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EDITORIAL

Growing Need For More Research. We wish to invite the attention of our kind readers to two very illuminating and thought-provoking articles published in this issue elsewhere dealing with very important problems, one on "From mineral power to plant power" by Mr. S. V. Ramamurthi, and the other on "Agricultural progress in India during the decade 1929-1939" by Sir Bryce Burt. Both Mr. Ramamurthi and Mr. Burt are eminent men fully acquainted with the agricultural developments in India for more than two to three decades, and a perusal of the articles by them throw a lot of light on the lines that India has to march if she is to be not only self-contained but an important unit in the commonwealth of nations. One visualises a post-war India great in her agriculture and industries. If this is to become an accomplished fact, before long there ought to be established in this country not only more Agricultural Research Institutes but also a number of Agricultural Technological Institutes in juxtaposition to the former. It is admitted on all hands that there is no lack of intelligence in this country. What is wanted is facilities for research so that all India's possible plant wealth may be tapped, analysed thread bare and their uses not lost sight of. The present war has given a great filip to the pursuit of knowledge in a number of directions. Many new uses are being found for plant material which were unknown before. In addition to its time honoured edibility groundnut oil has been found suitable for working Diesel engines and for burning improved types of lamps. There are also huge possibilities for manufacturing drugs and chemicals, including insecticides, from indigenous plants. India has such abundant plant material that it can face any amount of petrol rationing and run all its vehicles with charcoal. Only we have to find out which plants give the best charcoal and how we can maintain the supply to meet the growing demands.

As for agriculture proper which includes livestock problems also, much has been done by the Agricultural Departments of India, but certainly not enough; for India is a sub-continent and has a population of over 400 million people of several races and with several district systems of agriculture, based on widely differing soil and climatic conditions. As one of the results of the Royal Commission on Agriculture of 1926, the Imperial Council of Agricultural Research came into being, and every one is aware of the immense work it has been doing to improve agriculture in this land by promoting research, with the co-operation of the various Provinces and

States. The Agricultural Departments have to be thanked for providing good seeds, introducing "Agmark" Schemes in marketing, suggesting measures to combat plant diseases both fungoid and insects, effecting several improvements in livestock problems, effecting consolidation of holdings, at least in some places like the Punjab and the United Provinces, etc. With all this one has to accept that much more has to be done. If one looks at figures, it is seen that a sum only 1½d per head of the population is spent on agricultural and veterinary research in India and it is also seen that only a tenth of the cultivated area is under improved strains. Certainly these are not as they should be. In the discussion that followed Sir Bryce Burt's paper, Sir Malcolm Darling, rightly said "I myself have met many hundreds of cultivators who have spoken with grateful admiration of the work of the Agricultural Departments in the various fields mentioned by Sir Bryce Burt. But can these figures really be considered satisfactory for a sub-continent of the size of India? Sir Bryce Burt says in his paper that the total funds available for agricultural and veterinary research and development in India per year amount to less than 1½d per head of the population, i. e. less than Rs. 70 per 1,000. Yet in the Punjab in 1921 the figure was about Rs. 79 per 1,000 persons, and in the United Kingdom the equivalent of Rs 960. It seems to me, therefore, that we are spending far too little on agriculture in India, and now that our agricultural experts are in a position to deliver the goods, I think we must provide them with sufficient funds for the purpose. In a paper that I recently read before the East India Association I suggested how this might be done. My first suggestion was that a loan of 100 crores should be raised immediately after the war and founded for the purpose of rural development, and my second, that Great Britain, in gratitude for what India has done in the war, should return the gift that India made to her in the last war, which would provide another 100 crores."

Sir Frank Noyce, went a step further and remarked "The Agricultural Departments in India have done much to produce disease-resistant crops. We want them to do much more in the future to produce disease-resistant people. A population cannot be healthy unless it is properly fed, and we all know that the diet in India is deficient both in quality and in quantity. I hope that those who take charge of India's destiny under the new Constitution will use the Agricultural Departments to the fullest degree possible in producing a more balanced diet, and will try to secure for the people the fruits and vegetables and above all, the milk and other protective foods, such as ghee and fats, of which they stand in great need." The need therefore to increase research and make it very comprehensive so as to bring into its fold besides problems directly bearing on agriculture, others connected with the application of plants to industry, medicine, etc., is very great.

India played a noble part in the last war. Her food supply has ever been useful. It is so now as it was in the past. It will be so even in the future, when she is expected to be not only self-contained but in a position to meet the growing demands of other allied countries which lack such plant material as are found in plenty here.

Bananas of the Travancore State

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Introduction. The terms banana and plantain are synonymous. Banana is the name used in foreign countries for what is called plantain in India. *Nendran* (*Eththan*) which is generally known as banana in Travancore is called plantain by English speaking people elsewhere. The term banana may, therefore, better be used for all varieties of plantains including *Nendran*.

Status of the crop. Bananas are grown extensively throughout the State and form the chief fruit. These are grown as rainfed crops throughout the State except *Nendran* at Muvattupuzha, the northernmost taluk of the State. The perennial varieties are grown in elevated places locally known as *parambas* along with coconut, arecanut, jak and mango trees. Climate being favourable, a system of perennial cultivation is practised except for the variety *Nendran*. This is the only variety that is grown as a pure crop, whether rainfed or irrigated, often in comparatively rich lowlands, but not in rice fields as is the case in the adjoining districts of British India.

Nature and extent of cultivation. Twentyfive standardized varieties of bananas having 78 local names were recorded during a tour made by the author in November—December 1941 in this State. Next to the Malabar District it is the highest number recorded for any State or District in South India. Of these 25 varieties, *Matti* grown in the hill ranges near Nagercoil and *Eththa chingan* of Cherukol near Kozhencheri are new finds. Both these are economic varieties.

Common commercial varieties of the State are *Nendran* (*Eththan*), *Poovan* (*Paleycngodan*) and *Rasthali* (*Poovan*, *Thuluvan* or *Nattu thuluvan*).

Commercial varieties of local importance are *Matti* at Nagercoil; *Kadali* at Trivandrum, especially for temple use; *Chenkadali* at Trivanarum, Quilon, Punalur and other places; *Pacha nadan* at Nagercoil, Kottayam, Kozhencheri, Muvattupuzha and other places; *Kali* at Nagercoil, Muvattupuzha and other places; *Kunnan* at Nagercoil, Quilon, Kozhencheri and Muvattupuzha; *Karim kadali* at Kottarakara and Kottayam; *Thattilla kunnan* at Peermade; *Monthan* at Nagercoil, Trivandrum, Quilon and Kottayam and *Chingan* at Vaikom and other places.

Some special varieties. Stray plants of some special varieties are found here and there in the State.

1. *Chakkarakali*. It is considered the best banana in the world and known to be under cultivation only in certain parts of British India. It is found at Neyyattinkara, Nedumangad and Mundakayam and goes by the

name *Ezhuththani* in the first two places and as *Mysore poovan* in the last place. Wherever *Rasthali* (*Poovan*) is grown this variety can be grown successfully.

2. *Chinali*. This variety comes near to *Nendran* in having flesh-coloured pulp in the green fruits and also in having the bracts and the infertile flowers sub-persistent. It is a heavy yielder and requires heavy manuring. It can also be grown wherever *Rasthali* is grown. It is found at Neyyattinkara and its neighbourhood.

3. *Moongil*. It is a variety of *Nendran* usually bearing only one hand and grown in new clearings in hilly places near Neyyattinkara. When the fruits are intended for presentation, the fruits in the solitary hand are thinned leaving only one or two to develop. Such fruits attain the phenomenal size of a foot and a half in length and about three inches in diameter weighing about three pounds each. The fruits attain such big size only when grown in virgin soils with good deal of humus in them. They need steaming before use like *Nendran*.

Cultivation. The only variety which receives intensive cultivation is *Nendran*. In Central Travancore, considerable attention is paid to its cultivation. Good open land with deep soil having good drainage is selected. The soil is dug with *mamooti* after spreading a layer of cattle manure. Two to four weeks later, towards the end of November or beginning of December, the land is dug up in circles of two and a half feet diameter and nine feet from centre to centre. A pit just big enough to hold a well developed sucker is dug in the centre. After planting, the soil all round is worked once again thoroughly and the earth heaped and pressed moderately. About 550 plants go to an acre. Ten days after planting, cattle manure is again spread in the area and dug in. After two months when the plants put forth two to three leaves the earth is removed from the base of each plant to a depth of four to five inches and to a diameter of two and a half feet and ashes and dried leaves are applied and a ring formed all round with the excavated earth. In April—May, after getting a few showers these dried leaves are removed and oil cakes especially of *Hydnocarpus Wightiana* Bl. (*Mal: Maravatti*) at the rate of a pound per plant mixed with ashes is applied and the leaves are put back. In July, a shallow furrow is made round each plant inside the ring and Niciphos at the rate of quarter pound per plant is applied and covered. *Mamooti* hoeings are given once in two months. Drainage channels, if necessary, are dug during the South-West monsoon rains. In April—May, yams (*Dioscorea alata* L.), three for every banana, are planted outside the ring equidistant from one another. No manure is separately applied to these yams. Suckers which appear before the month of May are removed with the rhizomes. The banana plants come to flower after six months of planting and are ready for harvest three months after flowering. Infertile flowers (hearts) are cut off after the fruits have set, thereby making all the plant food available for the development of fruits. Though removal of

"hearts" in *Nendron* is not practised elsewhere, the practice here shows that it is advantageous even for this variety. The bunches are enclosed in cheap baskets made of plaited coconut leaves when the bunches are 'quarter-full'. This protection against sun and rain makes the fruits, according to the *ryots*, grow stouter and give them an attractive light green colour. Such protected fruits fetch higher price than the unprotected ones. Because of the forcing nature of cultivation, the flowering of the plants and the maturity of the bunches are uniform and the crop is harvested nine months after planting to synchronise with the "Onam" festival, when it fetches very high price. The average duration is about eleven months when grown in the ordinary way without any special treatment. Only one crop is taken. The average yield is about 35 fruits per bunch which fetch according to the demand from six to eight annas. The amount realised by sale of suckers is about two annas per plant taking each plant to yield four suckers on an average. The three yams fetch another two annas thus making an aggregate gross income of 10 to 12 annas from each plant. The crop is entirely rainfed. The *ryots*, therefore, have to be careful in making the best use of the rains received in the year. They get the plants established with the moisture retained in the soil from the North-East monsoon rains and induce plants to have vigorous growth during the South-West monsoon by the timely application of manure. The gross income per acre is about Rs. 350. Deducting Rs. 150 against the cost of cultivation, lease of land, etc., there is a net income of Rs. 200 in spite of the high cost of cultivation and heavy manuring. This high income is mainly due to the high prices ruling during the "Onam" festival.

Preparation of suckers for planting. The roots are trimmed and the shoots cut off leaving two inches beyond the rhizome. The trimmed suckers are smeared with ashes or dipped in cowdung water, dried in the sun for a day or two and stored for a week, before planting. This treatment appears to be a kind of vernalization which may also be responsible for the early maturity of the crop.

Types of Nendran. Five kinds of *Nendran* are under cultivation in these parts and are locally known as *Pindi eththan*, *Kali eththan*, *Elari*, *Kal eththan* and *Veleththan*.

General use. The fruits of *Nendran* are very much in demand throughout the State and both ripe and unripe fruits are used in some form or other in every household. The pulp of the ripe fruit being tough is generally cooked in steam before use. This cooked fruit is generally one of the items of food for breakfast. Unripe fruits are used as vegetable and many preparations are made of these. Banana crisps (the pulp of the unripe fruits is cut crosswise into slices of about $\frac{1}{8}$ inch thickness, fried in oil and salted to taste) are in great demand and are exported from Calicut to distant places like Baghdad and Basra. Banana figs are often prepared from this variety and kept to be used during the off-season. Flour made from the unripe fruits of this variety is used as infant food. The pulp of ripe fruits contains

only a third of the protein content found in *Rasthali* (*Poovan*). In food value, therefore, it is inferior to other varieties. But the calcium content is three times that of *Rasthali*. Food and fodder produced in the West Coast of the Madras Province being deficient in calcium, the availability of a fruit which contains this mineral in abundance is a blessing.

Cultivation of other varieties. The cultivation of all the other varieties of bananas is of a perennial nature. They are mainly confined to backyards of houses and open places in coconut topes. The only cultural operation practised is the removal of some of the broad leaved suckers and the earthing up of the plants at the commencement of the South-West monsoon. These suckers are planted immediately after removal in vacant places without being topped but with the leaf blades cut off, half way along their length. The fruits grown under these conditions develop the best taste and flavour.

Bananas are comparatively cheap in this State. There is scope for the preparation of banana figs by sun drying process during the comparatively rainless months between December and May. The variety *Poovan* (*Paleyan-godan*) is very cheap and suitable for this purpose. *Nendran Eththan* is also good for "fig" making, but it would be more economical to sell it as green or ripe fruits.

Diseases. Bananas in this State are not attacked by diseases to any great extent. In some parts, however, a disease known as—"Manda adappu"—occurs in stray plants. This disease is manifested by the tops of the pseudo-stems getting constricted, leaves fading and ultimately the plant drying up. It is a fungoid disease and the control method is more preventive than curative. The affected plants should be removed with the entire rhizome and scorched. Suckers from such plants should under no circumstances be used for planting.

Some suggestions for the improvement of banana cultivation.

1. Bananas may be cultivated in the *Nanjanad* (South Travancore) rice fields in rotation with rice crop in localities which have good drainage facilities.
2. Banana varieties like *Rasthali*, *Chakkarakeli*, *Matti*, *Chinali*, *Kali* and *Thattilla kunnan* may be cultivated intensively like *Nendran*.
3. Varieties like *Gros Michel*, *Pedda pacha aratti Kopur* and *Nendra padaththi* which do not occur in the State may be introduced with advantage.
4. Preparation of banana flour and banana fig may be organized as cottage industries as there are varieties suitable for both these purposes available in large quantities.

The names of all standardized varieties found in Travancore with local names in usage within and outside the State, short description and the economic aspect of each are given below. For description, etc., of those marked with asterisks, *Vide Madras Agricultural Journal*, Vol. xxx, No. 2, February 1942, pp 37—44.

1. *Vamanakeli* (*Musa paradisiaca* Linn. var. *Cavendishii* K. C. Jacob) (*M. Cavendishii* Lambert). (*Kuzhi vazha* at Neyyattinkara, *Kuttaththi vazha* at Varkala, *Morris* at Peermade). Outside the State this variety is known as *Gidda aratti* at Madanapalle; *Guja bale* in Bangalore; *Hara mowze* in Kurnool; *Kabul bale* at Udipi; *Kandy vazhai* in Trichinopoly; *Kuzhi nendran* in Trichur Farm; *Morris vazhai* at Villupuram, Tenkasi, etc., *Pacha aratti* at Kavali; *Vamanakeli* in Vizagapatam; *Basrai* in Bombay; *Jahaji kol* in Assam and *Harichall* in Cuttack. A few plants are grown here and there more as a curiosity. It is a native of Southern China. It was introduced into cultivation from Mauritius in 1829. Next to Gros Michel, it is the most popular banana in America and Europe and goes by the names Governor, Chinese, Canary Island or the Cavendish banana. This variety is extensively cultivated in the Canary Isles. This is the shortest of all banana varieties. It is generally cultivated in places subject to heavy winds because of its dwarfy nature. It is of recent introduction in India. Bracts and male flowers are persistent. The bunches are heavy and the fruits closely packed. Fruits are terete and without apex. The rind of the ripe fruit varies in colour, from green to greenish yellow according to seasonal and climatic conditions. The colour, however, of the fruit produced in the Canary Islands is yellow. The fruit has good taste and flavour. It has fairly good keeping quality. It is one of the commercial varieties in the Madras Province.

2. *Chingan* (*Musa paradisiaca* Linn. var. *chingan* K. C. Jacob). (*Chingan* or *Nachchingan* at Nedumangad; *Pacha chingan* at Kozhencheri and Kottayam). Outside the State it is known as *Shinga bale* at Mangalore and *Chingan* at Ponnani and Trichur. It is one of the rarest varieties and is confined to the West Coast. A few plants are grown here and there in Travancore. The plant is slender. Bracts and the male flowers are persistent. Bunches weigh from 15 to 25 lb. Fruits are terete and taper to a distinct apex. The rind of fruits remains green in colour even on ripening.

3. *Nendran* (*Musa paradisiaca* Linn. var. *Nendran* K. C. Jacob). (*Pindi eththan* at Chirairambu; *Kal eththan* at Neyyattinkara). Outside the State it is known as *Nana nendran* at Ponnani and Kongad; *Thiruvonam* at Tellicherry; *Chengazhikkadon* at Trichur and *Pisong Talon* or *Tandok* in Malaya. It is a short duration plant. Bracts and male flowers are persistent. Hands are rather compact.

The following are the four sub-varieties of *Nendran* under cultivation in this State:—

i. *Kali eththan* (*Musa paradisiaca* Linn. var. *nendran* forma *kali eththan* K. C. Jacob). (*Kali eththan* of Chirairambu; *Vaali eththan* of Neyyattinkara). Fruit is about a foot in length and an inch and a quarter across with the apex $\frac{3}{4}$ "-1" long. Bunches are rather compact. Duration is short and the yield heavy. It is probably the best type.

ii. *Ealri* (*Musa paradisiaca* Linn. var. *nendran* forma *elari* K. C. Jacob). (*Elari* at Chirairambu). Outside the State it is known as *Attu nendran* at

Nilambur and *Nedu nendran* at Trichur. In this the fruits are spreading and are $1' - 1\frac{1}{4}'$ long and about an inch across with very long apices of about an inch and a half. This has longer duration than *Kali eththan*.

iii. *Kal eththan* (*Musa paradisiaca* Linn. var. *nendran* forma *kal eththan* K. C. Jacob). (*Kal eththan* at Chirairambu). The fruit in this is the shortest in all *Nendran* varieties and is only about 6 inches long with apex of $\frac{1}{2}'' - \frac{3}{4}''$. The pulp and the skin (rind) of the fruit are harder than these of other types; hence the local name *Kal eththan*. This type is getting eliminated.

iv. *Veleththan* (*Musa paradisiaca* Linn. var. *nendran* forma *veleththan* K. C. Jacob). (*Veleththan* at Chirairambu). In this variety the stem, petiole and midrib are red in colour. It is very similar to *Kali eththan* in other respects except in duration which is a month longer. It is also getting eliminated due to the long duration.

