the prices published in the last report i. e. those which prevailed on 12th February 1940, the prices reveal a rise of 32 per cent in Trichinopoly and Negapatam, 31 per cent in Cocanada and Kumbakonam, 29 per cent in Madura, 27 per cent in Guntur, 25 per cent in Bezwada

and Vellore, 24 per cent in Ellore, 16 per cent in Rajahmundry, 14 per cent in Virudhunagar, ten per cent in Hindupur, nine per cent in Vizianagaram, eight per cent in Cuddalore, five per cent in Chittoor and four per cent in Tinnevelly, the price remaining stationary in Conjeevaram. (*From the Director of Industries and Commerce*).

Sugarcane—1940—Second report. The average of the areas under sugarcane in the Madras Province during the five years ending 1938-39 has represented 2·8 per cent of the total area under sugarcane in India.

The area planted with sugarcane up to 25th September 1940 is estimated at 149,420 acres. When compared with the area of 122,740 acres estimated for the corresponding period of the previous year, it reveals an increase of 21·7 per cent. The estimated area is the same as that of last year in Kurnool; a decrease in area is revealed in Guntur, Nellore, Coimbatore, and Tinnevelly, but it is more than counterbalanced by an increase in area in the rest of the Province owing to the favourable season. The increase in area is marked in South Arcot (+6,400 acres), Salem (+4,900 acres), North Arcot (+4,200 arcres), Vizagapatam (+2,200 acres), and Kistna (+2,000 acres). The areas reported for West Godavari, Bellary, Anantapur, Cuddapah, South Arcot, North Arcot, Salem, Tanjore and Malabar are the highest on record. The condition of the crop is fairly satisfactory. The seasonal factor for the Province as a whole works out to 97 per cent of the normal as against 98 per cent for the corresponding period of last year. The total yield for the Province is accordingly estimated at 413,580 tons of jaggery as against 343,120 tons for the corresponding period of last year. The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 7th October 1940 was Rs. 5—2—0 in Mangalore, Rs. 5—0—0 in Erode, Rs. 4—11—0 in Cuddalore, Rs. 4—8—0 in Rajahmundry, Rs. 4—5—0 in Chittoor, Rs. 4—4—0 in Salem, Rs. 4—2—0 in Vizagapattam, Cocanada and Adoni, Rs. 3—14—0 in Vizianagaram and Vellore, Rs. 3—1—0 in Trichinopoly, Rs. 2—14—0 in Bellary and Rs. 2—7—0 in Coimbatore. When compared with the prices published in last report, i. e., those which prevailed on 9th September 1940, these prices reveal a rise of approximately 20 per cent in Vizagapatam and five per cent in Chittoor and a fall of approximately 37 per cent in Coimbatore, 14 per cent in Salem, 11 per cent in Cocanada, ten per cent in Vizianagaram and Mangalore, four per cent in Cuddalore and three per cent in Rajahmundry, the prices remaining stationary in Adoni, Bellary, Vellore, Erode and Trichinopoly. (*From the Director of Industries and Commerce.*)

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 11th October 1940 amounted to 451,312 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939-40. The receipts in the corresponding period of the previous year were 434,832 bales. 446,957 bales mainly of pressed cotton were received at spinning mills and 114,432 bales were exported by sea while 114,327 bales were imported by sea mainly from Karachi and Bombay. (*From the Director of Agriculture*).

College News and Notes.

Students' Corner. Educational Tour:—In accordance with the pre-arranged programme the students of the third year B. Sc. Ag. Class were on tour from 1st October till 16th, led by Mr. Unnikrishna Menon, Senior Lecturer in Agriculture and Mr. T. Natarajan, Assistant Lecturer in Agriculture. Gudiatham was the first station to be visited from where the party proceeded to Kodur Fruit Research Station. In both these places enquiries were made as to the

ryots' method of raising crops, their economics and the extent to which they were benefited by the presence of the adjoining research stations. Two days' stay at the Dry farming station, Hagari, and a hurried visit to Siruguppa, contributed in no small measure to our knowledge.

