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EDITORIAL

Cholam—The Malting grain—Par—excellence. Malted foods are prescribed for the nutrition of infants and invalids of weak digestive powers, because, during the process of manufacture, these foods have been predigested by the enzymes they contain. The malt of commerce is obtained from the barley grain which is not grown in South India. Madras imports malted foods to a value of Rs. 18,00,000 annually. While it is not claimed that a completely soluble food of the type of Horlicks or Mellins food can be made in every home, the possibility of introducing cheap malt from South Indian cereals as a supplement in the diet of children and convalescing patients has been suggested by Dr. Aykroyd in his Health Bulletin No. 23. Such a need has been met by *cholam* which is an excellent grain for malting. Since 1917 the malting of this grain has been under investigation by the Government Agricultural Chemist in collaboration with the Millets Specialist, the latter supplying the strains, and this received an impetus in 1935 when the Imperial Council of Agricultural Research financed a research scheme for this purpose for a period of three years. The results achieved so far have been very encouraging, with the clinical tests in twenty-seven Government and private hospitals pronouncing an opinion that *cholam* malt is a good substitute for imported malted foods, especially in the case of convalescent children and invalids and that it has produced astounding results. The Government have therefore been pleased to sanction the starting of a malt factory at the Agricultural College, Coimbatore. The stage has thus been reached when there is scope for development for this industry both on a cottage and a factory scale. The preparation of perfected malt foods might involve a long training and profound knowledge of chemistry and technology. But by following carefully the instructions contained in the Leaflet No. 4 of the Department of Agriculture, Madras, a fairly satisfactory malt can be easily made in our homes to provide a nutritious and sustaining *conjee* or gruel at a cheap rate.

In an article on the Economics of Nutrition contributed to the *Indian Journal of Social Work*, for December 1941, published in this number, Dr. Aykroyd has pointed out that ignorance as well as poverty operates strongly in extending the zone of malnutrition. Where poverty prevents the purchase of imported foods, some trouble taken over the preparation of *cholam* malt, more than pays itself. Further, to-day, due to war conditions there is restriction in imports of malted foods. Next to rice, *cholam* has the largest area, namely about five million acres in our province. This being so,

and our country being mainly agricultural, we venture to suggest that this industry is taken up on hand, be it on a small or a large scale. In the article by Dr. Aykroyd, already referred to he has observed "An impartial analysis of the economic aspects of the problem of nutrition in India may leave little ground for optimism. But it is surely true that if the resources of science are brought to bear on the problem, progress can be made, however formidable the obstacles of poverty and ignorance." Here is an opportunity for the poor as well as the rich. For *cholam* is accessible to one and all and science has done its part to show how best it could be utilised. The Government Agricultural Chemist, Madras, gives a special course in malting every year at the College of Agriculture, Coimbatore, for a fortnight, between the 1st and the 15th of September. It is hoped advantage will be taken of this, and ere long *cholam* malted food finds a place in every home, in place of the more costly imported foods.

Better Prospects for the Cotton grower. It is a matter of great relief for the cotton growers to know that the Government of India have decided to levy an extra duty of one anna per lb. on imported cotton. This has come in at an opportune moment when enormous amounts of textiles required for war purposes are being largely supplied by India's own mills and the offtake of medium and long staple cotton is considerable. The Government do not propose to retain the duty a moment longer than is necessary for carrying out the specific objects for which it is being collected. The proceeds of the extra duty are to be credited to a special fund to be kept separate from the general accounts of the Government, with the idea of helping the cotton grower who has to considerably extend his area under medium and long staple cotton. The Indian Central Cotton Committee has done notable work in this direction and good results have been achieved in Madras, Sind, the Punjab, Central Provinces, Gujarat and Dharwar. It is said that there is immense scope for the increase of the area under medium and long staple cotton in the first five of these places. The Government propose to consult the Indian Central Cotton Committee on the utilisation of the 'Cotton Fund' and it is earnestly hoped that this important body will do their best for the cotton grower. If the area under medium and long staple cotton is very much increased, it will mean a double achievement; there will be the simultaneous reduction of the dependence of the Indian cotton grower on foreign markets and that of the Indian mills on imported cotton as the bulk of Indian cotton is short stapled and has to be purchased by other countries, Japan having been till recently one of the main purchasers. The proper utilisation of the Cotton Fund should therefore discourage imports and encourage the growing of cotton which could adequately meet the needs of our mills.

In addition to the extra duty on imports, if the rebate on exports of cotton manufactures contemplated by the Government becomes a fact it is needless to point out, that there are better prospects for the cotton grower now and in the future.

Bananas of the Mysore State

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Status of the crop in the State. Banana is the name used in foreign countries for the Indian plantain (whether used as fruit or vegetable). The crop is not important commercially in the Mysore State even though there is considerable demand for the fruits, especially in the two principal cities of the State, Bangalore and Mysore. The demand for bananas is mostly met from supplies received from Salem and Trichinopoly Districts of the Madras Province. The main varieties imported into these cities are *Poovan, Rasthali, Vamanakeli* and *Monthan. Poovan, Vamanakeli* and *Monthan* are obtained mostly from Mohanur on the Cauvery bank in the Salem District and from Trichinopoly in the Trichinopoly District. *Rasthali* is got mostly from Thottiyam and Karur in the Trichinopoly District. The price of both fruit and vegetable varieties is comparatively high especially in the two cities, where the fruits of *Chakkarakeli, Rasthali, Vamanakeli, Chenkadali* and *Monthan* are in great demand.