The pulp of the ripe fruits is rather tough and needs steaming before use. It is good for "fig" making. The flour of these varieties is used as infant food in this State. It is used largely as a vegetable. Bracts and male flowers are persistent. Bunches are fairly heavy and fruits loosely set. The ripe fruits have good keeping quality. It is the main commercial variety of the State.

4. *Moongil* (*Musa paradisiaca* Linn. var. *moongil* K. C. Jacob). (*Moongil* at Neyyattinkara). Outside the State it is grown at the Ollukara Farm near Trichur, where it goes by the name *Otta mukil* and at Cuttack as *Singapuri*. It is one of the rarest varieties and is grown in new clearings in hilly places near Neyyattinkara.

5. *Chinali* (*Musa paradisiaca* Linn. var. *chinali* K. C. Jacob). (*Chinali* at Neyyattinkara). Outside the State it is grown only at Trichur Farm and there it goes by the name *Chinari*. It is a very rare variety grown only at Neyyattinkara and its neighbourhood. The bracts and the male flowers are sub-persistent. The colour of the pulp is similar to that of *Nendran*. The fruits attain a size of 7 inches in length and an inch and a quarter across and are of medium quality. Green fruits are used for frying.

*6 *Chenkadali* (*Musa paradisiaca* Linn. var. *rubra* Firminger). (*M. paradisiaca* Linn. var. *chenkadali* K. C. Jacob). (*Chenthuluvan* at Nagercoil; *Kappa* at Neyyattinkara and Kottarakara; *Chovvazha* at Kottarakara; *Chuvanna kappa* at Varkala; *Chenkadali* at Quilon; *Raktha kadali* at Kottayam; *Malam poovan* at Peermade). Outside the state it is known as *Beet Java* in Cuttack and *Ratambala* in Ceylon. It is largely grown in sub-mountainous tracts like Punalur. Stray plants are found elsewhere.

7. *Venkadali* (*Musa paradisiaca* Linn. var. *rubra* Firminger forma *venkadali* K. C. Jacob). (*Thuluvan* at Nagercoil; *Pacha vettan* at Neyyattinkara; *Malam poovan* at Kottarakara, Kozhencheri and Peermade; *Vella-kappa* at Varkala; *Vella chovvazha* at Quilon and *Chora poovan* at

Always). Outside the State it is known as *Blay sugandhi* at Ramapuram; *Elakki bale* at Mercara; *Karim kadali* at Manantoddy; *Kappurap keji* at Simhachalam; *Ney vazhai* at Pannakkadu (Pulneys) and *Venkadali* at Perintalmanna. English: Green Red or White Claret. It is grown in sub-mountainous tracts like Punalur. A few plants of this are met with here and there. It is a bud sport of *Chenkodali*. When *Chenkodali* is grown under optimum condition for a number of generations this sport is sometimes produced. Every part of the plant is identical with that of *Chenkodali*, except the colour of the stem and fruit. The colour of the stem is purplish green and not purple as in *Chenkodali*. The rind of the unripe fruit is green in colour while that of *Chenkodali* is purple and on ripening the colour turns dull yellow while it is deep red in *Chenkodali*. Colour, taste and flavour of the pulp are similar to those of *Chenkodali*.

*8. *Rasthali* (*Musa paradisiaca* Linn. var. *rasthali* K. C. Jacob). *Nattu thuluvan*, *Thuluvon* at Nagercoil; *Poovan* at Nagercoil, Quilon and Kottayam). Outside the State it is known as *Potkapura* in Cuttack; *Malbhog kola* in Assam and *Ellaiichi* in Nagpur. The fruits of this variety are considered the best for dessert. The fruits produced in the State have very good taste and flavour without any "lump" in the flesh. It is one of the commercial varieties of the State.

*9. *Ney Poovan* (*Musa paradisiaca* Linn. var. *ney poovan* K. C. Jacob). *Rasa kadali* at Nagercoil and Quilon; *Kannaan poong kadali* at Nagercoil; *Thulu nattu kadali* at Nedumangad; *Madhura annaan* at Edakkode; *Naani poovan* at Nilamel and Kottayam; *Nhali poovan* at Kottarakara, Quilon, Kozhencheri and Peermade. Outside the State it goes by the name *Sufed velchi* in Bombay. This is grown along with other varieties in all banana areas especially in the back yards of houses.

*10. *Poovan* (*Musa paradisiaca* Linn. var. *poovan* K. C. Jacob). *Paleyangodan* at Nagercoil, Kottarakara, Kottayam and Peermade; *Palayen thodan* at Neyyattinkara, Quilon and Kozhencheri. The second name may be a corrupt form of the first. Outside the State it goes by the name—*Lal velchi* in Bombay. This is the second important commercial variety of the State.

*11. *Chakkarakeli* (*Musa paradisiaca* Linn. var. *chakkarakeli* K. C. Jacob (*Ezhuththani* at Neyyattinkara and Nedumangad; *Mysore poovan* at Mundakayam). Only a few plants are grown in these places.

12. *Kadali* (*Musa paradisiaca* Linn. var. *kadali* K. C. Jacob). (*Kadali* at Trivandrum, Kottayam and Peermade and *Nivedya kadali* at Kottayam). Outside the State it is known as *Devar kadali* at Kuttaparamba; *Poovan kadali* at Kongad and *Kadali* at Tellicherry, Manantoddy and Nilambur.

It is a very rare variety peculiar to the West Coast. It is the sacred banana largely used for offerings in Hindu temples. The fruits of this variety have very thin rind. Fruit is small and terete with distinct apex. Pulp of the ripe fruit is firm, juicy and sweet, and has good flavour. It is

used in the Sri Padmenabhaswami Temple at Trivandrum for making "Thrimadhuram" (a preparation made of the pulp of the ripe fruit of this variety with sugar and honey as offering to the deity). Hands are compact. The axis is naked and sub-erect.

13. *Kali* (*Musa paradisiaca* Linn. var. *kali* K. C. Jacob). (*Chingan* at Nagercoil and at Edakkode near Trivandrum; *Padaththi* at Nagercoil, Quilon, Peermade and Muvattupuzha; *Thodon* at Quilon and *Mannan* at Varkala). It is a commercial variety of some importance in the State.

14. *Pacha nadan* (*Musa paradisiaca* Linn. var. *pacha nadan* K. C. Jacob). (*Chingan*, *Nattu chingan* at Nagercoil; *Padaththi* at Nagercoil and Kottayam and *Kali* at Kozhencheri). Outside the State it is known as *Bengala* at Jagadevipet near Nellore; *Eardan* at Perintalmanna and Trichur; *Kali* at Trichinopoly and Tanjore; *Korangu ladan* at Coonoor; *Mannan* at Calicut; *Pacha nodan* at Cuddalore and Coimbatore; *Thodon* at Nilambur and *Vella padan* at Calicut.

It is not largely grown anywhere in the State. A few plants, however, are found in many banana gardens. The fruits are unequally five-sided and without apex. The rind is very thick and the colour of the ripe fruit is greenish yellow. It is similar to *Kali* in other respects.

15. *Kunnan* (*Musa paradisiaca* Linn. var. *kunnan* K. C. Jacob). (*Poong kadali* at Nagercoil; *Annaan* at Neyyattinkara, Nedumangad and Varkala; *Kannan* at Quilon, Kozhencheri and Muvattupuzha). Outside the State it is known as *Adukkann* at Tellicherry; (*Chinna sugantham* at Giddalore; *Chitti bale* at Kampli; *Jirike bale* at Kallamandkur near Moodbidri; *Kunnan* at Calicut and Kongad; *Sanna aakkulu chettu* at Nidubrolu and *Vellai kadali* at Sankarankoil).

This variety is largely grown in the West Coast. It is not grown on a large scale anywhere in this State. A few plants, however, are grown in all banana gardens. Fruits are considered to have medicinal properties. Green fruits are used for "curry", especially for invalids. The leaves have somewhat of an erect pose on the plant. The pulp of the ripe fruit is firm. The fruits have good keeping quality. Hands and fruits are closely set. Fruits are nearly terete with a distinct apex.

16. *Venneettin kunnan* (*Musa paradisiaca* Linn. var. *venneettin kunnan* K. C. Jacob). (*Samba poong kadali* at Nagercoil). Outside the State it is known as *Venneettu kunnan* at Calicut. It is very similar to *Kunnan* in all respects except the bloom (ashy coat) on the fruits. It is a very rare variety.

17. *Adakka kunnan* (*Musa paradisiaca* Linn. var. *adakka kunnan* K. C. Jacob). (*Samba kunnan* at Kozhencheri). Outside the State it is known as *Chara kunnan*, *Adakka kunnan* and *Pakada kunnan* at Kongad near Palghat and *Mundi kunnan* at Pulamanthol.

This has very short and plumpy fruits; hence the varietal name *Adakka kunnan*. A few plants are grown in Central Travancore. The flour

prepared of the green fruits is used as an infant food. It contains double the quantity of protein that is usually found in any other variety of banana and it is a happy coincidence that the flour of this variety has for long been in use in Malabar as an important infant food. The pulp of the ripe fruit is very firm.

18. *Thattilla kunnan* (*Musa paradisiaca* Linn. var. *thattilla kunnan* K. C. Jacob). *Koombillaaka*, *Koombilla chingan* at Nagercoil and Neyyattinkara; *Koombilla kannan* at Kottarakara and Kozhencheri, *Koombilla annaan* at Varkala; *Thattilla kunnan* at Quilon; *Chundilla kannan* at Kottayam, Peermade and Muvattupuzha and *Chundillan* at Peermade). Outside the State it is known as *Benda aratti* at Piridi near Bobbili; *Kaththe bale* at Bangalore; *Kodapilla kunnan* at Trichur Farm; *Poola chundan* at Brahmadesan and Thenkasi; *Rundu bale* at Moodbidri and Mangalore, *Thattilla kunnan* at Nilambur, Ponnani and Calicut.

A few plants are grown amongst other varieties in many gardens. It is peculiar in having only pistillate (female) flowers which develop into fruits. There is no male flower in this variety. Fruits are unequally five-sided and often slightly flat. Fruit tapers to a very long apex. The pulp of the dry fruit is dry and white in colour. The taste of the ripe fruit is very sweet. It is one of the choicest varieties of bananas. Bunches are heavy and the fruits closely packed.

19. *Karim kadali* (*Musa paradisiaca* Linn. var. *karim kadali* K. C. Jacob). (*Karim kadali* at Neyyattinkara, Kottarakara and Peermade). Outside the State it is known as *Chodari* at Kuttaparamba near Tellicherry; *Irachchi kai* at Kurumathur near Taliparamba; *Karim kadali* at Trichur and *Vettan* at Manantoddy.

It is a rare variety peculiar to the West Coast. It is not cultivated anywhere as a pure crop. Few plants are, however, found in all banana gardens in this State. Fruits are about 7 inches long and about an inch across. They are nearly terete without a distinct apex. The pulp of the ripe fruit is firm. The green fruit is used as vegetable often with meat. It is considered to have the property of softening meat when cooked with it. Both ripe and unripe fruits are used medicinally in the treatment of dysentery.

20. *Ney mannan* (*Musa paradisiaca* Linn. var. *ney mannan* K. C. Jacob). (*Peyan* at Nagercoil; *Pey monthan* at Neyyattinkara; *Chara kali* at Nilamel and Quilon; *Cherathali* at Kottarakara and *Chathura kali* at Varkala). Outside the State it is called *Bhysi mowze* at Kurnool; *Javari* at Hospet and Hampi; *Malamundi* at Nilambur and Manjeri; *Nattu vazhai* at Pannakkadu (Pulneys), Srivilliputtur, Palamcottah and Tuticorin; *Ney vannan* at Kongad; *Thiyyan mannan* at Tellicherry and *Vayal vazhai* at Palni, Sankarankoil and Sendamaram.

This variety is grown in some banana gardens especially in South Travancore. It is extensively grown in the adjacent British Indian districts,

viz, Tinnevely, Ramnad and Madura. It is mainly used as vegetable and occasionally as dessert. Green fruits are excellent for "curries". Ripe fruits are insipid but are largely used by some in the Ramnad and Tinnevely Districts.

21. *Venneettu mannan* (*Musa paradisiaca* Linn. var. *venneettu mannan* K. C. Jacob). (*Chara kali* at Kottayam). Outside the State it is known as *Boodithi* at Kurnool; *Boothi javari* at Kampli; *Samba vazhai* at Muttanandal (Madura Dt.) and *Venneettu mannan* at Nileshwar and Pattambi.

It is very rare in the State and is similar to *Ney mannan* except that the fruits are thickly ashy coated.

*22. *Monthan* (*Musa paradisiaca* Linn. var. *monthan* K. C. Jacob). (*Monthan* at Nagercoil, Neyyattinkara, Kottarakara and Peermade; *Mula monthan* at Neyyattinkara; *Ponthan* at Quilon and Kottayam, and *Kuppakali* at Kottayam).

A few plants are grown in all banana gardens to meet the requirements of the household.

23. *Sambrani monthan* (*Musa paradisiaca* Linn. var. *sambrani monthan* K. C. Jacob). (*Samba monthan* at Nagercoil and Neyyattinkara). Outside the State it is known as *Bonya kilandi* at Udipi; *Boothan kaya* at Gudalur; *Boothi madhuranga* at Palhalli near Mysore; *Sambrani monthan* at Erode; *Venneettu manga* at Nileshwar and *Venneettan thezhuthani* at Manantoddy.

It is very rarely grown here and is similar to *Monthan* except that the fruits are thickly ashy coated. It is considered better than *Monthan* as a vegetable.

24. *Matti* (*Musa paradisiaca* Linn. var. *matti* K. C. Jacob). (*Matti* at Nagercoil).

The cultivation of this variety is confined to Theriluppakkaadu, Thadikkaramkonam Hills, Black Rock Estate, Pioneer Estate and other Estates in the low hills near Nagercoil. This is the commonest variety cultivated in these Estates. The bunches and fruits look like those of *Thattilla kunnan*. The general appearance of the plant is like that of *Surya kodali*. The pseudostems are about seven feet high and about 19 inches in girth at the base. The petiole is about 15 inches long. The margins of the petiole are far apart. Lamina base on the right side is truncate and three inches shorter than the left which is acuminate on the petiole. The peduncle is short and pubescent. Bunches are compact and the fruits are closely packed. The pedicel is short and about a third of an inch in length. The apex of the fruit is very long, often up to an inch and a half. Ripe fruit is juicy and sweet with very good flavour. It is a commercial variety of considerable importance in South Travancore.

25. *Eththa chingan* (*Musa paradisiaca* Linn. var. *eththa chingan* K. C. Jacob). (*Eththa chingan* at Kozhencheri).

This variety is not cultivated to any large extent anywhere in the State. A few plants are grown in some banana gardens at Kozhencheri and other places in Central Travancore. The pseudostems are about 12 feet high and about 26 inches in girth at the base. The leaves are narrow and about 8 feet in length. The lamina base on the left side is two inches longer than the right and is acuminate on the petiole, while the right side is truncate. The petiole is about 16 inches long. The margins of the petiole are dark red to a width of a sixteenth of an inch. Peduncle is pubescent. Bracts and the male flowers are persistent. Bunches are rather closely packed and heavy. Fruits are nearly terete and are about 6 inches long without a distinct apex and with part of the style persisting. The skin of the fruit does not turn yellow on ripening but remains green in colour. The fruits are sweet and have good flavour. It deserves to be cultivated extensively.

My thanks are due to Sri T. R. Naganatha Ayyar for assisting me in this investigation.

The Deleterious After-effects of Sorghum—A Review.

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The deleterious effects of sorghum on crops that follow have been extensively reported upon by American workers—Bennet (1897), Ten Eyck and Shoe Smith (1906), Snyder and Osborn (1915), Willaman et al. (1919), Vinall and Ghetty (1921), Breazeale (1924) and Conrad (1927, 1928, 1932 and 1937). Fletcher (1912) observed the adverse effects of sorghum on a succeeding crop of *Sesamum indicum* in experiments conducted by him in Surat, Bombay. Ramanatha Ayyar and Sundaram (1941) have recorded that similar to their observations on the black soils of Tinnevely, the harmful effects of sorghum have been noted under conditions obtaining in the Coimbatore, Salem and South Arcot districts of the Madras Presidency. Breazeale (l. c.) however states that in China, sorghum is grown year after year upon the best land and that no injurious effects have been visible.

Causes of sorghum injury. American workers attribute the deleterious effects of sorghum on the succeeding crops to one or more of the following.

- a) Toxic products of decay of roots and stubbles which harm the succeeding crop.
- b) Decomposition products of crop residues encouraging the growth of certain micro-organisms which in turn compete with the succeeding crops for essential food elements.
- c) Toxic root excretions.
- d) Depletion of plant food by the heavier feeding sorghum.
- e) Depletion of moisture.