Availing the opportunity a section of the students organised a pilgrimage to the famous ruins of Hampi, the historical city of the forgotten Vijayanagar empire.

In Bangalore city we paid visits to Hebbal Agricultural School, the Imperial Dairy Institute and the tastefully laid out Lal Bag gardens and notwithstanding the threatening weather the stay in Bangalore was both pleasant and instructive. On the receipt of information that the outbreak of plague in Hosur was under control, we proceeded to Hosur Livestock Research Station. Here we made the best use of the limited time at our disposal. Physical activities were not entirely neglected during the tour. We played two games one at Bellary in hockey against the town team and another at Hosur in foot-ball against the Station XI. In both we had to satisfy ourselves with a draw as only few members of the regular College team were represented in the class. Our thanks are due to those responsible for our comfortable stay at the centres and for the lavish hospitality extended to us. Our hosts were unsparing in their efforts to render our visits as educative and enjoyable as possible.

College. His Excellency the Governor of Madras paid a passing visit to the Agricultural College on 9—10—40. The students of the second year class clad in the College uniforms presented a guard of honour in front of the Freeman building. His Excellency was shown round the College by the Principal, Rao Bahadur G. N. Rangaswami Iyyangar.

Students' Club. Under the auspices of the Students' Club, Dr. Ida Scudder, Principal of the Vellore Womens' Medical School, delivered a lecture on 'The adventure of Vellore Womens' Medical School' on Monday the 14th October. The Principal, Rao Bahadur Rangaswami Iyyengar occupied the chair. The lecturer introduced herself as a humble servant of India and briefly enumerated the innumerable services rendered to this country by her grand-father and other philonthropic American Missionaries. The traditional hospitality and the spotless affection of the Southern Indians, she mentioned, was in a large measure responsible for her determination to spend the rest of her life in this country.

The chairman, paying glowing tributes to her love of service fervently hoped that the broad appeal for funds for raising the medical school into a College, be generously responded.

At an urgent general body meeting of the Students' Club held on 22—10—'40 the question of 'Constructing a new block of Club buildings for the students' was discussed. A resolution was adopted to the effect that the new buildings shall be handed over to the Government after completion. It is hoped that the annual Club Day celebration in January 1941 will be performed in the new structure.

Games. *Foot-ball.* The first Intercollegiate match in foot-ball was played against the Government College, Coimbatore on 20—10—'40 on our grounds and we lost the match by 2 goals to nil both of which were scored during the last five minutes of the game,

Cricket. The Agricultural College cricket team won the first round of the Intercollegiate matches by getting a walk-over the Municipal College, Salem, as the latter failed to turn up.

Visitors. Among the distinguished visitors to the College and Research Institute were H. E. the Governor of Madras, Mr. S. Basu, I. C. S. Secretary, Imperial Council of Agricultural Research, New Delhi, Dr. P. L. Patel, and Dr. J. A. Muliyil, Biological Pest Control Officer, New Delhi.

Ladies' club. The annual club day of the Agricultural College ladies club is to be held on the 23rd November. The tournaments in various indoor and outdoor games are now in progress.

Personal. Messrs. M. Kanti Raj and P. D. Karunakar who were interviewed by the Public Services Commission, New Delhi, in connection with the appointment of the Assistant Agricultural Commissioner, have returned to Coimbatore. It is understood that Dr. R. Kochukrishna Pillai of Chemistry section will be proceeding to Delhi next week for an interview.

The Agricultural College Officers' Club Day. The annual club day was celebrated on 18th and 19th instant with great *eclat*. The annual dinner was held on the 18th night and the rest of the activities connected with the club day were held on the 19th amidst a number of amusements and a variety of interesting games and other items.

The following are the results of the tournaments conducted in connection with the club day.