In the black soils of the Tinnevely district, however, where the injurious after-effects of sorghum on the succeeding cotton crop is a well known

feature, intensive studies by Ramanatha Ayyar and Sundaram (l. c.) showed that the "sorghum effect" observed in this tract was due to none of the above causes. It was concluded by them that the effect was primarily due to the rise of replaceable sodium in the soil and consequent alkalinity produced by the growth of the sorghum crop. They however point out that the "sorghum effect" under the 'Tinnies' conditions is very much different from that met with in America where the effects are reported on shallow rooted cereals like wheat and small grains, while in the 'Tinnies' tract the effects felt are on the deep rooted cotton crop.

Toxic products of decay of sorghum residues. The idea that the decomposition products of sorghum roots and stubbles give rise to products that are injurious to the succeeding crop has found favour with several workers. Sewell (1923) observed that in pot cultures where wheat received its moisture solely from water percolating through perforated trays in which corn and kafir crops were growing, the growth of the kafir plants inhibited the development of wheat. From this he concluded that there are decomposition products from the crop residues of kafir which have a retarding effect on the growth of wheat which follows. Breazeale (l. c.) grew wheat in water cultures containing chopped up pieces of kafir stubble and found that a toxic property was developed during the decomposition of the stubble that was injurious to wheat plants. From a mixture of kafir stubble and water he distilled off a poisonous compound that would kill wheat plants in a few hours. He found, however, that the toxic body resulting from the decomposition of the stubble was quickly decomposed into non-toxic substances. He also observed that while the toxic body is in the soil, the flora that generates CO_2 is to a large extent killed, and this tended to produce deflocculation in the soil. Hawkins (1925) found that the sorghum root residues are not so detrimental to plant growth as are the stalks. He observed that the detrimental effects disappeared in a few months, and that certain crops like field peas which do not use the upper parts of the soil as do the sorghum plants are not depressed in growth following a crop of sorghum. Ramanatha Ayyar and Sundaram (l. c.) however, found that in the black soils of Koilpatti the addition or removal of sorghum stubble did not make any difference in yields in succeeding cotton. The toxicity of sorghum stubble was also sought to be eliminated by ploughing in the residues early (as recommended by Breazeale) but it was found that the ploughing had not produced any more beneficial effect than the treatment 'not ploughed'.

Increased growth of micro-organisms that compete with the succeeding crops It was estimated by Conrad (l. c. 1) that sorghum roots may contain as much as 15 times the amount of sugar as is contained in the roots of corn and that when this is liberated into the soil after harvest, it stimulates the growth of certain micro-organisms which in turn compete with the succeeding crops for nitrogen and possibly other essential elements. The sorghum root decay may also depress nitrification. He believes, along

with others, that the after-effects disappear in a few months and that this period may be hastened by the removal of stalks and stubble and by inducing rapid decomposition. Wilson and Wilson (1928) suggest that the injurious after-effects of sorghum may be associated with the comparative ease with which its roots are oxidised in the soil. This process which is accompanied by an increase in the number of soil organisms and an increase in the assimilation of nitrate nitrogen would tend to deplete the soil of nitrate nitrogen. The extent to which these forces are operative in the soil when young plants are in need of nitrogen, may determine the amount of injury which the sorghum crop exerts on those crops that follow.

Toxic root excretions. The question of toxic excretion from roots of sorghum was investigated by Ramanatha Ayyar and Sundaram (l. c.) by studying the effect of the soil leachates from plots cropped with sorghum and *Pennisetum typhoides* as well as from fallow plots. These leachates were used to irrigate cotton plants raised in sand-cultures. No differences were observed in the growth of the cotton plants.

Depletion of plant foods. Holter and Fields (1899) and Harper and Murphy (1930) were of the opinion that the deleterious after-effects of sorghum were due to the greater depletion of plant foods by the sorghum plants. Sewell (l. c.) observed that kafir removes more fertilising elements from the soil than corn, but that this does not sufficiently explain the effect of kafir in depressing the yield of wheat. He also observed that the growth of kafir does not affect the ability of the soil to liberate nitrogen. Ball (l. c.), McKinley (1931) and Miller (1931) were not in favour of the view that the heavier feeding of sorghum sufficiently explains its deleterious effect upon succeeding crops. Ramanatha Ayyar and Sundaram (l. c.) found that in the black soils of Koilpatti, neither the application of manures to correct possible depletion nor the reduction of dry matter produced by the sorghum crops as effected by growing sorghum in thinner stands, showed any improvement in the deleterious effects of sorghum on the cotton crop which followed it. They concluded that in the conditions existing in the black soils of Koilpatti, soil exhaustion was not the cause of the deleterious effects observed.

Depletion of moisture. It has been suggested that under certain conditions where moisture is a limiting factor, the depletion of moisture by sorghum may account in part for its deleterious after effects (Ball, l. c.; Breazale, l. c.; Conrad, l. c. 1, l. c. 4). On the other hand, Ramanatha Ayyar and Sundaram (l. c.) found that in spite of the low rainfall, the aridity and the close spacing for sorghum adopted in the black soils of Koilpatti, the deleterious after-effects of sorghum on the succeeding cotton crop could not have been brought about by deficiencies in soil moisture.

Production of alkalinity and injury to soil texture. Hawkins (l. c.) observed that soils cropped with sorghum are poor in physical condition. He attributed this in part to the fact that sorghum plants as they approach maturity have much more abundant roots as compared with corn in the

upper 6—8 inches of soil. It was also noted by him that certain crops like field peas which do not use this upper part of the soil as do the sorghum roots are not depressed in growth. Ramanatha Ayyar and Sundaram (l. c.) found that in the black soils of Koilpatti, the well marked physical condition of the sorghum soils, viz., "lower cracking", "earlier erodability", reduced percolation, higher dispersion values and cloddy condition could be explained by the increased alkalinity exhibited by such soils. They observed that the growing of both *P. typhoides* and sorghum disturbed differently the Na-ion contents of the soil. In soils cropped with sorghum, the rise of replaceable sodium was greater with the growth of the crop but its later decline was much slower than that in the case of *P. typhoides* plots. As a consequence, the former soils were left more alkaline at the time of sowing of the succeeding crop of cotton, which condition would appear to be responsible for the lower yields recorded after sorghum crops. They also noted that the seed setting and duration of sorghum influenced the intensity of the deleterious effects of sorghum, since the effect was not manifest in the crop cut at the shot blade. This phenomenon they ascribed to the normal penetration of the sorghum roots into the alkaline region of the soil below the second foot. They could not get conclusive results regarding the correctives they tried for this alkalinity, but it was surmised that the application of correctives in the lower layers might show some response. Ploughing experiments showed that these soils were not benefited by cultivating them prior to the sowing of cotton; therefore a saving in the cost of cultivation could be effected by reducing preparatory cultivation to the minimum. Thick sowing of cotton improved the yields of cotton in 'after sorghum' plots both in good and poor seasons of rainfall.

Remedies suggested. Conrad (l. c. 1) suggests that since sugars and possibly other carbohydrates are the primary source of injury, every means should be adopted to reduce the amounts entering into the soil by the removal of stalks and stubble, growing sorghum in thinner stands and planting varieties whose roots develop only low percentages of sugars. He also recommends ploughing the land immediately and then irrigating it to induce the sorghum roots and stubbles to decompose rapidly. In his view certain naturally inoculated legumes make good growth after sorghum.

Ramanatha Ayyar and Sundaram (l. c.) found that for cotton following sorghum in the black soils of Koilpatti, neither the removal of stubbles, nor ploughing in the residues early, nor the growing of sorghum in thinner stands gave any beneficial effects. They found that thick sowing of cotton improved its yields after sorghum. They suggest that the application of correctives for alkalinity in the lower layers of soil may have some beneficial effects.

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From Mineral Power to Plant Power*

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Some twenty years ago I read a book by an American on the "Coming of Coal". The thesis of the author was that modern civilization had been built on the surplus energy furnished by iron, coal and oil. The use of these minerals was the basis of the Industrial Revolution. Nations which possessed such materials in their countries became powerful. Others sought to gain possession of such countries in their search for power. In India, iron and coal are present but in restricted quantities. Oil is barely available. With difficulty and with the help of tariffs, India has been able to build up a steel industry. Her coal has been of an inferior grade. Oil she has had to import in large quantities. India has been therefore obliged to be content largely with the production of raw materials for the industries of other nations who were richer than she in iron, coal and oil.

During the last decade, there has arisen a change in the position as regards the sources of power. Countries which had not enough of petrol have developed producer gas engines. In several countries as a result of war conditions, a considerable part of motor transport has changed or is

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changing over from petrol to charcoal power. In this, Madras has led the way in India. The scarcity of kerosene oil has produced an urgent need for vegetable oil to replace it for lighting. Several lamps have been devised. The Madras Government will shortly undertake demonstration and propaganda for the use of satisfactory lamps burning vegetable oil. It has been calculated that all the requirements of oil for lighting in this Province can be met by the groundnut grown on seven lakhs of acres whereas our total annual cultivation of groundnut in this Province touched 45 lakhs of acres a couple of years back. Experiments made by the Government on the use of groundnut oil as power for Diesel engines have shown that vegetable oil can be satisfactorily used for such machines. On the basis of the results actually achieved, it is now permissible to state that the power of coal and oil mined from the earth can be replaced by the power of fuel and oil seeds grown in our farms and forests.

Besides coal and oil, the industrial revolution has used iron as the vehicle for power. During the last decade, the use of wood for iron for many purposes for which iron alone has been used hitherto has been developed with the help of methods of wood preservation, one of the most effective of which has been developed by a Madrassi Engineer at the Forest Research Institute, Dehra Dun. Wood has yet been used as a vehicle only for potential energy. Its use as a vehicle for the transformation of potential energy into kinetic energy remains yet to be developed. The position thus is that of the three minerals, iron, coal and oil, on which modern civilization has been built, it is now possible to replace mineral sources by plant sources almost entirely as regards coal and oil and partially as regards iron. We are thus witnessing a revolution in power. The revolution has as yet taken place in principle. Its bulk extension is a matter of time and organization.

The change of power from mineral to plant has many implications. Mineral power is derived from the dead earth while plant power is derived from the living sun. The former is limited. What iron and coal and oil there are already in the bowels of the earth, men can mine. No more. It has indeed been calculated that all the petrol supplies will be exhausted in a few decades at the rate at which petrol has been used. Plant power is however unlimited. It is derived from sunlight. Compared with the earth, the sun is almost immeasurable in size and mass and almost eternal in time. Mineral power becomes available through great heat which destroys while the power of plants and also of animals and men becomes available by life constructing its food into more complex plant and animal tissue. The same food that builds a man can also yield heat to move an engine. But a living body produces more power by the consumption of its food than a machine does with the same material. The living machine is thus more efficient than a machine of matter. Mineral power being limited leads to greed and war. Plant power, provided its production is fairly organized, will by its derivation from an unlimited reservoir of power enable men to live and let live.

The industrial revolution with its use of mineral power has been a laboratory for a large scale organization of man's power. It has shown the possibilities of quantitative expansion. Hereafter man cannot go back to the small scale and isolationist life of the pre-industrial revolution period. But the germ of the new construction will be not matter but life. The industrial revolution was a revolution in power—from man power to mineral power. To-day we are again witnessing a revolution in power—from power of matter to the power of life, of plant life in the first instance. This revolution is necessary to adjust our economic conditions to our social ideas. We have come to recognize the basic rights of all men. But on the basis of mineral power, there is not enough to give equally to all and enough to each. We have thus built a world where progress for any is possible only by denial to some. Our social ideas are compatible only with the production of enough to meet the basic needs of all. For this the surplus of energy produced by iron, coal and oil on which the civilization of the last two centuries has been built is too inadequate. We want food and power for each as freely as there is air for each to breathe. The power of life alone can keep pace with the needs of life. Only the power of the sun fed through plants can meet the needs of all men.

We who are witnessing this revolution have to prepare for the problems that arise during and after the revolution period. Plants have hitherto been treated as sources of food for men and animals. They were not treated as sources of power for machines which man has built up for his use. Life is both an end and a means. Plant life may now be treated as a means for serving the needs of men in all ways. Take the groundnut. It gives food to man. It gives food to animals and manure for plants. It also, we have now found, gives power for machines. The difference between the power of life and the power of matter as sensed before the industrial revolution was that the former could be had only in small quantities while the latter could be got in large quantities. A man using the power of his body could do but little work. A machine with coal and oil moved large loads. But now we find that the small groundnut creeper produced on a sufficient area can be used to give practically all the power that mineral oil could give. Research will, I believe, enable vegetable oil to serve indeed all the purposes for which mineral oil is used. The large multiplication of small living things is an equivalent to the power compressed in coal and oil during centuries. Coal and oil are limited. The cultivation of groundnut can be carried on without limit of time. So too fuel can, by planned production, yield us all the power which petrol gives to move motor vehicles. Petrol can be exhausted. The growth of trees for fuel can go on indefinitely. In the past agriculture has been cramped by being viewed too exclusively as a means for providing food for men and animals. Food for men and animals is a form of power. The bodies of men and animals convert the potential energy of food into kinetic energy. But there are other forms of power which plant life can yield. Plants which are not suitable as

food can yet move machines of matter. Edible nuts can be both food and other power. Unedible nuts cannot be food but yet be a source of power. There are trees which yield food or timber. But almost all plants can supply fuel. If the function of plant culture is recognized to be not only the production of food but also the production of power, the scope of agriculture is enormously increased. The bogey of over cultivation of food is removed. There can be no fear of a slump in prices with an extension of irrigation. Irrigation can be used first for all the food man needs. He does not get enough now. Then it can be used to produce fodder and build up herds of valuable animals. Next it can produce valuable manure for plants. Last it can grow timber and fuel plants. The scope of agriculture with the help of irrigation is thus tremendously increased. It is not enough to say "Grow more food". We need food. But we also need other things. We need motor vehicles, for which we must produce charcoal or alcohol or oil. We need lighting. For this we have to produce vegetable oil. Our slogan must be widened from "Grow more food" to "Grow more power". For mineral power, you dig; plant power, you grow.

There are two major problems which I would suggest to you for research in regard to plant culture and plant technology. The first is the supply of pure water. Pure water is as vital to plant culture as steel is to mineral technology. Water is the carrier of food from the soil to the plant. In South India we have land and sun-light but not enough of fresh water. *Ryots* when they dig wells more often get brackish water than fresh water. The fresh water that comes to us through rivers is largely wasted into the sea. It is a shock to most people to hear that only four per cent of the Godavari river water that reaches the anicut is used for irrigation and the rest wasted into the sea. Of the Krishna river water, only three per cent is so used. The need for increased irrigation is obvious. The fear of producing more plant growth than is needed for food need not hereafter stand in the way of an increased use of the Godavari and Krishna waters. But simpler than the building of new irrigation systems, and indeed, in addition to such new irrigation as is undertaken, there is, I believe, scope for the reclamation of brackish water, including sea water. The sea has over 97 per cent of fresh water. Enormous masses of this water lie by the shore of South India. That fresh water can be made from sea water is known. But the process which is distillation is not cheap enough. I suggest it as a problem for South Indian intelligence that a way of making fresh water from sea water, and indeed all brackish water, must be found. Ten years ago, it was my dream to replace kerosene oil by vegetable oil for lighting our homes. To-day the dream has come true. I believe that the other dream of mine about making fresh water from water containing over 97 per cent of fresh water will yet come true. When it does, South India with land, sunlight and fresh water will be a paradise on earth. It will witness the conversion of sunlight into power needed for human progress on a gigantic scale. So much for the major problem of plant culture.

The major problem of plant technology that I would place before you is the making of engines with low temperatures. Mineral power is transformed into kinetic energy through great heat. Hence iron needs to be its vehicle. Yet millions of engines including ourselves are working at the temperatures of men and animals and plants, and efficiently transforming food into energy. For such low temperatures, wood can be a vehicle. The condition requisite for replacing iron by wood is the discovery of low temperature engines. It should be possible to do it because Nature is making such engines and working them. Cannot man find the secret of Nature? Man seeing birds fly has learnt to fly. Let man seeing Nature make fresh water from sea water and making engines work at low temperatures learn to do so too.

With this new power what new civilization shall we build? The industrial civilization of the last two centuries was built out of limited material. The power released by the new revolution will be from unlimited material. The limits of development under the old revolution were narrow. The new revolution has scope for limitless development. The ethics of a civilization based on mineral power when if one man has, another man has not, will be replaced by the ethics of a civilization based on vital power when if one man has, another man may have too. Based on the limitless power of the sun, our new civilization will attain levels of plenty, grandeur of conception and execution, width of vision and ranges of goodness and greatness, which the old civilization confined to the narrow walls of material power dug from the bowels of the earth could never reach.

We shall indeed be no longer children of the earth alone. We shall also be the children of the sun, members of a great confederacy of planets with the sun as the centre. The sun shall sustain us as our father while the earth our mother takes us to her bosom.

It is a great vista that opens before us through the revolution from mineral to plant power. In this, the Agricultural Research Institute may play a great part. I would, if and when I could, develop this Institute of Agriculture into an Institute of Plant Culture and Technology. You have learnt to play the role of Brahma the Creator. I ask you to play also the lesser but not easier role of Viswakarma the technician.

I have a great faith in Indian intelligence which with Chinese intelligence has made the oldest and longest contribution to civilization. India and China, according to the great Russian scientist, Vavilov, have domesticated more than half the plants and animals that serve civilized man. They have harnessed the forces of life for the progress of man, and preached and practised tolerance towards all life. May they again take the lead in the arts and crafts of a new Age!

SELECTED ARTICLE

Agricultural Progress in India During the Decade 1929—1939

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Ever since I undertook to deliver this lecture I have marvelled at my temerity and, indeed, it is impossible to do justice to my subject. Not only is one dealing with the varied agriculture of a sub-continent peopled by 400 million people of several races, but also with several distinct systems of agriculture based on widely differing soil and climatic conditions. Progress has been marked and general, but it has taken many forms. My choice of this period for review was largely governed by the fact that, speaking broadly, it coincides with the decade following the report of the Linlithgow Commission.

The decade under review was a notable one for other reasons, for Indian agriculture, like that of many other countries, had to adapt itself to the conditions arising from the world economic depression. Equally important was the effect on agriculture of industrial progress within India, leading to a demand for increased quantities and better qualities of the natural products which form the raw materials of industry. Above all, the increase in population afforded larger outlets for agricultural products, the demand being intensified by a distinct increase in the general standard of living. Indeed, India almost ceased to be an exporter of wheat and other cereals, despite a considerable expansion of production. To-day, however, I propose to confine myself in the main to a brief account of the steps which were taken to implement the recommendations of the Royal Commission and the results which have been achieved. My task has been lightened by the reports made to the Government of India in 1937 by Sir John Russell, and by Dr. Norman Wright.

Report of the Royal Commission. The report of the Royal Commission was more than an authoritative review. It was a clarion call to action for which India was ready. The Commission stated categorically that the application of the scientific method to the problems of Indian agriculture had borne fruit, but that only the fringe of the problem had been touched, and that a great combined effort was needed. Indian Agricultural Ministers had already reached much the same conclusion, and one of the most encouraging features of Indian administration has been the growing support of all political bodies and parties for sound measures designed to improve Indian agriculture,

There has been a striking increase in the staff and funds devoted to agricultural and veterinary problems. The total funds available annually for agricultural and veterinary research and development in India have now passed the £ 2 million mark—a substantial sum, though still less than 1½d. per head of the population. The increase in man-power is as striking, but, owing to changes in the form of annual provincial returns, strictly comparable figures cannot be presented.

Research Organisations. The organisation of the Imperial Council of Agricultural Research has been so admirably described by its first Vice-chairman, Sir T. Vijayaraghavacharia, in a paper read before the Society some years ago, and more recently by Sir John Russell, that it is not necessary for me to describe it.

The Royal Commission had stated in considerable detail in what directions further research was required, and the Council at once proceeded to the discussion of tentative projects for research on problems of obvious importance. The Advisory Board considered these in the light of work already in progress in India and the facilities available for such research in existing institutions, and eventually recommended modified projects, or groups of projects, for grants. In this manner full advantage was taken of the experience of senior research workers and of their land, buildings and equipment, and grants were given, in the main for staff and apparatus.

The Council was fortunate in two important respects. Following the lead of the Nizam's Dominions the larger Indian States decided to contribute to the Council's funds and share in its activities, and in 1939 Hyderabad, Mysore, Baroda, Travancore, Cochin, Bhopal and Kashmir were all represented on it. Many other States co-operated with the Council in particular activities. Secondly, it was found possible to obtain an important measure of assistance from the Science Colleges of the Indian Universities, who undertook special investigations with the aid of grants.

By common consent the Council became responsible for liaison with overseas agricultural research organisations, especially the Imperial Agricultural Bureau. In increasing degree it obtained valuable assistance from British research institutes, not the least important of which was the training of research workers in special methods. It was also able to obtain valuable information, literature and material for Indian investigators and to put them in touch with research workers in other parts of the world.

The funds placed at the disposal of the Council by the Government of India during the nine years ending March, 1939, including the cost of expert staff, secretariat and publications, amounted in all to about a million sterling. The policy of the Council has always been to supplement, and never to supplant, local effort. Thus, in 1939 it was aiding, in greater or lesser degree, nearly a hundred research projects, with grants of varying magnitude and met the salaries of nearly three hundred research officers and scientific assistants. Of the total funds allocated by the Council in nine years, about £600,000 was devoted to twenty-six major projects.

Special arrangements exist for research on cotton and jute. The Royal Commission on Agriculture commended the work of the Indian Central Cotton Committee, and that body, which derives its funds from the cotton cess, has continued to promote and aid research for the improvement of cotton-growing and to provide for technological research. Its operations have been expanded and developed, the Committee's expenditure in 1938-39 being approximately £72,000, compared with £57,000 ten years earlier.

Usually the Committee provides part only of the expenditure on a project, the Province or State concerned contributing also, usually in increasing degree when grants are renewed. The Committee paid increasing attention to means for translating the results of research into practice, its unique technological research laboratory was expanded and operations to improve the marketing and handling of Indian cotton and to stop malpractices were continued.

The Royal Commission on Agriculture recommended that a Central Jute Committee should also be set up to deal with all problems connected with the growing and marketing of jute, and provided with an annual grant from central revenues of five lakhs of rupees. For various reasons this recommendation was not acted upon until 1936. The Committee first met in February, 1937, and no time has since been lost. Arrangements for agricultural research were made at Dacca. A technological research laboratory for work on the quality of the jute

fibre was built and equipped and opened by H. E. Lord Linlithgow in January, 1939; work in temporary accommodation had been proceeding for some time previously. The co-operation of the Indian Jute Mills Association, which maintains its own research department for the improvement of manufacturing processes, was readily forthcoming, and arrangements were made for the mutual interchange of information and for consultation on research programmes. The difficult question of improving the statistics of jute production was tackled, and the problems of jute marketing were brought under survey.

Brief reference should be made to the loss to Indian agriculture which resulted from the destruction of the Pusa Research Institute by the great Bihar earthquake in 1934. After careful consideration the Government of India decided not to rebuild at Pusa, but to provide a new institute at the capital, and a suitable site was found about three miles from New Delhi. The transfer was completed towards the end of 1936 and a considerable measure of reorganisation effected simultaneously. In its new home the Imperial Agricultural Research Institute has far better contacts with agricultural and other scientific workers, and has immeasurably greater opportunities of co-operating with provincial research organisations than hitherto. This is important, since the first duty of an agricultural experiment station, especially when maintained by the State, is to apply scientific knowledge and methods to definite field problems.

Local Activities for Agricultural Improvement. From this brief and necessarily imperfect description of research organisations we may now turn to the agencies for translating the results into agricultural practice and eventually into increased income to the Indian cultivator.

As one indication of the progress made we may note that the number of organised demonstrations carried out in 1937-38 was 113,000, compared with 37,000 ten years earlier. Moreover, such demonstrations have improved in character. To a marked extent "better farming" campaigns embodying a number of improvements have taken the place of piecemeal efforts, and the demonstrations have been backed by a "service" organisation.

Perhaps more important still is the increasing degree in which extra-departmental agencies are assisting in agricultural development. For example, the better conservation of natural manures and improved sanitation are now being dealt with as one job in many villages, which is as it should be. Co-operative societies are doing more, though still not nearly enough, to assist the cultivator to obtain the seeds and implements that he needs, and the increase in the number of better farming and better living societies is most encouraging.

It is dangerous to prophesy, but the time may not be far distant when the "nation building" departments of Government concerned with the improvement of the conditions of village life will make a combined approach to this great task.

Practical Achievements. To turn very briefly to some of the results which have been achieved. There is no room for doubt that the average yield per acre of several crops in India has been raised by means which enhance the monetary reward to the grower and provide him with more and better food for his family and his cattle. This is a sweeping statement, but is made deliberately. It can best be tested in the case of cotton, as practically the whole of the crop is baled and used in mills or exported, and the acreage figures are substantially accurate. The Central Cotton Committee's examination of the trade returns showed that the average yield in the quinquennium 1932-37 was 108 lb. per acre as compared with 96 and 95 in the two previous quinquennial periods. The Government forecast for 1938-39, based largely on the standard yields, was over a million bales, or 20 per cent below the actual commercial crop, whereas for the quinquennium

1922-27 it was only 9 per cent short. In 1939 the question of raising the standard yields was under active consideration.

In the case of wheat special crop-cutting experiments and the evidence collected in the course of marketing surveys, indicate that where improved varieties and methods have spread, production per acre has increased substantially. Turning to sugarcane, the estimated production per acre expressed as *gur* (raw sugar) was 1.4 tons in 1937-38, despite the fact that it was a bad season, as compared with 1.1 tons per acre in 1927-28, which was a favourable year. Such examples could be multiplied. It should, of course, be added that the increase in the all-India average yields is partly due to improved irrigation facilities. On the other hand, when one examines local figures, one finds that it is precisely in the irrigated tracts that the increase due to improved methods is greatest. There have also been important improvements in the quality of several crops. I shall mention a few examples later.

Varietal improvement, including the provision of good seed, has been one of the most important activities of the Indian Agricultural Departments since their inception, and is as important as ever. In 1937-38 it was reported that the area under improved varieties had reached 23 million acres, as compared with 10 million in 1936-37.

As the net area cropped annually in British India alone is some 230 million acres, the ascertained area under improved crops is still less than 10 per cent. of the total, but even so it represents an additional annual income to Indian agriculture of the order of £ 20 million.

Agricultural improvement, however, does not stop at the supply of good seed, and the present attitude of the majority of agricultural workers in India to crop improvement can fairly be stated as follows: Varietal improvement is both an important immediate objective and a necessary preliminary to further developments. Of all improved methods, it is the one which the cultivator most easily understands, and can most easily adopt, provided that the "service" organisation is good. Moreover, the success achieved has given him confidence and has provided the contacts necessary for other extension work. Usually the improved variety brings an immediate reward for enterprise, even if there is no improvement in methods of cultivation. But the full advantage of an improved variety is rarely, if ever, realised unless its introduction is accompanied by better soil management. Consequently, the Agricultural Departments, in increasing degree, are organising demonstrations which combine the use of an improved variety with improvements in cultivation and manuring—and with increasing success.

Various crops. Cotton. To turn to some individual crops, cotton should, perhaps, come first, because, as the result of nearly 20 years' co-operative effort by the Indian Central Cotton Committee and the Provincial and State Agricultural Departments, the character of the Indian cotton crop has been radically altered. The total area under improved varieties in 1938-39 was 5,663,000 acres out of a total of 23½ million, nearly one-quarter of the whole. The change in the quality of the crop is important. In the three years 1927-28 to 1931-32, short staple cottons, i. e., below $\frac{7}{8}$ ", formed 75 per cent of the whole, and medium staples 25 per cent. In 1938-39 the figures were: short staple 63 per cent, medium staple 32½ per cent, long staple 4½ per cent. Moreover many of the short and medium cottons had been materially improved in spinning value. It is fortunate that a long view was taken, that the importance of quality was never lost sight of, that adequate technological tests preceded the introduction of new cottons into general cultivation, and that marketing organisation accompanied seed distribution schemes. The Indian textile industry provides a constant and

growing market for the longer-stapled cottons which are also assured of a market in Great Britain. On the other hand, the export demand for the shortest Indian cottons has contracted severely, though it will probably never disappear, and the consumption of these by Indian mills, though large, is unlikely to expand much.

Jute. In the case of India's other great export, jute, in 1937-38 the area under Departmental varieties was reported to be 1,763,000 acres out of a total of 2,889,000 acres. These varieties were, in the main, chosen for their high yield, but were reported on by the trade to be of satisfactory quality before they were put into general cultivation.

Oilseeds. Some valuable fundamental work was done in earlier years, but until recently the amount of agricultural work on this group of crops was disproportionately small in view of their value as cash crops and their importance for Indian industries and export alike. The remarkable expansion of the groundnut crop has continued until India is the world's largest producer and its second exporter, despite the enormous internal consumption. For an "introduced" crop to spread from 300,000 acres in 1900 to nearly 9 million acres in 1937-38 is in itself a striking proof that the Indian cultivator knows a good thing when he sees it. From 1934 to 1938 production averaged 2,800,000 tons, and of this 39 per cent was exported, the remainder being retained in the country, and about 1,200,000 tons, or 43 per cent, used for the production of oil. The reported area under improved varieties is only some 417,000 acres, but these figures relate mainly to recent work and exclude the earlier distribution of seed by the Agricultural Departments. As a result of the action taken by the Research Council, well-planned experimental work is now in progress, including the production of better varieties, improved methods of cultivation and manuring, and better methods of harvesting and handling. The objective is high yield and disease resistance, coupled with a high oil percentage and low fatty acid content. Correctly used in a rotation, the groundnut crop is a valuable aid to the maintenance of soil fertility, especially in some of the important cotton areas. Co-ordinated research schemes are also in operation for the improvement of the linseed, rape, castor and other oil seeds.

Sugar-cane. The sugar-cane crop forms a natural link between the commercial crops and the food crops, and is of particular interest, since, speaking broadly, no other crop gives the Indian cultivator so large a cash reward for his labour and that of his family. Sugar-cane production in India has been revolutionised since 1929, and India now has a modern white sugar industry which is capable of supplying all her requirements, and, on the whole, is technically efficient. Of the total area under cane in 1939 approximately 80 per cent was under improved varieties, mainly Coimbatore canes. Very much has been done in recent years to improve the efficiency of the Indian sugar industry, both by factory improvements and in the organisation of the cane supply, though several control problems have yet to be solved, but the more efficient production of cane is still the first requisite. To that end intensive cane improvement schemes, many of them aided by the factories concerned, are in progress in several important areas—notably in the United Provinces—where an effort is being made to secure better cultivation and manuring, combined with the systematic supply of healthy seedling canes of the varieties best suited to the area. In the Bombay Deccan important work has been done on the problems of sugar-cane cultivation in that area, of which alkali formation and a fall in fertility were outstanding. As a result, systems of soil management and cane cultivation have been worked out which are now being put into practice.

Rice and Wheat. In 1928 the amount of attention devoted to rice was disproportionately small for a food crop occupying annually some 72 million acres. In

Madras good work was in progress, in Bengal a sound foundation for future work had been laid, but elsewhere there was less to record. The Research Council made a point of remedying this defect at the earliest opportunity by a series of co-ordinated research schemes. In 1937-38 the area under improved varieties had reached 3,759,000 acres, compared with 634,000 in 1927-28. In Madras one-sixth of the total area was growing departmental strains. Work has by no means been limited to plant breeding, and the whole chain of experiment stations is co-operating in cultivation and manurial trials.

Wheat was one of the first crops to occupy the attention of agricultural departments. Progress in the improvement of wheat production has been steady, and the total area under improved varieties only just fell short of the seven-million-acre mark in 1937-38, this being nearly one-fifth of the total area. Progress has been most rapid in the Punjab, where half the total area is under improved kinds, and important progress has been made elsewhere. Both yield and quality have been improved and the gain to the cultivator is substantial. Of later years work on the rust problem has been of outstanding importance, and the work done by Dr. K. C. Mehta has enabled the breeding of resistant varieties to be undertaken with precision. More important still is the knowledge which has been gained of the ways in which the black and brown rusts are disseminated annually and of the foci of infection.

Tobacco. Tobacco presents features of special interest. In 1929 the production of cigarette tobacco of the Virginia type in India was in its infancy. Now it is an important established industry employing about 2,500 flue-curing barns. Some 85 per cent of the total requirements of the Indian cigarette factories were provided by Indian grown leaf in 1938, and an important export trade had been developed. The centre of the industry is Guntur, in the Madras Presidency, and the Research Council finances a research sub-station in that district for the study of rotations, fertilisers and other factors influencing yield and quality. A set of co-operative experiments on the production of cigarette tobacco in other provinces from two standard varieties is also in operation. It is of interest to note that the value of the exports of Indian tobacco has risen from about £637,000 to approximately £1½ million during recent years.

Considerable progress has also been made in the development of fruit growing, both in the hills and the plains, and in the cold storage of fruit.

Plant Protection. The reduction of the loss of crops caused by insect pests and plant diseases received the attention of the agricultural departments from the outset, but progress since 1929 has been marked, both in the application of knowledge and in investigation. Rarely can much be done by the use of insecticides or fungicides except with plantation, orchard and garden crops, and pest control must be secured by more radical measures, often involving substantial changes in agricultural practice. We have, however, one dramatic example of war on insect predators in the measures taken to deal with the locust invasion which became so important in 1929-30, though actually it had started some three years earlier. To the Research Council fell the task of co-ordinating effort, providing intelligence of the progress of locust invasion, of advising on control measures and of maintaining contact with locust control organisations in other countries. The Council was fortunate in securing the co-operation of the considerable number of Indian States affected both in the provision of information and intelligence and in control measures. The cost of the locust visitation to India, including control measures and the remissions of land revenue in affected areas and loss of crops, ran into crores of rupees, and it was resolved that India should not again be caught unprepared. A survey was made of the permanent and semi-permanent breeding grounds of the desert locust in

India, and the course of this and previous visitations studied. Certain areas on the Mekran coast of Baluchistan were quickly found to be important, and desert laboratories were set up to study the locust in this breeding ground. The conditions which cause the locust populations in these tracts to increase suddenly, thus leading to swarming and migration, are now fairly well understood and control measures have been worked out. A permanent locust warning service has been set up in order that prompt action may be taken if a visitation threatens in future. It is possible that it may soon be tested, in view of recent reports of locust activity in Baluchistan.

One other group of entomological undertakings may be mentioned, viz., the campaign against the pink boll worm of cotton in the United Provinces and the clean-up campaigns against the spotted boll worm in Bombay and the Punjab. The field work followed on successful scientific investigations, and both were financed by the Indian Central Cotton Committee. The effect on both the yield and commercial quality of the cottons of the tracts concerned is now apparent. Similar work is in progress in Hyderabad and Baroda States with satisfactory results. Important work is also in progress on the other insect pests of cotton and those of sugar-cane, rice, fruit trees and tobacco, and promising results have been obtained.

In combating plant diseases, the principal weapon has been the production of resistant varieties and their substitution for susceptible kinds. Much more attention has also been paid in recent years to the effect of cultural methods on the incidence of plant diseases. Much useful work has been done which cannot here be described.