Items.	*Winners.*	*Runners up.*
1. Tennis (singles) (C. Ramaswami's cup)	M. Kalimuthu.	C. N. Babu.
2. Tennis (doubles) (Rao Bahadur G. N. Rangaswami Ayyangar's cup)	T. R. Narayanan & P. S. Narayanaswami.	K. Sanjeeva Shetty & R. L. N. Ayyangar.
3. Contract Bridge (open) (Padmanabha shield)	K. S. Subba Rao & K. V. Gopala Iyer.	G. K. Chidambaram & P. S. Narayanaswami.
4. Crontract Bridge (Partners by lots) K. Ramiah's Cup & Mr. Dutt's Cup.	T. S. Ramasubramanian & M. A. Sankara Ayyar.	G. K. Chidambaram & P. K. Menon.
5. Table Tennis Doubles (singles) (M. C. Cherian's Cup)	N. Muthuswami Naidu	C. N. Babu.
6. Table Tennis Doubles	C. H. Krishnan & C. K. Seshadri.	E. S. Kodandaraman & N. K. Sundaresan.
7. Tenekoit (Dr. K. Narayanan's Cup)	K. Ramaswami & K. S. Subba Rao.	Dr. K. Narayanan & C. N. Babu.
8. Carrom (singles) (K. Krishnamurthi Rao's Cup)	C. H. Krishnan.	K. Santhanam.
9. Carrom (doubles) (H. Shiva Rao's Cup)	K. Santhanam & P. K. Menon.	E. S. Kodandaraman & T. V. Reddy.
10. Chess (M. U. Vellodi's cup)	E. J. Verghese.	N. Krishna Menon.

Weather Review—SEPTEMBER 1940.

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	3·7	−3·8	67·6	South	Negapatam	1·0	−2 8	7·2
	Calingapatam	5·5	−1·9	42·4		Aduthurai *	4·6	+1·6	16·9
	Vizagapatam	4·4	−2·1	26·0		Madura	4·8	−0·3	24·7
	Anakapalli*	6·7	−1·1	34·5		Pamban	0·4	−0·8	11·9
	Samalkota*					Koilpatti*			
	Maruteru*	6·5	−0·9	32·4		Palamkottah	3·1	+1·9	10·3
	Cocanada	5·4	−0·4	33·7					
	Masulipatam	4·3	−1·9	23·4					
	Guntur*	0·0	0 0	0·0	West Coast	Trivandrum	1·1	0·0	46·9
						Cochin	2·2	−6·8	102·3
Ceded Dists.	Kurnool	6·9	+0·7	25·1		Calicut	8·4	+0·7	108·5
	Nandyal*	0·0	0·0	0·0		Pattambi *	0·6	−7 4	82·32
	Hagari *	2·4	−2·4	16·0		Taliparamba *	1·81	−8·9	132·70
	Siruguppa*	3·0	−3·4	17·1		Kasargode *	3·63	−5·6	134·1
	Bellary	3·2	−1·9	16·9		Nileshwar*	2·4	−6·7	142·1
	Anantapur	3·9	−3·4	10·9		Mangalore	3·1	−7·3	130 5
	Rentachintala	4·7		20·5					
	Cuddapah	6·4	+0·4	27·5					
	Anantharaju-pet *	2·6	−2·0	19·8	Mysore and Coorg	Chitaldrug	4·4	−0·1	20·9
						Bangalore	4·8	−2·2	23 6
Carnatic	Nellore	3·6	−1·2	18·4		Mysore	13·0	+8·8	31·7
	Madras	2·8	−2 2	18·0		Mercara	1·5	−9·3	128·0
	Palur *	5·8	+1·9	16 8					
	Tindivanam *	5·2	+1·2	19·0	Hills	Kodaikanal	7·6	+0·3	39·5
	Cuddalore	6·5	+0·4	17 8		Coonoor			
Central	Vellore	6·4	−0·9	20·0		Ootacamund *	3·7	−1·4	34·6
	Salem	12·2	+5·6	34·3		Nanjanad *	2 0	−2·9	34·0
	Coimbatore	4·1	+2·6	19 6					
	Coimbatore A. C. & R. I.*	2·2	+0·4	15·2					
	Trichinopoly	7·3	+2 5	17·2					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