Livestock. The fundamental importance of the improvement of Indian livestock to the development of agriculture was emphasised by the Royal Commission who made a number of far-reaching recommendations. In India cattle form almost the sole motive power for cultivation, and a better milk supply is now the first requirement for the better nutrition of the population. If any real and permanent advance is to be made there must be better protection against epidemic disease and other pests, better breeding and better feeding. Much has been done in these directions during the past few years, though the results are only now becoming apparent. The grants made by the Research Council have enabled a number of important investigations on disease control to be undertaken, some at central institutes and some in provinces and states. Disease investigation officers, who act as a reconnaissance and intelligence service for the Imperial Veterinary Research Institute, have been provided in each province and in several Indian States.

The Central and Provincial Governments have expanded their operations in the production and use of protective sera. The great value of the more important breeds of Indian cattle has been recognised, and cattle improvement placed on sounder basis. The improvement of Indian milk production and dairying was the subject of a special enquiry by Dr. Wright (Director of the Hannah Dairy Research Institute), and as a result the Government of India decided to appoint a Director of Dairy Research and to establish a central dairy research institute. In the meantime, some important surveys of milk production were carried out.

The arable area in India has steadily expanded at the expense of grazing grounds, and with an increasing population this process is unlikely to be reversed even if checked. Consequently, a balance can only be maintained if a real increase in the production of fodder crops, the greater use for cattle food of such industrial by-products as the oilcakes and much more thorough measures to conserve and improve the larger grazing areas can be secured.

Though there are exceptions, most parts of India are ill-suited to the production of good grazings. Consequently, on the average holding the production of fodder crops must take the place occupied by temporary leys in England. Fortunately, India is rich in such crops, and it is known that in most provinces and states there has of recent years been a growing response to departmental propaganda. An important feature has been the steady, though gradual, expansion of the cultivation of *Berseem* (Egyptian Clover—*Trifolium Alexandrinum*) in Northern India, especially in the North-West Frontier Province and the Punjab.

Grazing and fodder problems are essentially provincial, and often local, and call for the co-operation of several departments. Provincial fodder and grazing committees have been set up in all provinces and several Indian States, and a central committee of the Research Council secures liaison. The Council has made grants to meet part of the cost of some experimental and development work. The Forest Departments have supported these efforts, and in several provinces have undertaken important work themselves. Work on the improvement of grazing by better management and controlled rotations has been started, and several provinces have in progress grazing surveys, which include a study of the grasses.

Careful experiments have shown that by the substitution of mixed farming including milk production, for the mere raising of crops for sale, agriculture in many parts of India could be raised to a higher level. Mixed farming is already the custom in parts of Northern India, but elsewhere there is scope for development and everywhere there is room for improvement. Towards the end of 1938 the Research Council approved proposals for active demonstration work to this end by provincial and State organisations. Such developments have a very marked economic aspect. If cultivators are to expend money and labour on the better feeding of cattle they need a profitable outlet for animal products. The demand for these exists, but market organisation is of primary importance.

To animal breeding only a brief reference is possible here. Provincial and State Governments have substantially improved their organisation for the production and issue of bulls of good breed and for the encouragement of private breeders. The breed characteristics of the more important types have been published by the Research Council and several breed societies established. The All-India Cattle Show first held in January, 1937, was a great success, and has become an annual event which is being continued even in war-time. Breeders have found that the sales which result justify their exhibiting.

The improvement of cattle is necessarily a slow business, but the fruits of quarter of a century's patient work are now being realised. To quote two examples only pure bred *Sahiwal* cows have now reached a milk yield of 11,000 lb. in a 10-month lactation period; ten years ago the record was 6,500 lb., and when the Pusa pedigree herd was started it was about 3,500. Secondly, the number of approved breeding bulls at studs throughout India has increased greatly. Complete figures are not available, but in the Punjab the number was 11,302 in 1937-38, compared with 2,890 in 1927-28. What perhaps, is more important is the fact that issues of pedigree sires from Government farms are now largely limited to selected areas where definite arrangements exist for the elimination of scrub sires from the breeding herds. Slowly but surely animal husbandry in India is coming into its own.

Consolidation of Holdings. It is no exaggeration to say that, at the present day, there is no greater single obstacle to the introduction of improved methods of cultivation in many parts of India than the fragmentation of holdings. Steady progress has been made in the removal of this disability. In the Punjab, through the medium of co-operative societies established for the purpose,

approximately 919,000 acres had been consolidated by 1938, the addition for the year being 132,000 acres in 255 villages. Ten years earlier the consolidated area was about 165,000 acres. In the Central Provinces a Consolidation of Holdings Act was passed in 1928. By 1938 an area of 894,000 acres had been consolidated, the villagers paying the entire cost. In the United Provinces considerable progress has been made on lines similar to those adopted in the Punjab, but without legislation, and about 100 co-operative consolidation societies were operating in 1938. Of special interest is the alternative method of consolidation of cropping in an intensively cultivated tract where sugar-cane, wheat and rotation crops are grown under tube-well irrigation. In the Baroda State, which commenced consolidation in 1921 and adopted the co-operative method in 1925, steady progress has been made, and 48,000 acres has been consolidated by 1938.

The most satisfactory feature is that consolidation is now popular, and the applications are in excess of the immediate capacity of the staff. In some other provinces and states interest has been aroused, and a start is being made. In various ways also steps are being taken to avoid future fragmentation of holdings, particularly in large canal colonies where the evil does not at present exist.

Soil Management and Fertilisers. Although the improvement in soil management is of outstanding importance I shall deal briefly with it, since this paper in the main is a record of progress and much of the work is comparatively recent. In a recent paper by Dr. Burns reference was made to "dry farming", i. e., to improved methods of cultivation in areas of deficient and uncertain rainfall. The Research Council has aided four complementary schemes in Madras, Bombay, Hyderabad State and the Punjab. The object in each case is to introduce a system of agriculture, including methods of conserving moisture, the use of drought-resisting and short-period varieties, suitable tillage methods and manuring and the necessary implements. Physiological studies and soil studies form part of the programme. In Bombay work was commenced in 1923, and by 1934 the "Bombay dry farming method" had proved its value. With an average rainfall of 23.70" the average yield of millet grain over seven years was 1,260 lb. per acre, compared with 741 with indigenous methods of cultivation. The method is now used on some thousands of acres. Work on the crops and scientific soil studies have been intensified since 1934, and some very promising results are now appearing. There are great tracts of precarious rainfall where irrigation is impossible, so that increased production by the better conservation of the scanty rainfall is of primary importance. The soil in relation to irrigation has received more attention of late years, the most notable work being at the Irrigation Department's Research Station, notably in the Punjab. Here methods of alkali prevention and the reclamation of alkali lands have been systematically studied, and a great deal of valuable information on the management of such lands secured. In Sind an alkali survey was carried out in conjunction with the planning of the Lloyd Barrage Canals. In most provinces attention has been given to the problem of waterlogging in canal areas, and both the Agricultural and Irrigation Departments are endeavouring to secure the more economical use of irrigation water.

At the Indore Research Institute which, since 1923, has been financed jointly by the Indian Central Cotton Committee and a number (now 27) of Indian States in Central India and Rajputana, the better management of the Malwa black soils has been the subject of continuous study with special reference to the avoidance of colloidal conditions incompatible with a good tilth during the monsoon period. The Indore method of compost manufacture is now well known. In the various provinces systematic attention is being given to demonstrations of compost making by one method or another according to conditions and the materials available, and to the better conservation and use of cattle manur

Artificial fertilisers are still used in limited quantities, the consumption of ammonium sulphate being approximately 70,000 tons per annum only, and other "artificial" about 25,000 tons. On the other hand the use of the non-edible oil-cakes as manure, especially for sugar-cane, has expanded considerably, as has green manuring.

At the New Delhi Research Institute genetic studies on soil profiles, the collation of existing soil data and the preparation of a preliminary soil map of India form an important part of the Institute's programme.

Improvement of Marketing of Agricultural Produce. The improvement of the marketing of cotton has received the continuous attention of the Indian Central Cotton Committee since 1921, but prior to 1929 little had been done for other crops. The Royal Commission on Agriculture made definite recommendations for provincial action, and the improvement of marketing was included in the functions of the Research Council. The general plan of work was described by Mr. Livingstone, the Marketing Adviser to the Government of India, in a paper read before the Society in 1938.* Careful marketing surveys formed the basis, and were undertaken for 32 commodities and simultaneously a survey of existing marketing methods and organisation was undertaken. The full reports have now been published on 11 commodities, viz., wheat, linseed, eggs, tobacco, grapes, coffee, rice, potatoes, milk, groundnuts, sugar and fish (preliminary), and most of the other surveys have been completed.

An agricultural marketing and grading Act was passed in 1937, which enabled statutory rules to be made for the grading and marking of the commodities scheduled. For those crops which are normally dealt in at wholesale markets, e. g., wheat and oilseeds, attention was first devoted to the standardisation and improvement of the wholesale contracts and better definitions of quality, putting as far as possible a definite premium on the sale of high quality produce. For commodities which go more directly to the consumer "national mark" schemes for graded produce were adopted. Constant consultation with traders of all classes was necessary, and a large measure of agreement was reached on rules and standards before they were introduced. Experimental grading and packing stations were set up and it was speedily found that consumers were willing to pay satisfactory prices for marked and graded produce. Ghee (melted butter fat) affords an excellent example of the success achieved. There is always a keen demand in India for pure ghee, and by the end of 1939 there were 17 licensed packers running 84 grading and packing centres and in all 6,707,000 lb. of graded ghee were sold and fetched some £ 322,000. A central control laboratory, with branches, was set up and the purity of each packing checked by analysis. Six Indian States set up their own laboratories and graded under the "Agmark" Scheme.

"Agmark" schemes were developed for a number of other commodities, and grading and packing stations set up to deal with hides, eggs, fruit, potatoes and special rices. In 1939 there were 150 grading stations which dealt with £ 450,000 worth of produce. It is of interest to note that in 1940 there were 363 authorised packers operating over 400 centres, and produce to the value of £ 767,000 was graded and marked. A particularly interesting development in 1939 was the extension of the Marketing Act to cotton of specified varieties at the request of the Indian Central Cotton Committee, to enable a scheme of "marking" improved cottons of known purity to be introduced. In the first year cotton worth £ 127,000 was sold under this scheme, and growers received an average premium of 5 per cent over the current market quotation for the same type of cotton not so certified.

* *Journal of the Royal Society of Arts*, Vol. 86, p. 1029.

The Royal Commission drew attention to the pressing need for the better control of the primary markets which serve the growers and for the regulation of the charges made in them, and the surveys provided the necessary detailed information. The control of such markets is purely a provincial question, and in 1939 the Punjab, North-West Frontier Province and Mysore State passed Acts for the regulation of markets on the lines of an agreed model; Madras, the Central Provinces, Hyderabad and Baroda were engaged on the revision of their existing Acts, whilst Bills had been introduced in Bengal, Sind and the United Provinces.

In March, 1939, the Central Legislature passed a new Act for the standardisation of weights in India, and during the year provincial legislation was under preparation applying these standards locally—a reform long overdue. Time does not permit a description of the arrangements made for the dissemination of market intelligence and information about prices, but the above brief account will show that a considerable advance has been made towards the solution of the problem of ensuring to the producer a fairer share of what the consumer pays and of securing better prices for high quality produce.

On this note I may appropriately conclude this imperfect review of the progress of Indian agriculture during ten years of great activity, for the whole object of all these efforts is to enable the Indian cultivator to obtain a better reward for his labours, either in cash or in kind, and to enable him to achieve a high standard of living. Much of interest and importance has necessarily been omitted, but there is no room for doubt that the application of scientific methods to the study of his problems has aided the Indian peasant. More important still is the fact that millions of cultivators now trust their agricultural and veterinary departments and know that they can be helped. (*Journal Royal Soc. Arts*, Vol. 90, No. 4607, February 20th, 1942.)

Gleanings.

Grow More Food—Government's Assurance to Cultivators. In connection with the food production drive inaugurated by the Government of India, the question has been raised whether the position of the cultivator will not be seriously affected if a nationwide effort towards increased food production leads to such an augmentation of output as to affect the saleability of the crops. It has been suggested that in the event of a sudden termination of hostilities, the demand for food-stuffs may fall off, leading to a deterioration in prices.

The Government of India regard the possibility of any such developments as remote. They would, therefore, ask the cultivators to be on their guard against any exaggeration of these fears and to go ahead with their plans for increased food production to meet the proved need of the hour. With the growing demand for food stuffs on all sides, there is little chance of any serious fall in prices in the immediate future.

Even after the cessation of hostilities the demand for foodstuffs from countries now devastated by war, is likely to increase rather than decrease. India herself with her growing population needs more food than she grows at present.

It is however, likely that genuine apprehensions may be felt about the transport situation and certain temporary difficulties in the marketing of crops on that account, and it was to counter such apprehensions that it was recommended at the Food Production Conference held in New Delhi on April 6, 1942, that "the Government of India should undertake, should such a contingency threaten, to

buy such quantities of foodstuffs in the open market as would prevent any serious deterioration in the level of prices".

The Government of India have accepted the principle of this recommendation, and the details of a scheme for giving effect to it are now being worked out in consultation with the interests concerned. Meanwhile, the Government of India desire to convey this assurance to the cultivators that, should any developments take place which affect the saleability of the food crops, they will buy such quantities of foodstuffs in the open market, whether in British India or in the Indian States, as are calculated to prevent a serious fall in the prices. The Government of India are anxious to see that those who respond to their appeal for increased food production in this emergency do not suffer thereby. (*Indian Information*, July 15, 1942.)

The Central Food Advisory Council. In pursuance of a recommendation of the Food Production Conference held in April, 1942 the Government of India have decided to constitute a Central Food Advisory Council.

The functions of the Council would be—

- 1) to pool, study and disseminate all available information regarding food and fodder production ;
- 2) to plan on an all India basis the food and fodder production programme for the different regions and tender advice in regard to its execution; and
- 3) to advise the authorities responsible about the equitable distribution of the available food stocks. (*Indian Information*, September 1, 1942.)

Cows for Breeding Purposes. There are few cattle farmers who do not make every effort to secure the best bulls for their herds.

The same attention is, however, not always bestowed upon the heifers and cows, in spite of the fact that much can be done in this respect to accelerate the improvement of the herd.

Although there has been a marked improvement in the average quality of our cattle as a result of the application of the Cattle Improvement Scheme, the rate of improvement will slow down once a certain stage has been reached, unless selection is applied also to the cows of our herds.

Even though the bulls used possess a sufficiently high degree of prepotency, which is often not the case, and even if the successive bulls are selected with the greatest care, considerable variation will occur in the progeny if there is marked divergence among the cows. If the cows are also selected for the desired qualities, uniformity, as far as these characters are concerned, will be achieved much sooner.

It is not the contention of the writer that selection is an easy matter, nor the selection alone will solve all problems. It will, however, considerably expedite the process of improvement.

In regard to the principles of selection, it may be briefly stated that for breeding purposes those animals must be used which produced the largest progeny possessing the required characters.

There is no advantage in possessing a cow which, although she is a high milk-producer, calves irregularly, since she will be of value to the owner only during her lactation periods and is of little further use to the herd or the breed. The same is true of a cow which calves regularly but whose calves do not also calve regularly, but be unable to produce enough milk for her offspring. This is often the experience of beef breeders, who usually do not resort to hand rearing of calves.

The main requirements are, therefore, a knowledge of the individual cow and of her breed, her characters and history, and a clear conception, on the part

of the breeder, of his purpose with his herd. The following should serve as a guide :

Select cows which began breeding at an early age and regularly produce calves of good quality, i. e. possessing the qualities desired in your herd. It stands to reason that these qualities will be evident only in the case of older animals. It is necessary to know the production record if only of a few of the calves of a particular cow in order to be able to determine whether she produces good quality calves or not.

Only good quality cows which are themselves descendants of good quality cows, must be kept for breeding purposes. For this information, the stud book may be consulted, and if it has been kept properly, it will reveal whether the animal's ancestors for a few generations were bred for the desired qualities. If that is the case, there is an increased possibility of obtaining from a cow calves as good as she herself is, or even better, if she is mated with a suitable bull. However, full particulars are not available in the case of all animals. It is, for instance, impossible to say whether a heifer will be a satisfactory producer or not. In such cases animals must be selected merely because they are descendants of good animals. It may also be desirable to keep certain animals, even though absolutely no particulars are available. This frequently happens because most farmers do not keep records of parentage, milk production and breeding ability.

It may therefore be necessary to keep animals just because they are good producers or because they comply with certain conformation requirements. The influence of environment on production, breeding ability and other qualities must not be overlooked in the selection of cows. It would, for instance, not be fair to compare the milk production of well cared for cows with that of cows who have to fend for themselves on the veld. The amount of milk produced in relation to a fixed amount of feed must also be taken into consideration. Some animals produce much more economically than others.

How to effect improvements. The cow's adaptability as well as her milk production must be taken into consideration. Animals bred for very high milk production, for example, should not be kept on poor grazing. Nor does it pay, on the other hand, to spend too much on feed for low producing animals which can never earn their feed.

There are various aids to sound selection. The following are important:—

1. The cow's milk record will be a guide to her production, both as regards quantity and quality.
2. A herd record will furnish information on such points as descent, with all particulars, age at which the cows first calved, number of calves and particulars.
3. Feed registers for individual cows will make possible a comparison between the cow's food consumption and her milk production with a view to determining her profitability.
4. The standards of perfection, where they have been compiled for a particular breed, will serve as guide in judging a cow's conformation. The value of these standards will naturally depend upon whether conformation is correlated with any of the qualities desired by the breeders.

It is clear, therefore, that there are so many factors which exercise an influence on the profitable breeding of cattle that a thorough system of records of all particulars is essential for sound selection. *Weekly Press Service, Department of Agriculture and Forestry, Pretoria. (Indian Farming, Vol. 3, July 1942.)*

Beeswax is valuable. Although bees are kept primarily for the honey they will produce, the latter is by no means the only product of their labours. Pound for pound, beeswax is worth more than honey. Therefore beekeepers are well advised to save every particle produced, says C. B. Gooderham, Dominion Apiarist, Central Experimental Farm, Ottawa.

Every apiary will yield some wax, while in large commercial yards run exclusively for extracted honey, the amount may reach several hundreds of pounds annually. Unfortunately in many apiaries, especially where only a few colonies are kept, pieces of comb taken from the hives during the summer months, broken or discarded combs are too often thrown aside and wasted when they could just as easily be placed in some receptacle and saved. If the beekeeper would only remember the price he has to pay for comb foundation he might perhaps be a little more careful of the wax produced by his own bees.

There is a certain amount of wax in every piece of comb and also in the cappings removed from the combs at extracting time, and while good combs are too valuable to melt down for the wax they may contain, there are always enough broken or discarded combs, brace or burr combs and cappings from which sufficient wax may be extracted to more than pay for the time and labour involved.

Wax as taken from the apiary always contains more or less impurities, therefore some means must be used to separate them. Two methods are in general use, one utilizes heat from the sun while the other requires artificial heat. The solar wax extractor is very useful for rendering small pieces of comb as they are taken from the hives during the summer time and it may also be used to extract the wax from small amounts of cappings. For large quantities, however, the most efficient method is first to melt the combs or cappings in boiling water and then to submit the molten mass to pressure. Presses, especially constructed for this purpose are available from dealers in apiary supplies. A large proportion of the wax may be secured from the melting alone by allowing the melted mass to cool. The wax being lighter than water will rise to the surface and harden. A small percentage of the wax, however, will be held in the slum gum beneath while some of the lighter impurities will be imbedded in the lower surface of the wax cake. Where this occurs the wax can be remelted and strained. There are a number of capping melters available which permit the melting down of all cappings as they are pared from the combs at extracting time, but all beekeepers do not have one and therefore must postpone this work until a later date.

Now that the bees are snugly packed away for the winter and the honey crop taken care of the time is appropriate to recover the wax crop. Before melting down the cappings, however, carefully inspect your stock of drawn combs consigning all those that are broken or distorted to the melting pot with the cappings. By doing this, enough wax may be secured not only to supply the necessary foundation for next summer but also to trade in for other supplies. It is quite possible that the wax crop may be the difference between profit and loss on the season's operations. *Press note, Dominion Department of Agriculture, Canada, (Indian Farming, Vol. 3 July 1942).*

Manufacture of Vegetable Insecticides. The discovery of several useful vegetable insecticides and the possibilities of their manufacture in India are revealed in a leaflet (No. 20) published by the Forest Research Institute, Dehra Dun. To control agricultural as well as household pests vegetable insecticides are preferred to others, such as lead and copper salts, arsenic and nicotine, because they are non-poisonous to man and animals.

The growing demand for vegetable insecticides was hitherto met mainly by a plant called "derris" from Malaya the Dutch East Indies and Philippines. Investigations conducted by the Forest Research Institute have now shown that

other plants bearing the same toxic content as "derris" are available in this country; and the existing material is rich enough for the preparation of effective insecticidal emulsions and powders. Their toxic content is capable of still further improvement by proper cultivation and treatment.

Certain parts of India, it has been found, possess suitable climatic and soil conditions for the introduction and cultivation of richer varieties of Malayan "derris". Experiments in this direction have already proved successful in Mysore, Cochin and Assam. (*Indian Information*, September 1, 1942)

Press Notes.

Note on the Activities of the Department of Agriculture, Madras, for the quarter ending 30th June, 1942.

Propaganda. The activities of the district staff were mainly confined to the food production drive. The District Agricultural Officers and Agricultural Demonstrators interviewed a large number of *ryots* and convened a number of meetings to impress upon the cultivators the need for increased production of food crops. During his tours in the Districts of Bellary, Anantapur, Tanjore, Trichinopoly and Madura, the Director of Agriculture himself initiated the food production campaign by addressing large number of *ryots* and rural organizations on the need for growing more food and restricting the area under commercial crops.

Ryots were advised to apply groundnut cake liberally to their paddy and other irrigated crops so as to get an increased yield. Cake was stored in the several agricultural depots in the presidency and supplied to *ryots*. To help the poor cultivators, *takkavi* loans were also sanctioned for the purchase of manures.

In Guntur, a competition has been instituted, with the permission of the District Collector, to produce maximum yield of rice, irrespective of cost. A sum of Rs. 200 has been placed at the disposal of the District Agricultural Officer for the award of prizes to successful competitors.

In Tanjore District, the supply of water in rivers and channels was advanced by three weeks of the usual period and cultivation was thereby made earlier than usual. As a result, it is expected that 20,000 acres of single crop paddy area would come under double cropping. Arrangements were made in Nellore District, in co-operation with the Revenue and Public Works Departments, to raise paddy seedlings in concentrated areas under selected channels for double planting in the Mopad project area and a special Demonstrator with a staff of four Demonstration Maistries was posted for this work. In the District of Bellary, contour bunds were put up over 1,500 acres, to prevent sheet erosion.

Research. The harvest of all varietal observation plots at the Agricultural Research Station, Anakapalli, did not reveal any sugar-cane variety that could out-yield Co. 419, the standard cane. At the Dry Farming Station, Hagari, out of 354 cotton selections studied in the breeding plots, 21 were found to be superior in yield to H. 1 cotton strain. It was also found out that onions can be grown as an intensive and profitable garden crop. The cost of cultivation per acre worked out to Rs. 255, whereas the value of seed obtained came to Rs. 490, leaving a good profit of Rs. 235 per acre. Experiments conducted at the Coconut Stations, Kasaragode, Pilicode and Nileshwar definitely established that burial of coconut husk (not used for retting) in trenches $1\frac{1}{2}$ ft. deep between rows of trees at the rate of about 1,000 husks per tree, in addition to growing a crop of green manure, increased the yield of experimental trees from 37 to 62 per tree per year, without any other manuring.

A strain of *ragi*, E. C. 3735, a shorter duration mutant of the popular strain E. C. 593, when tried in comparison with the cultivators' seed at Tiruvannamalai and Chengam taluks of North Arcot District gave 26.1% and 27% increase of grain yield respectively. In a trial plot in the cultivators' field at Polur in the same district, the *ragi* strain E. C. 3517 yielded 20.3% more grain and 32.1% more straw than the local seed.

The new strain of groundnut, viz., A. H. 198, which combines high yield and high shelling outturn of kernels has given an average increase of 20% and 42% respectively over the local varieties in the district trials conducted in South Arcot and Salem and is very much appreciated by the *ryots*.

Experiments at the Fruit Research Station, Koduru, have shown that flour prepared out of certain varieties of banana fruits, makes a wholesome food and when mixed with milk and sugar to taste is quite relishing.

At the Entomological Laboratory at Coimbatore control of sugar-cane borer is being attempted by mass breeding of their egg parasite, *Trichogramma minutum*. Trials with indigenous plant products have shown that aqueous extracts of the kernels of *Thevetia neriifolia* possess considerable contact insecticidal properties and are effective in the control of crop pests. A station for the breeding of the predatory lady bird beetle—*Rodolia cardinalis*, to check the fluted scale which has assumed pest proportions on wattle plantations, has been established at Kodaikanals.

The Chinese Orange Grader. After long and systematic experimentation a simple and efficient grader has been designed for sorting tight-jacket oranges into the several sizes prescribed by the Agricultural Marketing Adviser to the Government of India. The contrivance is almost fool-proof in operation and can be manipulated with ease by a boy. It is worked by foot by pressing a pedal beneath the dumping hopper and the two hands are free for either pushing the fruits down the inclined plank or guiding them to start their forward journey on the agitating rack. All the essential parts are made of wood except those which necessarily have to be of iron or steel. A novice can handle five to six thousand fruits per hour with this mechanical sorter and in the hands of an experienced person the output can be increased by nearly fifty per cent. The peculiarity about this device is not merely the accuracy of the sorting but the entire absence of injury of any kind to the fruits when handled by this grader. As per current prices of hardware and timber, the cost per grader amounts to Rs. 100, packing and freight charges being extra. Three of these machines are now at work with the Kodur Fruit Growers' Co-operative Society's grading centres at Kodur and Rajampet. It is an ideal machine for grading tight-jacket oranges and can be expected to give long and satisfactory service for a number of years. There are no wearing parts or adjustments likely to require frequent or periodic attention. Similar machines can also be made and supplied for grading lime fruits and they are recommended for grading concerns. The chinee orange grader can be had from the Research Engineer, Lawley Road P. O., Coimbatore.

Marketing Agricultural produce to the value of 7½ lakhs of rupees was graded during the quarter under report. The value of rice graded amounted to over 4½ lakhs mainly in the districts of Nellore, South Arcot, Trichinopoly and Tanjore. Tobacco to the value of Rs. 2.25 lakhs was graded in the Guntur District with the trade and in Kistna District with producers. Along with officers of the Co-operative Department, the work of co-operative storage of rice to meet the emergencies of food supply was discussed in the Districts of Coimbatore, Salem, the Nilgiris, Anantapur, Chittoor and Nellore. Market survey of onions, chillies, milllets and basket work was continued. Reduced rates at one-third parcel rates have been granted by the railways for export of eggs from Madras

to Bombay. Reports on the prices of commodities in important markets and the position of stocks of rice of the presidency were prepared.

Sales and Demonstrations. Distribution of improved agricultural implements and high yielding varieties of seeds and plants were continued and 279 ploughs, 6 interculturators, 141 other implements, 1,310 spare parts, 8,40,734 lb. of paddy seeds, 42,299 lb. of millets seeds, 9,436 lb. of cotton seeds, 17,544 lb. oil seeds, 19,39,265 sugar-cane setts, 14,421 lb fodder crops seeds, 1,56,401 lb green manure seeds and 55,266 fruit plants and suckers were sold to the cultivators during the quarter under report. As usual, 273 varietal, 22 cultural and 27 manurial trial plots and 992 varietal 400 cultural and 10 manurial demonstration plots were arranged by the Demonstrators.

General. With a view to secure the co-operation of the *ryots* in the 'Grow More Food Campaign' 1,796 exhibitions and lectures and 1,646 meetings were arranged (From the Director of Agriculture, Madras.)

Concessions granted by Government to Stimulate Increased Production of Food Crops in the Madras Presidency.*

In my previous talks on more food production I have mentioned that to meet the full requirements of our Province and the partial requirements of Ceylon, Cochin Travancore, Hyderabad, Mysore and Bombay, it was necessary to produce nearly 9½ lakhs of tons of rice or rice and other cereals over the average for 5 years from 1935-36 to 1939-40. There has no doubt been some increase in production during the last two years but the progress is not sufficient. With a view, therefore to increase further the production of food grains, Government have recently sanctioned a number of concessions and I now propose to explain these concessions in order that the cultivators might take the fullest advantage of them.

In to-day's talk I want to keep you informed of the various concessions Government have been pleased to grant to the agriculturists of this province to help to stimulate the increased production of food crops and I trust that full advantage will be taken of these concessions by the agriculturists and that production of food grains and vegetables would be greatly increased. I now proceed to give you in a summarized form the several concessions announced by Government so far. I request all the listeners to this talk to carefully note down the concessions for their own benefit and the benefit of the other people who have not been able to listen to this talk. These concessions may be broadly classified under the following heads:—

A—Favourable terms for food production.

B—*Takkavi* loans.

C—Concessions for particular areas.

Under the head A—Favourable terms for food production, the following are the concessions granted.

i. *Free cultivation of unoccupied lands.* Food grains including paddy may be cultivated free of assessment in *Faslis* 1351, 1352 and 1353 on any unoccupied assessed Government land, unassessed land or disafforested land on which crops had not been raised during both the *Faslis* 1349 and 1350. It should be possible to bring a few lakhs of acres of such land into profitable cultivation for growing food grains of some kind or other at a time when prices for food grains are ruling high.

* This note was delivered as a talk at the All India Radio Stations, Madras and Trichinopoly, in Telugu and Tamil on the 5th and 8th August 1942, respectively.

ii. Concession No. 2 gives exemption from wet or dry assessment for food crops grown on the above classes of lands, but it is necessary to obtain previous permission for the use of Government water according to existing rules and the usual charge is payable for the use of such water.

iii. Concession No. 3 extends the permission for cultivating food grains including paddy on land which has been unoccupied for 18 months, lands within a belt of 2 or 3 chains from the reserved forest boundary and land which is in a compact block lying outside the areas benefited by the Cauvery Mettur Project in the Tanjore District and the Cauvery irrigation in the Trichinopoly District. In announcing the above concessions, Government have also ordered that eviction proceedings need not be taken and that in such cases temporary occupation for cultivation during *Fashis* 1351 to 1353 may be permitted. They have also given further directions that when assigning lands in compact blocks, preference should be given to the landless poor. The landless poor people in villages have now a very good chance to get a parcel of land for growing their own food grains and vegetables. It is earnestly hoped that enlightened people in the villages will widely broadcast this information among the landless poor and help them in getting such lands assigned to them for temporary cultivation.

Cultivation of Railway lands. The South Indian Railway have agreed to permit the cultivation of railway lands under their control with food crops for 3 years from *Fashi* 1352 subject to the following conditions :

- i. Railway 'B' class (temporary) land may be leased by the Revenue Department without reference to the railway authorities;
- ii. The railway authorities will demarcate plots of Railway 'A' class land at stations and these may be leased by the Revenue Department;
- iii. Preference should be given to railway employees;
- iv. A reasonable rental will be levied and 95% of it credited to the railway.

The Madras and Southern Mahratta and the Bengal Nagpur Railways have also granted similar concessions for food crops for three years from *Fashi* 1352.

During the last war similar concessions were granted by the railway authorities for the cultivation of food crops on railway lands and they were readily availed of by the railway employees, particularly pointsmen, porters and gang coolies. I am sure that these and other classes of employees on the above railways would come in large numbers to take up cultivation of food crops on railway lands.

Cultivation of tank beds. Tank beds were not ordinarily allowed for cultivation under normal conditions as tanks are primarily meant for storing water for irrigating crops in other lands, except to grow vegetables and dry grains as catch crops in unfavourable seasons when tanks were not required for storing water and that too on payment of the highest dry rate of the village. Government have now ordered that for the duration of the war, cultivation of tank beds may be permitted in all seasons, *free of charge*, when the tank is not required for storing water subject to the following conditions;—

- i. Preference will be given to applicants in the following order :—
 - a) to *ayacutdars* who wish to grow vegetables;
 - b) to *ayacutdars* who wish to grow dry food crops;
 - c) to *non-ayacutdars* who wish to grow vegetables; and
 - d) to *non-ayacutdars* who wish to grow dry food grains subject to this, equal extents will be given as far as possible.
- ii. Crops should be completely removed before the tank is required for storing water.

In the case of tanks under the control of the P. W. D, that department should be consulted before permitting cultivation of tank beds

Backyard Cultivation. In most of the districts every home whether big or small has a plot of land attached behind each house, commonly known as 'backyards'. The aggregate area occupied by such backyards should be fairly large. The backyards are naturally very fertile pieces of land through the accumulation and decay of all kinds of habitation wastes for years and are not cultivated to any great extent except perhaps to grow a patch of greens or other vegetables in certain parts of the year to meet the domestic needs of the household. If full use of such backyards are made for growing some food crop or other at all times of the year with the help of rains during the monsoons or with the help of water from the household well at other times, I am certain that a large part of the nation's requirements of fresh vegetables would be easily met. I should like to point out here a glaring defect in our national diet despite the claim we often make that we are mainly a vegetarian nation—we grow only 7 lakhs of acres under vegetables and fruits in this province out of a total of nearly 280 lakhs of acres devoted to food crops of all kinds whereas out of every 100 lakhs of acres grown to food crops in the U. S. A considered a meat eating nation, nearly 25 lakhs of acres are devoted to vegetables and fruits. So even under peace time conditions we are consuming far less vegetables than is necessary for the normal maintenance of our health. And it is in cultivating vegetables of all kinds that every house holder in this presidency could join in the effort of the nation in the "Food Production" campaign. To stimulate such an enterprise, the Government have been pleased to permit the cultivation of such backyards with dry food grains or vegetables up to an extent of 25 cents in each case free of charge and no charge will be made for cultivation in excess of this limit also provided that the excess area is cultivated with food crops or vegetables. I hope every one in this country would avail of this concession and begin to dig up his backyard from now on and grow food crops of all kinds including, of course, vegetables.

Government have also permitted the revenue-free cultivation of vegetables and other food crops in lands including the compounds of churches, schools, hospitals, etc. and held free of land revenue, for the duration of the war.

B. *Takkavi Loans.* It is estimated that nearly 6½ million acres of *ryotwari* holdings and a similar extent in *Zamindari* areas are left uncultivated each year, mainly it is believed, through lack of capital to carry on cultivation. Government have been pleased to provide a sum of 20 lakhs of Rupees for granting *Takkavi* loans to bring such neglected land into cultivation without prejudice to the cultivation of other lands. The loans will be granted to reliable cultivators at the rate of Rs. 10 per acre of wetland and Rs. 5 per acre of dry land which was left uncultivated during *Fashi* 1351 and is likely to remain so during *Fashi* 1352 unless a loan is given. The loans will be granted by the Revenue Inspectors on the personal security of the borrower and surety (if any) up to five times the assessment or rent payable by them which will be payable in two annual instalments commencing not earlier than the harvest following the loan. Registered holders of *ryotwari* land, *ryots* in estates with occupancy rights and tenants in the Malabar district with valuable and transferable rights are eligible for these loans.

Government have also raised the limit for loans under *Takkavi* loan system. Though under *Takkavi* loan rules, loans could be granted up to 65% of the value of the property (after deducting encumbrances, if any) the limit has been restricted through executive instructions to 60% of the value in the case of unencumbered property and 50% of the net value in the case of encumbered

property. Government have now decided to raise these limits to 75% for unencumbered property except for loans under the Agriculturists' Loans Act, for which 60% and 50% will continue.