The weather over the peninsula was characterised by scattered thunder storms during the first half of the month. On the 14th weather became unsettled in the Bay of Bengal and by the next day a depression had formed centred at about 300 miles east of Vizagapatam, and moved inland between Cocanada and Vizagapatam by the 17th, and moving in a north west direction near Portblair on the 18th and by the 19th near Surat and thereafter receding to the North East disappeared over the United Provinces by the 23rd. A second depression moved into the Bay of Bengal from the East on the 20th and was centred in the North of the Bay on the 21st but filled up the next day.

The first depression caused widespread rain on the Circars coast, Hyderabad and the Ceded districts during its traverse, while the second failed to affect the weather in the peninsula.

Rainfall was generally below normal in the Circars, Ceded districts, West Coast, Mysore and the hills, and locally in excess in the Carnatic and Central districts.

Other climatic elements were not far from normal.

The chief falls of rain reported were:—

Mysore	5·1″ (11th).
Cocanada	3·8″ (17th).
Anantapur	2·9″ (9th).
Cuddapah	2·8″ (13th).
Salem	2·7″ (7th).
Coimbatore Town	2·7″ (28th).

Weather Report for the Agricultural College and Research Institute Observatory

Report No. 9/1940.

Absolute maximum in shade.	...	93·8°F
Absolute minimum in shade.	...	66·0°F
Mean maximum in shade.	...	90·3°F
Departure from normal.	...	+0·8°F
Mean minimum in shade.	...	70·9°F
Departure from normal.	...	+0·4°F
Total rainfall for the month.	...	2·21 inches.
Departure from normal.	...	+0·42 ,,
Heaviest fall in 24 hours.	...	1·11 ,,
Total number of rainy days.	...	4
Mean daily wind velocity.	...	2·0 M. P. H.
Departure from normal.	...	−3·2 ,,
Mean humidity at 8 hours.	...	76·3 %
Departure from normal.	...	+2·8

Summary. There were numerous thunder storms during the month, 2·21″ of rain was recorded. The sky was moderately to heavily clouded and the relative humidity was slightly more than the normal. The maximum and minimum temperatures were nearly normal. The wind velocity was below normal.

P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

Appointments.

Sri. K. Venkatarama Ayyar, Superintendent, Agricultural Research station Anakapalle, in Category 8, class I, Madras Agricultural service to category 6, class I, Madras Agricultural service, with effect from 1st September 1940, without prejudice to his present appointment vice Sri. Rao Sahib G. Jogi Raju retired.

Sri. K. C. Naik, temporary superintendent, Fruit Research station, Kodur, to be a full member of the Madras Agricultural service in category 8, class I of the Madras Agricultural service with effect from 1st September 1940, without prejudice to his present appointment vice Sri. K. Venkatarama Ayyar.

Confirmation.

Dr. S. Ramanujam, B. A, (Hons), Ph. D (London), Second Economic Botanist, Imperial Agricultural Research Institute, New Delhi, is confirmed in his appointment with effect from the forenoon of the 1st September 1940.

Subordinate Services.

Transfers.

Name of officers.	From	To
Sri. S. Suryanarayana,	A. D., Vuyyuru Sugar Factory,	A. D., Sugarcane Growers Society, Kirlampudi.
„ R. Guruswami Naidu,	A. D., Kaikalur,	A. D., Gudivada.
„ L. Narasimhacharya,	Offg. A. D. A., Bellary,	A. D., Chittoor.
„ S. V. Kuppuswami.	D. F. S., Hagari,	A. R. S., Siruguppa.
„ R. Krishnamurthi,	A. D., Saidapet,	A D., Chengam.
„ K. B. Vaideeswaran,	A, D. Chengam,	A. D., Gudiyatham.
„ F. L. Daniel,	Offg. Asst. in Chemistry, Coimbatore.	D. F. S. Hagari.