Government have also been pleased to empower District Agricultural Officers to grant loans up to Rs. 25 in each case for the purchase of manures and improved seeds. The loans could be granted to registered holders of *ryotwari* land, *ryots* possessing occupancy rights in estates and tenants in the Malabar District possessing valuable and transferable rights in their holdings, the loan being repayable in two annual instalments the first being not earlier than the harvest following the grant of the loan.

Government are also prepared to consider the grant of loans on the security of the estates for the purpose of repair and improvement of irrigation works provided the estates are clearly solvent and particularly in those cases where the estates are likely to continue under the Courts of Wards for some time.

I am glad to be able to inform you that the District Agricultural Officers in many districts have already started giving such loans in large numbers. Cultivators owning 4 to 5 acres, who, of course, form the major group among the land owning classes in this country, could buy enough manure for adequately manuring and enough improved seeds to sow their entire holdings with the help of such loans. I am sure that as years go on, these small loans for productive purposes would become a general feature of rural agricultural credit and would serve to raise the average acre yield of crops from the low level it has touched now.

C. Concessions for Special Areas. i. Cauvery Mettur Project area in Tanjore and Trichinopoly Districts—Assignment of lands not in compact blocks. Government have been pleased to order that 5% of the land not in compact blocks be reserved for assignment to the communities eligible for help by the Labour Department and that it should be open to members of these communities to take temporary grants of such reserved lands. The rest of the land not in compact blocks has been ordered to be assigned or sold for market value. In case no one wishes to buy such land or if there are no reasonable offers, it may be granted temporarily for cultivators under the conditions applicable to land in compact blocks. These conditions are given below:—

The ban on assignment of land in compact blocks will continue but such land may be granted temporarily for cultivation on the following conditions:—

- (a) lands which are fit for wet cultivation should be granted for paddy cultivation ;
- (b) preference should be given to the landless poor ;
- (c) the grant will not confer any *sivaijama* right or right to compensation ;
- (d) temporary grants for paddy cultivation will be for five years ;
- (e) lands not yet fit for wet cultivation should be granted temporarily for one year at a time ; and
- (f) no premium will be levied for these grants but they will be subject to the usual assessment and water rate.

Another concession granted by Government in the Tanjore District is the removal of the minimum of Rs. 5 charged as water rate for second crop paddy grown on single crop lands and substituting the levee at half the single crop assessment. This concession will take effect from *Fush* 1352 and will continue for the duration of the War and apply to the following taluks and areas*. This concession has been granted to extend the area under *Kuruvai* on single crop lands and their conversion thereby into double crop areas as a sure means of increasing the output of rice in that district. Through this concession and

by advancing the irrigation season in that district by about three weeks, it is confidently expected that many thousands of single crop *Samba* lands would have been converted into double crop areas in the current *fashi*. Besides the above concession Government have appointed 6 special Revenue Inspectors and 6 Agricultural Demonstrators to disturb loans to cultivators in the Cauvery Mettur Project area to bring under immediate cultivation lands left uncultivated for want of funds and also waste lands to be newly brought under cultivation.

* Pattukottai Taluk.
Negapatam Taluk.
Tiruturaipundi Taluk.
Shiyali Taluk.
Mayavaram Taluk.

Arantangi Taluk.
Areas outside the double crop zones already fixed in August 1934 in the taluks of Mannargudi and Nannilam.

From the catalogue of the many concessions granted, and other measures taken by the Government, you could easily realize that every encouragement is being given to the cultivators for increasing the production of food grains and vegetables in this province to build up a strong National Food Front, in the grave crisis we, with the rest of the world, are just now passing. My only request to you is to make the fullest use of the various facilities and concessions now granted and do your utmost in building up an unassailable 'National Food Front' as a chief bulwark of the National War Front. Thank you all and good luck to every one of you. (From the Director of Agriculture, Madras.)

Food Production in Madras.*

Considering the fact that agriculture is the chief occupation of the people of the Madras Province, one is apt to think that we must be self-sufficient in the matter of food production. But we are not, the reason being that while the population went on increasing year after year, the area under wet and dry crops remained without corresponding increase. Further a large number of cultivators who formerly depended on home grown dry grains like *cholam*, *cumbu*, etc., for their domestic consumption have now developed taste and sentimental preference to rice, by extending the cultivation of commercial crops like groundnut and tobacco in their own lands. Groundnut, for instance, was a minor crop some 30 years ago occupying only poor lands but since then it has steadily extended to such dimensions as it covered three years ago nearly 45 lakhs of acres of all kinds of lands at the expense of mainly food crops. The net result was that the food grains produced in our province became insufficient for our needs and we were obliged to supplement our production of these crops by importing every year large quantities of rice from foreign countries like Burma, Siam, etc., to make up deficit.

The position has now changed very considerably. Our imports of rice from Burma and other countries have been completely cut off from the time Japan entered the war last year. Ceylon, Travancore, and Cochin, which depended even to a larger extent than ourselves on foreign imports of rice have also been deprived of their supplies and are now looking to us for help. We are thus required to grow more food crops not only to make up our loss of imports but also to meet the partial requirements of our neighbours. The present war is being fought on many fronts, including against food supplies and our production of food grains has, therefore, to be so planned as in the event of any dislocation of traffic there should be no shortage anywhere of food supply to meet the demand of all our civil population and also the military requirements.

* This note was delivered as a talk in Telugu at the All-India Radio Station, Madras, on the 25th August 1942,

All this would show that it is not enough if we look to the needs of our province alone. What is required to meet the situation created by the war is to plan the production of food crops in such a way as we should be able to meet not only our own requirements, but also to help as much as we can, Ceylon and our neighbouring provinces and States which form a regional unit along with Madras. In other words, we are called upon to meet the partial requirements of Ceylon, Cochin, Travancore, Mysore, Hyderabad and Bombay, which even in normal times depended to some extent on rice produced in our province and which are now in greater need of our rice and other food grains due to the loss of their imports of Burma rice. It is now for the cultivators to realize the food situation created by the war and put forth their best efforts to produce more food grain of all kinds. The quantity which they are required to produce is about 20% more than that was produced in peace time. One-half of this extra production is required for our internal consumption and the rest for our neighbours.

Now the point for consideration is whether it is possible that we could produce this extra yield of rice and other food grains. It is, by no means, an impossible task provided the seasonal conditions are not adverse and the cultivators take the full advantage of the facilities offered to them by Government for growing more food crops. The prices of all food grains have increased considerably and are not likely to fall below the present level for the duration of the war and two or three years thereafter. Government are also prepared to provide as far as possible facilities for the transport of food grains, to prevent their accumulation in any particular places.

On the other hand, the position of commercial crops like groundnut, cotton and tobacco, is rather uncertain for want of external markets and also for want of reasonable certainty of obtaining waggons for their transport. There is thus every possibility of the prices of these crops falling down while the position of food grains is safeguarded as much as possible. The cultivators are not altogether unaware of these facts and the response which they have so far given in the matter of food production is encouraging.

Production of food crops can be increased to a good extent by bringing new lands under cultivation, by increasing the area under food crops at a slight sacrifice of other crops and by adopting intensive methods of cultivation.

For increasing the area under food crops, Government have recently granted a number of concessions and are also prepared to provide water, wherever possible, for the conversion of single crop paddy lands into double crop lands as they have already done in the Tanjore District. The more important way of increasing food production is to curtail the area under commercial crops by about 15% and utilize the area thus released for the cultivation of food crops. This entails no hardship on the cultivators. Every attempt is being made to induce the cultivators to take the fullest advantage of the concessions and to reduce the area under commercial crops.

Intensive methods of cultivation are possible only in the case of irrigated crops like paddy and by these methods it is quite possible to increase the yield up to 15%. The intensive methods include better cultivation, higher yielding seed, reduction in seed rate, economic transplanting of seedlings and liberal application of manure. Propaganda is being carried on for the adoption of all these methods on a wide scale. Government have recently sanctioned four schemes for the multiplication and distribution of pure paddy seed on an extensive scale, one in the Cauvery delta, one in the Godavari delta, one in the Kistna delta and another in the South Arcot District and the four schemes are expected to supply enough seed for 10½ lakhs of acres. Government have also set apart a

large sum of money for the purchase and distribution of oil cake to be used as manure. In addition, the officers of the Agricultural Department have been empowered to issue *Takkavi* loans up to a maximum limit of Rs. 25 for the purchase of seed and manure and an equal amount for the purchase of implements to each deserving cultivator in addition to similar loans granted by the Revenue Department. Cultivators are taking advantage of this concession. They are also being encouraged to grow green manure crops more extensively and are being supplied with as large quantities of green manure seed as possible. Green manure is the most valuable manure for the paddy crop and few cultivators are ignorant of its importance.

Thus the cultivators are given a number of facilities for the increase of production besides the most important concession of providing transport for food grains from centres of production to places where they are required for consumption. These facilities should serve the cultivators as sufficient inducement to grow more food crops even in their own interest if not with any higher motive.

It is also the duty of consumers to see that there is no wastage in the consumption of food grains. It is well known that polished rice is not only low in nutritive matter but loses certain amount of weight by the removal of bran or the outer coat of the rice grain, which is the most nutritive part. If rice is hand-pounded instead of being mill-polished, it not only retains a large part of the nutritive matter but also results in the economy of its use by 5 to 6%

There is also a shortage of pulses in our province almost equal to our production, but there is no particular reason why this shortage should continue. It is quite possible that a large part of the present deficit can easily be met by growing redgram and greengram in particular as mixtures with other crops. Pulses can also be grown in the midst of tree crops.

Finally, we also require more vegetables, both from the point of view of health and the increased demand for food. As garden crops vegetables will give very high yields by intensive cultivation. Due to such causes as supplies to the troops and for dehydrating, the demand for vegetables has increased of late, and it is profitable to grow both English and Indian vegetables in suitable areas, both from the point of view of the cultivator and in the interest of national health. (*From the Director of Agriculture, Madras.*)

Circular.

Economic condition—Production of coconuts and copra—measures to increase.
It has been estimated that India has been importing on an average about twenty per cent of her total requirements of coconuts, copra and oil from Ceylon and Straits Settlements during the past several years. But the war conditions prevailing at present have necessitated the stoppage of these imports making it imperative on our part to increase internal production so that we may meet the Indian demand fully.

Although valuable information has been made available to the *ryots* by this Department for increasing the production of coconuts, yet the severe fall in prices of coconuts and coconut products prevented the cultivator from incurring any expenditure on his gardens, which resulted in their neglect. The prices have now shown marked improvement and are likely to be maintained at an economic level as imports from Ceylon which used to compete with the Indian produce have been stopped. It therefore appears advantageous to the coconut grower to increase his production.

The District Officers are requested to bestow more attention to this crop. Propaganda may be directed to focus *ryots'* attention to the following practices which would increase production considerably.

Cultivation. Bunding coconut gardens into suitable plots, and cultivating them regularly to keep down weeds, increase the yield even over 100 per cent and reduce the unfavourable effects resulting from adverse seasons. One round of ploughing with iron plough or digging with mammutties at the commencement of the monsoon rains, a second ploughing or digging after the cessation of rains and a third during the summer months preferably with a cultivator are very helpful for the increase of yield.

Manuring. The following scheme of manuring has been found to be the best for increasing production:—

(a) Growing a green manure crop of cowpea, *daincha*, sunnhemp or *kolingi* and ploughing it in.

(b) Application of 20 lb. of well preserved ash per tree per annum.

(c) Application of 3 lb. of Ammonium sulphate per tree per annum. Since Ammonium sulphate has become very costly and difficult to obtain, about 10 lb. of oilcake such as groundnut, castor or *pungam* may be applied.

Application of cattle manure or burying green leaves or coconut husks in trenches also enhance yields.

Irrigation. Wherever facilities exist, irrigation of the garden during the summer months may be done.

Harvest. The practice of harvesting coconuts when they are not fully mature should be discouraged. It has been found that immature nuts get spoilt on storage and give less quantity of copra and oil than a mature nut, the percentage of reduction being 6, 16 and 33 respectively for nuts harvested one, two or three months prior to full maturity.

Pests. Rhinoceros beetle and the black-headed caterpillar (*Nephantis serinopa*) have been known to do considerable damage to coconut trees and reduce their yields. Regular search and destruction of these pests will enhance yields.

More detailed information on all aspects of coconut cultivation is given in Pamphlet No. 8. (From the Director of Agriculture, Madras.)

Correspondence.

Letter of Sri. M. A. Balakrishna Ayyar, L. Ag., District Agricultural Officer, Vellore:—

I am enclosing herewith a letter written by Rao Bahadur A. Vedachala Aiyar, Retired Registrar of Co-operative Societies. He had settled in his village of Anakavur, Cheyyar Taluk, North Arcot District, and if only we have such gentlemen in villages to guide the *ryots*, I am sure the economic position of the *ryots* would be better than, what they are now. There is an *ayacut* of nearly 1600 acres of wet land in the village and in the course of 7 or 8 years the whole *ayacut* in the village is covered with the improved strains in addition to the other improvements mentioned in the letter. On a modest estimate the village as a whole gets about Rs 4000 of extra income as a result of this gentleman settling in his village after retirement.

Letter of Sri. A. Vedachala Aiyar:—

"I occupied the position in 1920 at retirement of Registrar of Co-operative Societies. The Revenue Department secured my service in various capacities for 25 years and the Co-operative Department for 10 years. The two services kept me in close touch with the agriculturists in the main and created in me an

ardent desire to take up agricultural industry as a special hobby after retirement. I settled in the village of Anakavur, (my native place) Cheyyar Taluk, North Arcot District, and planned for carrying on agriculture in a scientific manner, observing whatever was usefully practised by the *ryots* for a large number of years and the advice of the Agricultural Department from its own experiments, practical and scientific. I have been breathing the atmosphere of agriculturists and lived their life in sympathy and close contact with the rich and poor agriculturists. I was able to do something in the directions noted below with the kind hearted assistance of the Agricultural Officers and the co-operative spirit of my brother agriculturists.

The introduction of new and improved varieties of paddy as advised by the Department (G. E. B. 24, Co.2, Co.3 and B. K. 10905) in my wet lands and my stocking of such seeds grown in my lands with care and drying have led my brother agriculturists to taking up to cultivation of the new varieties. The *Chinna samba* paddy (old kind) in the village has been replaced entirely by Co 2, Co.3 and G. E. B. 24. Where there is water supply to raise seedlings, B. K. 10905 is a new variety just experimented only last year. Single planting is being practised in all cases of transplantation.

I have introduced iron ploughs, and people are convinced of the efficiency of deep ploughing, but have not been able to go in for them because of the initial cost of purchase and of the inferiority of cattle employed by poor agriculturists. One or two moneyed men have gone in for the iron plough. But for the fact that the local co-operative society is dying its natural death for the last 8 years without any hope of renewal I would have desired to keep iron ploughs in stock to be let out for hire by the local society. The Agricultural Department might advisedly keep the improved implements in stock in the village under the supervision and custody of any well meaning *ryot* or village head-man and let them out for hire. The system if worked for five years will induce the *ryots* to go in for deep ploughing and at the proper season.

I have in my wet lands four wells sunk by me and one sunk by the tenant. Since my adventure in wells, three more wells have been sunk in wet lands. The disinclination of the *ryots* to sink wells in wet lands is slowly giving way as such wells are useful for growing nurseries with paddy seed sufficiently in advance of the supply of channel water to the tank.

Collection of manure in cattle sheds has been done in a scientific manner. The *ryots* are taking to this system in very large numbers. They have learnt the value of cattle manure so much so that practically no first crop is grown in the village without application of such manure.

Green manures such as indigo and *daincha* have been applied by me by growing them in my own lands and the *ryots* have seen the value of such manure culminating in the better outturn of crop in quantity and quality. The *ryots* have appreciated this and are in the run for seeds which the Department is unable now to cope up with.

The most neglected item in agricultural industry is *insufficient drainage* as a result of which valuable crops such as sugarcane, betel and turmeric cannot be cultivated. More than 200 acres of wet lands have become saline and all my efforts to seek the aid of Revenue, Agricultural and Irrigation (D. P. W.) Departments have met with very little success. So far as my lands are concerned I am doing my bit to secure drainage. The wet lands suffer more from flooding than from insufficient supply. My own personal belief is that if drainage is properly arranged for, the food production will get increased by 33 per cent.

The Revenue Department will not do anything connected with works in charge of the Department of Public Works nor does it do anything for the

works under its charge because it hardly appreciates the benefits of drainage system for profitable cropping. The D. P. W. would not stir an inch beyond its sluices, anicuts and tanks or will it take up any question besides supply. The Agricultural Department feels impotent to do any thing for want of financial resources and men. I have been agitating about this during the last seven years and will do so till something is done. The question can be successfully solved if the ryots are made to feel the value of drainage.

I am using pig manure, castor cake and groundnut cake. The supply of such cakes by the Agricultural Department from depots established in important villages will be the only method by which such manures can be used profitably by the ryots, rich and poor, either on cash or credit basis. I hope this system will get a hearty trial by the Department."

"The salvation of the agricultural industry lies in the self-helping spirit of the agriculturists, and the Agricultural and Cooperative Departments working their way only through local village organisations worked by the people and for their benefit.

(Sd.) A. Vedachalam.

Derris elliptica Benth. In the "Hindu" of 9th August 1942, under "Science Snippets" and under "Selected Articles" in the April 1942 issue of the Madras Agricultural Journal, in the article "The Search for Economic Plants" importance is given to *Derris elliptica* Benth. as a source of Rotenone, an insecticide, and advocates its acclimatization and cultivation in this country as the Malayan supply is not available now. During a tour by the writer in the Travancore State in December 1941 a plant of *Derris elliptica* Benth. was seen by him being successfully grown at Aymanam near Kottayam by Mr. Kurian John, a leading planter of that place. He got it from Malaya and he told the writer that he would spare some planting material for a trial in other suitable places. It will thrive in the West Coast Districts of this Province.