Leave.

Name of Officers.	Period of leave.
Sri. Parameswarajotilakshminata, Asst. A. D., Bhimilipatam,	Extension of l. a. p. for 3 months with m. c. from 1—9—40.
„ V. S. Rangachary, F.M., A.R.S., Kodur,	L. a. p. on m. c. for 40 days from 7—10—40
„ N. Ranganathachari, A. D., Done,	L. a. p. on m. c. for 1 month from the date of relief,
„ S. D. S. Albuquerque, A. R. S., Pilicode,	L. a. p. for 33 days from 21—10—40.
„ D. Marudarajan, Asst., Govt. Eycologist,	L, a. p. for 2 months from 24—10—40.
Janab A. Muhamed Ali Sahib, A. D., Puttur,	L. a, p. for 1 month from 14—10—40.
Sri. B. P. Papaiah, A. A. D., Narasapur,	L. a. p. for 1 month from 6—10—40
„ C. Krishnamurthi, A. D., Kovur,	L. a. p. for 30 days from 2—10—40
„ B, N. Padmanabha Ayyar, A. D., Gingee,	L. a. p. for 1 month from 1—10—40.
„ K. Sitarama Ayyar, Farm Manager, A. R. S., Pattukottai,	L. a. p. for 1 month from the date of relief .
„ M. Narasimham, A. D., Guntur,	Extension of l. a. p. for 1 month from 1—10—40.
„ S. V. Doraiswami Iyer, F.M., A.R.S., Guntur,	L. a. p. for 1 month from 7—10—40.
„ A. Mariakulandai, Asst. in Chemistry, Coimbatore,	L. a. p. for 30 days from 7—10—40.
„ L. Sankarkumar Pillai, A. D., Rasipuram,	L. a. p. on m. c. for 1 month from 29—9—40.
„ A. Krishaswami Iyer, A. D., Madura,	L. a. p. for 2 months and 23 days from 1—10—40.

„ R. Alagiamanavalan, A. D., Punganur,	L. a. p. for 1 month from 25-9-40.
„ K. Raman Menon, A. D., Coonoor,	L. a. p. for 2 months and 13 days from 11-10-40.
„ M. R. Balakrishnan, Asst. in Chemistry, A. R. S., Sirugappa,	L. a. p. on m. c. for 2 months from 17-8-40.
„ V. Satagopa Ayyangar, Secy., Groundnut Market Committee, Cuddalore,	L. a. p. p. for 4 months from the date of relief.
„ K. Govindan Nambiar, F.M., A.R.S., Nanjanad,	Extension of I. a. p. for 2 months from 5-10-40.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the quarter ending 30th September 1940.

A. Books.

1. *Indian Weather Code.* Indian Meteorological Publication. (1940). 2. *An Introduction to the Geology of Mysore.* Rama Rao, B. (1939). 3. *The Physics of the Divining Rod—Being an account of an Experimental Investigation and Mineral divining.* Maby, J. C. and Franklin T. B. (1939). 4. *Changes in Farm Power and Equipment: Field Implements—(U. S. A. Works Projects Administration—National Research Project No. A-11).* McKibbent, E. G. etc. (1939). 5. *An outline of Indian Agriculture.* Allan, R. G. (1940). 6. *Vegetable Growing in the Tropics,* Saunders, L. H. (1940) 7. *Administrative Procedure and Practice in the department of agriculture under the Perishable Agricultural Commodities Act, 1930.* Sellers, A. and Goodrich, W. W. (1939). 8. *Trends in employment in agriculture—1909-86. (U. S. A. Works Progress Administration—National Research Project Report No. A-8).* Shaw, E. E. and Hopkins, J. A. (1938). 9. *Social Problems in Agriculture: Record of the permanent Agricultural Committee of the International Labour Office.* (1938). 10. *Revolution in Land.* Abrams, C. (1939). 11. *Federal, State and Local Administrative Relationships in Agriculture (U. S. A.) in 2 Volumes.* Ball, C. R. (1938). 12. *Principles of Economics—Vol. 2 Rev. Edn.* Taussig, F. W. (1939), 13. *Methods of Research in Agricultural Economics.* Wellman, H. R. (1939). 14. *The New Systematics: Modern Problems in Systematics in relation to General Biology Papers contributed by several Authors.* Huxley, J. Editor. (1940). 15. *The Virus: Life's Enemy.* Smith, K. M. (1940). 16. *Statistical Theory of Estimation.* Fisher, R. A. (1938). 17. *History of the Cauvery—Mettur Project.* Barber, C. G. (1940).