Agricultural Research Institute. }
Lawley Road, Coimbatore. }

(Sd.) K. Cherian Jacob.

Crop and Trade Reports.

Statistics—Crop—Groundnut—1942—Second report. *Summer crop—Area and yield.* The area under the summer or irrigated crop of groundnut in parts of the Madras Province during the five months January to May 1942, is estimated at 39,700 acres as against 65,300 acres estimated for the corresponding period of last year, representing a decrease of 39.2 per cent. The decrease is due to (i) want of timely sowing rains, (ii) propaganda conducted to reduce the area under groundnut cultivation in the last season and (iii) the low price of groundnut at the time of sowing. The crop suffered from drought to some extent in Chingleput. The harvest of the crop is in progress. The yield per acre is expected to be normal in all districts except Chingleput. The total yield is estimated at 35,100 tons of unshelled nuts as against 50,600 tons estimated for the corresponding period of last year, representing a decrease of 30.6 per cent.

Early crop—Area and yield. The area under the early crop of groundnut (mostly unirrigated) upto 25th July 1942 in the districts of Salem and Coimbatore is estimated at 141,000 acres. When compared with the area of 105,000 acres estimated for the corresponding period of last year, it reveals an increase of 34.3 per cent owing to favourable seasonal conditions. The yield per acre is expected to be normal in both the districts. The yield in these two districts is estimated at 70,300 tons of unshelled nuts as against 52,500 tons estimated for the correspond-

ing period of last year, representing the same increase as in the case of acreage namely, 34.3 per cent.

The wholesale price of groundnut (Machine shelled) per imperial maund of 82½ lb (equivalent to 3,200 tolas) as reported from important market centres on 10th August 1942 was Rs. 7-12-0 in Vizianagaram, Cuddapah and Vellore, Rs. 7-11-0 in Adoni, Rs. 7-8-0 in Vizagapatam and Guntakal, Rs. 7-7-0 in Guntur and Cuddalore, Rs. 7-5-0 in Nandyal, Rs. 7-0-0 in Salem and Rs. 6-12-0 in Bellary. When compared with the prices published in last report, i. e., those which prevailed on 14th April 1942 these prices reveal a rise of approximately 75% in Cuddapah, 68% in Vellore, 63% in Vizianagaram, 62% in Adoni, 61% in Cuddalore, 56% in Nandyal, 53% in Guntur, 45% in Bellary and 42% in Salem.

Statistics—Crop—Sugar-cane—1942—Intermediate condition report. The condition of the sugar-cane crop is satisfactory in all the districts outside East Godavari and parts of South Arcot where the crop suffered from drought to some extent. The recent rains have, however, improved the condition of the crop in some degree in the South Arcot district. The yield per acre can be expected to be normal in the other districts of the Province if the season continues to be favourable.

The wholesale price of jaggery per imperial maund of 82½ lb. (equivalent to 3,200 tolas) as reported from important markets on 7th September 1942 was Rs. 14-6-0 in Vellore, Rs. 14-0-0 in Cuddalore, Rs. 13-11-0 in Chittoor, Rs. 12-14-0 in Mangalore, Rs. 11-3-0 in Trichinopoly, Rs. 11-0-0 in Vizagapatam, Rs. 10-11-0 in Rajahmundry, Rs. 9-14-0 in Cocanada, Rs. 9-12-0 in Coimbatore, Rs. 8-4-0 in Vizianagaram; Rs. 7-9-0 in Erode and Rs. 7-7-0 in Bellary. When compared with the prices published in the last report, (i. e.) those which prevailed on 11th August 1942, these prices reveal a rise of approximately 29 per cent in Vellore, 22 per cent in Cuddalore, 21 per cent in Chittoor, 11 per cent in Bellary, eight per cent in Rajahmundry, six per cent in Vizianagaram, Trichinopoly and Mangalore and three per cent in Cocanada and a fall of approximately 41 per cent in Erode and nine per cent in Coimbatore.

(Additional Joint Secretary, Revenue Department, Madras).

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1942 to 11th September 1942 amounted to 553,994 bales of 400 lb lint as against an estimate of 563,800 bales of the total crop of 1941-42. The receipts in the corresponding period of the previous year amounted to 548,137. 484,456 bales mainly of pressed cotton were received at spinning mills and 2,592 bales were exported by sea, while 80,597 bales were imported by sea mainly from Karachi and Bombay. (Director of Agriculture, Madras).

Moffusil News and Notes.

Agricultural Exhibition, Vriddhachalam. An agricultural exhibition on a small scale was held on the occasion of "Tiru-Adipuram" festival on the 14th and 15th August '42 at Vriddhachalam. Specimens of the Departmental improved strains and labour-saving implements together with important pictorial and word posters were exhibited. Models of different methods of manure preservation and live specimens of green manure crops were also put up. On both the days a large number of ryots visited the exhibition stall and they were explained the exhibits and posters, and advised to increase the area under food crops and vegetables.

T. G. M.

Estate News and Notes.

Students' Corner :—The College was closed for the Michaelmas holidays on the 17th September 1942.

Students' Club. Under the auspices of the club, Rt. Hon. V. S. Srinivasa Sastri, P. C., C. H., delivered a lecture on "Disillusionment", on the 31st August. Sri R. S. Sankara Ayyar, Retired District Judge, presided. Mr. Sastri referred to two of his disillusionments one in 1921 and the other after the Round Table Conference. Though thoroughly disillusioned he predicted a happy future for the world in general and India in particular. On the 10th September Mr. S. V. Ramamurthi, I. C. S. addressed the club on "From Mineral Power to Plant Power"; Mr. P. H. Rama Reddy, Director of Agriculture, Madras, presided. This address is published elsewhere in this issue.

Games. Cricket. Two matches were played with the Coimbatore Cricket Club, one on the 9th August and the other on 30th August, and our college won both the matches.

An inter-class match for the Victory Cup was played between the II year and the III year on 21-8-42 and the III year were the winners.

Hockey. A match was played against a Navy XI in our grounds on 10-8-42 and we won the match by 6 goals to nil.

Two matches for the Victory Cup were played, one between the I year and the II year on the 27th August, in which the I year won, and the other, the finals, between the I year and the III year on 3rd September, in which the III year won.

Foot Ball. Two matches were played against a Town team, one on 7th August and the other on 14th August; our college was defeated by 2 goals to nil in both the matches. Another match was played against G. D. Naidu's team on 22nd August in which our College won by 3 goals to 1.

Estate Scouts. Mr. V. Subrahmaniam, B. A., B. T., the Provincial Organising Commissioner, Madras, paid a visit to the Headquarters of the Ramakrishna Scout Group on 15th August 1942, and in his honour a rally was held, and it was attended on invitation by the Blue Mountain Scout Group of the British Evacuees Camp, Coimbatore. Both the Groups gave displays. In his address the Provincial Organising Commissioner paid a tribute to the smart turn out of the Estate Scouts and also their keen enthusiasm and discipline.

On 16th August the scouts and rovers of the Group numbering nearly 40 had a day's camp. Though unexpected rains slightly altered the programme of the camp, yet everybody enjoyed the outing thoroughly. The evening's camp-fire was run as an inter-patrol competition and provided some excellent entertainment.

Visitors. Sri P. H. Rama Reddy, Director of Agriculture, Madras camped at the College from the 7th to 14th September. Mr. S. V. Ramamurthi, I. C. S., Adviser to H. E. the Governor of Madras, visited the College and Research Institute on the 10th and 11th September 1942.

Departmental Notifications.

Gazetted Service.

Appointment and Postings.

Sri D. Marudaraja Pillai, Assistant in Mycology, is appointed to officiate as Government Mycologist *vice* Sri K. M. Thomas granted leave.

Sri T. Budhavidheya Rao Nayudu, Deputy Director of Agriculture, on return from leave, is posted as Deputy Director of Agriculture, Northern Division, Guntur.

Subordinate Service.

Promotions.

Agricultural Section.

Consequent on the retirement of Sri S. Narayana Ayya, on 12-8-40, Sri E. Kunhappa Nambiar to be permanent in I Grade, Mr K. M. Jacob to be permanent in II Grade and Sri T. G. Muthuswami Ayyar to be permanent in III Grade.

Consequent on the confirmation in the M. A. S. of Sri P. Subramanyam on 1-4-41, Sri K. Ramanuja Acharya to be permanent in I Grade, Sri V. N. Subanna Acharya to be permanent in II Grade and Sri M. Subramanya Pillai to be permanent in III Grade.

Consequent on the confirmation in the M. A. S. of Sri M. Viraraghava Naidu on 1-4-41, Sri M. P. Kunhikutty to be permanent in I Grade, Sri D. Panakala Rao to be permanent in II Grade and Sri A. Venkatarangam to be permanent in III Grade.

Consequent on the confirmation in the M. A. S. of Sri K. W. Chakrapani Marar on 1-4-41, Sri K. Govindan Nambiyar to be permanent in I Grade and Sri M. A. Balakrishna Ayyar to be permanent in II Grade.

Consequent on the confirmation in the M. A. S. of Sri A. Gopalan Nayar on 1-4-41, Sri S. Kuppuswamy Ayyangar to be permanent in II Grade.

Consequent on the confirmation in the M. A. S. of Sri K. Avudainayakam Pillai on 1-4-41, Sri K. K. Raghavan to be permanent in III Grade.

Consequent on the confirmation in the M. A. S. of Sri V. T. Subbayya Mudaliar on 1-4-41, Sri A. Chidambaram Pillai to be permanent in III Grade.

Consequent on the retirement of Sri V. Ratnaji Rao on 3-9-41, Sri M. P. Gourisanisankara Ayyar to be permanent in II Grade.

Science Section.

Consequent on the appointment of Dr. S. Ramanujam, Second Economic Botanist, Imperial Agricultural Research Institute, on 1-9-40, Sri T. Rajagopala Ayyangar to be permanent in IV Grade.

Consequent on the confirmation in the M. A. S. of Dr. J. A. Muliyl on 11-3-41, Sri D. Marudaraja Pillai to be permanent in I Grade, Sri C. Krishnan Nayar to be permanent in II Grade, Sri C. Vijayaraghava Acharya to be permanent in III Grade and Dr. R. Kochukrishna Pillai to be permanent in IV Grade.

Consequent on the confirmation in the M. A. S. of Mr. Jobitharaj, on 1-4-41, Sri K. Govindan Nayar to be permanent in II Grade and Mr. C. M. John to be permanent in III Grade.

Consequent on the confirmation in the M. A. S. of Sri P. N. Krishna Ayyar on 22-2-42, Sri S. Dharmalinga Mudaliar to be permanent in I Grade, Sri T. S. Ramakrishna Ayyar to be permanent in II Grade and Sri P. Krishna Rao to be permanent in III Grade.

Consequent on the confirmation of Sri S. N. Chandrasekhara Ayyar, in the M. A. S. the following promotions are ordered with effect from 15th July '42.

Sri C. Krishnan Nayar to be permanent in I grade.

Sri P. Vishnu Somayajulu to be permanent in II Grade.

Sri V. K. Subramania Mudaliar to be permanent in III Grade.

Sri P. K. Parameswara Menon, A. D., Palghat, to be permanent Assistant in Botany in IV Grade, but to continue to officiate as Agricultural Demonstrator in the Agricultural Section.

Consequent on the confirmation of Sri C. Krishna Nayar as Assistant in I Grade with effect from 15th July 1942, the following provisionally substantive appointments are ordered in place of Dr. S. Kasinatha Ayyar, Assistant in Chemistry seconded:—

Sri K. Govindan Nayar to be provisionally substantive in I Grade.

Sri T. K. Balaji Rao to be provisionally substantive in II Grade.

Sri M. Suryanarayana, to be provisionally substantive in III Grade.

Dr. R. Sankara Ayyar Assistant in Cotton provisionally substantive in IV Grade to continue to be provisionally substantive in IV Grade.

Consequent on the reduction of 9 posts in IV Grade in the Agricultural Section ordered in G. O No 628 Ms. Development dated 27-3-41, the following appointments and reversions are ordered:—

Sri T. K. Thangavelu, provisionally substantive in II Grade (new) to be permanent in II Grade (new) from 1-4-41 *vice* Sri M. A. Balakrishna Ayyar promoted.

Sri D. Bapayya, provisionally substantive in IV Grade to be permanent in IV Grade *vice* Sri C. M. John promoted from 1-4-41.

Sri K. Sivasankara Menon, provisionally substantive in IV Grade to be permanent in IV Grade *vice* Sri P. Krishna Rao promoted from 22-2-42.

To revert from IV Grade provisionally substantive to V Grade permanent from 1-4-41.

Sri P. K. Parameswara Menon, A. D., Palghat.

Sri A. Rammohan Rao, A. D., Yellawaram.

Sri S. V. Ramachandra Ayyar, A. D., Tenkasi.

Confirmations.

The following approved probationers in III Grade (new) are confirmed as full members of the service:—

<i>Name.</i>	<i>Date of confirmation.</i>
Sri B. Suryanarayana Rao	10-4-40
.. B. L. Narasimhamurthi	1-9-40
.. K. Saptarishi	29-11-40
.. G. Konda Reddi	13-3-41
.. K. C. Thomas	1-1-41
.. P. Somayajulu	1-1-41
.. A. Kondayya Sarmā	vacancy reserved for agency.
.. V. Venkatadri Reddi	1-1-41
.. B. W. X. Ponnayya	1-4-41
.. K. Reghunatha Reddi	1-4-41
.. K. Bhushanam	1-9-41
.. T. Venkataramana Reddi	Do.
.. F. L. Daniel	Do.
.. N. H. V. Krishnamurthi	Do.
.. P. N. Muthuswami	Do.
Muhammad Basheer Sahib	Do.
Sri T. Devasikhamani	Do.
.. Ch. Venkatchallam	Do.
.. M. Bhavani Sankara Rao	Do.
.. R. Guruswami Nayudu	18-3-42
.. P. Gopalakrishnan	1-3-42

Transfers.

Name of officers	From	To
Sri N. Venkayya,	F. M. D. F. S., Bellary.	F. M. A. R. S., Siruguppa.
„ D. Srinivasa Rao,	A. D., Narasaraopet,	F. M. A. R. S., Guntur.
„ T. Paramanandam,	F. M. A. R. S., Guntur,	A. D., Narasaraopet.
„ M. Bhavani Shanker Rao,	Asst. A. R. S., Tindivanam,	Asst. in Oil Seeds, Coimbatore.
„ A. Shanmuga Sundaram,	F. M. A. R. S., Pattukottai,	A. D., Dindigul
„ J. S. C. Anthony,	A. D., Dindigul,	F. M. A. R. S., Pattukottai.
„ U. Narasinga Rao,	Asst. in Oil Seeds, Coimbatore,	Asst. F. R. S., Kodur.
Mr. A. Mohamed Ali,	Asst. F. R. S., Kodur,	A. D., Krishnagiri.
Sri T. Gopaln Nair,	Asst. in Fruits Nursery Scheme, Taliparamba,	Asst. Pomological Station, Coonoor.
„ N. S. Rajagopalan,	Asst. Pomological Station, Coonoor,	Asst. in Fruits, Nursery Scheme, Taliparamba.
„ R. Venkatarama Ayyar,	A. D., Krishnagiri,	A. D., Chengam.
„ K. Narayanan Nair,	A. D., Namakkal,	A. D., Trichengode.
„ N. Narayana Ayyar,	A. D., Trichengode,	A. D., Arkonam.
„ V. Ramaswamy Mudaliar,	Asst. Botanist, Pemppheres Scheme,	Asst. Cocanada Scheme, Narasaraopet.

Leave.

Name of officers	Period of leave.
Sri G. Ganapathi Iyer, Asst. in Chemistry, Coimbatore,	Extension of l. a. p. on m. c. for 4 months from 2-9-42.
„ D. Panakala Rao, A. D. Tadepalligudam,	Extension of l. a. p. on m. c. for 2 months from 11-8-42.
„ M. Subramanya Chetty, Cotton Asst., Cocanada Scheme,	L. a. p. for 30 days from 4-9-42.
„ S. Suryanarayana, A. D. Kirlampudi,	L. a. p. for 2 months from the date of relief.
„ M. Ramamurthy, A. D. Peddapur,	L. a. p. for 2 months from 21-9-42.
„ F. L. Daniel, Asst. in Soil Physics, D. F. S. Bellary,	Earned leave for 60 days from 17-9-42.
„ E. Achuthan Nair, A. D. Harur.	L. a. p. for 1 month from 15-9-42.
„ L. Neelakanta Ayyar, Cotton Asst., A. R. S. Koilpatti,	Extension of l. a. p. up to 18-9-42.
„ A. Maziakolandai, Asst. in Chemistry, Coimbatore,	Extension of l. a. p. for 30 days from 26-8-42.
„ M. A. Sankara Ayyar, Asst. in Millets, Coimbatore,	L. a. p. for 2 months from 1-9-42.
„ N. Annaswami, A. D. Giddalore,	Extension of l. a. p. for 1 month from 20-8-42.
„ M. K. Padmanabhan, Asst. A. R. S. Aduthurai,	L. a. p. for 1 month from 31-8-42.
„ R. Subramania Ayyar, A. D. Arantangi,	L. a. p. for 1 month from 7-8-42.
„ K. Balaji Rao, A. D. Siruguppa,	Extension of l. a. p. on m. c. for 1 month from 11-8-42.
„ K. Tejappa Shetty, A. D. Kalyandrug,	Earned leave for 33 days from 29-8-42.