B. Proceedings, Conferences and Special Publications.

1. Proceedings of the 4th meeting of the Board of Agriculture in Travancore. (1939). 2. Proceedings of the Sugar Technologists' Association of India. (1939). 3. Proceedings of the International Conference of Agricultural Economists—5th Conference, 1938. (1939). 4. Proceedings of the Ohio State Horticultural Society. (1939). 5. Proceedings of the National Joint Committee on Fertilizer Application. (1939). 6. American Fertilizer Practices—Second survey-(Published by the National Fertilizer Association—A report relating to the use of commercial Fertilizers, presenting information obtained by a survey among 32,000 farmers in 35 States, U. S. A.) (1939). 7. Pioneering in Western Agriculture: A resume of the first Half-Century of Research at the Utah Agricultural

Experiment Station. (1938). 8. Digest of Annual Reports of State Boards for Vocational Education to the United States Office of Education, (1939).

C. Annual Reports of Agricultural Institutions, Stations etc.

9. Scientific Reports of the Imperial Agricultural Research Institute, New Delhi for 1938-39. 10. Agriculture and Animal Husbandry in India - 1937-38. 11. Travancore Agricultural Department Annual Report for 1938-39. 12. Farm Accounts in the Punjab - 1937-38. 13. Sind Agricultural Department Annual Report for 1937-38. 14. North West Frontier Province Annual Report for 1937 - 38. 15. Central Board of Irrigation in India - Annual Report, for 1938 - 39. 16. England Imperial Economic Committee Annual Report 1938 - 39. 17. England Imperial Bureau of Soil Science Annual Report 1939 - 40. 18. Longashton Agricultural and Horticultural Research Station Annual Report - 1939. 19. Canadian Seed Growers' Association - Annual Report for 1937 - 38. 20. Louisiana Agricultural Extension Work - Annual Report for 1938. 21. Massachusetts Horticultural Society Year Book - 1939. 22. New Hampshire Agricultural Experiment Station - Annual Report for 1939. 23. New Hampshire Agricultural Extension Work - Annual Report for 1938. 24. New Mexico Agricultural Station - Annual Report for 1937 - 38. 25. Nebraska Agricultural Experiment Station Annual Report for 1938. 26. Nebraska Potato Improvement Association Annual Report for 1938. 27. Oklahoma Agricultural Experiment Station - Biannial Report for 1936 - 38. 28. Oklahoma Agricultural Extension Division - Annual Report for 1938.

Obituary.

We record with regret the death of Mr. T. A. Rangaswami Ayyangar, Agricultural Demonstrator, Tindivanam on the 16th September 1940.

The late Mr. Rangaswami Ayyangar joined the department, after obtaining the certificate of Proficiency in Agriculture at the Agricultural College, Coimbatore. He was appointed as Fieldman under the Government Sugarcane Expert in August 1917 and was promoted to the Lower subordinate service in March 1918 and remained in the Sugarcane section till January 1925 when he was transferred to District work as Assistant Agricultural Demonstrator. He worked as Asst. Agricultural Demonstrator in Salem district for about 10 years aad in Tanjore district for 4 years. He had barely spent 2 months in Tindivanam to which place he was last posted before his untimely death. Mr. Rangaswami was a hardworking and experienced officer of the department. He leaves behind him his aged mother, wife and four children to whom we extend our sympathy.