Nature and extent of cultivation. The bananas in the Mysore State are mainly grown as an interplanted crop in areca and coconut topes. They afford shade to young coconut and areca plants in newly planted areas. These are also grown to some extent as a pure crop as at Hiriyur, Nanjangud and on the outskirts of coffee plantations in the *Malnad* Districts. The *ryots* appear to be ignorant of the proper methods of cultivation of this very important crop. It requires a good deal of water for its successful growth but at the same time it cannot stand water stagnation to any extent. The limiting factor for the extension of the cultivation of this crop where the rainfall is not very high is the availability of irrigation water practically throughout the year. It is, therefore, necessary to provide wells in addition to other irrigation sources, unless the latter is capable of supplying water for at least 10 months in the year.* "A note on the cultivation of bananas in the Madras Presidency" by the author gives the details of banana culture. There is considerable scope for the extension of the cultivation of bananas in Mysore State especially in the vicinities of towns and cities.

Varieties. The main varieties grown in these plantations are, *Kali, Boothi bale* and *Poovan. Rasthali* and *Poovan* are grown at Nanjangud and Hiriyur respectively. Apart from these four main varieties the following are found as stray plants in some of the banana gardens of the State:— *Ney poovan, Monthan, Chenkadali, Chakkarakeli, Vamanakeli, Sambrani monthan, Anaikomban, Vannan* and *Ela vazhai.* But *Sirumalai* and *Virupakshi,* the two very important commercial varieties of bananas that are intercropped with coffee and oranges in the Sirumalais and Lower Pulneys respectively of the Madura District in the Madras Province are absent here.

* The Madras Agricultural Journal, Vol. XXVII, No. 6, June 1939.

There is considerable scope for the introduction of these varieties into the *Malnad* where they would serve also as shade to coffee. The *Sirumalai* grown in the Sirumalai Hills between 2,500 and 3,000 feet elevation is in great demand in the Madras City. The fruits have very good taste and flavour. The *Virupakshi* (malapazham) is largely grown at Pannakkadu, Virupakshi and other ranges in the Lower Pulneys between 4,000 and 4,500 feet elevation. There is great demand for this fruit throughout Southern India. Apart from the good taste and rich flavour, these fruits by virtue of the dry nature of their pulp have very good keeping quality and can be kept up to three weeks after they have ripened. These fruits are largely used in the preparation of *panchamritham* in South Indian Hindu temples especially in the one at Palni. Morphologically these two varieties are one and the same and are only ecological types of *Vannan*, a variety commonly grown on the West Coast.

Cultivation of bananas as a pure crop is practised as already mentioned in two places in the State, viz., at Hiriyur in the Vanivilasa Sagar area in the Chitaldrug District and at Nanjangud.

Hiriyur. The *ryots* from Erode and other places in the Coimbatore District have emigrated to this place and are cultivating about 1,000 acres of bananas for the past 20 years according to the system of cultivation in vogue in their original homes. *Poovan* and *Monthan* are the main varieties under cultivation. The crop is kept from three to five years in the same area followed by rice crops for two to three years. The produce is exported to Hubli, Dharwar and other places in the Bombay Province. *Chakkarakeli, Vamanakeli, Rasthali, Chenkadali*, etc., can also be easily grown here.

Nanjangud. There are over 1,200 acres under bananas in this tract. The main variety is *Rastholi* locally known as *Rasa bale.* It is cultivated in rice lands in rotation with rice crop – three years banana and three years rice. Generally, elevated places are preferred for its cultivation. During the period of these three years only two crops are harvested. After the harvest of the first crop, all suckers, in most cases three to four, are allowed to grow up in each stool. No manuring is given. Drainage is often inadequate. The cultivation practised in this place is primitive; but the primitiveness of the method of cultivation adopted here is often a blessing in disguise, since the bunches that are produced in this manner will be free from "lumps" that are generally found in the pulp of *Rasthali* fruits grown under heavy manuring. Bananas will have the best taste and flavour when grown under natural conditions without resort to very heavy manuring, constant watering, desuckering, etc., but the size of the bunch and fruit will be small. The size of the majority of the bunches and individual fruits of Nanjangud *Rasa bale* brought for sale in the markets of the two cities is very small. This defect can easily be remedied without losing any of the good qualities of the fruit by adopting a judicious system of cultivation and manuring. The bunches and fruits of *Rasthali* grown in South Kanara and Malabar Districts are of medium size but without any lump in the pulp and

are floury in consistency when ripe. Under the present system of banana cultivation practised at Nanjangud the plants tend to become susceptible to the attack of diseases. The crop is attacked with a disease locally known as "Tharagumari". Unless a proper system of banana cultivation is adopted, the banana cultivation of this locality will cease to exist at no distant date.

Below is given a list of the varieties grown in the State with their local names (both in and outside the Mysore State), their diagnostic characters and the economics of their culture.

1. *Kali (Musa paradisiaca* Linn., var. *kali.). Pacha bale* at Bangalore market, Kyatsandra and Nagavalli; *Cheena bale* at Bangalore nursery; *Kai bale* at Nagavalli; *Kabbale* at Chikkanayakkanahalli; *Elakki bale* at Kowsika, Ambuga and Gundlupet. Outside the Mysore State this variety is known as *Kali* at Perintalmanna; *Padaththi* at Alwaye; *Mannan* at Manantoddy; *Padalu* at Kumaranallur near Pattambi; *Pakki, Padu vazhai, Kai vazhi, Vella padan* at Gudalur; *Vellai chingan* at Sankarankoil; *Pacha nadan* at Thisayanvilai; *Kuppa mannan* at Nileswar; *Chingan* at Vallioor; *Nattu mannan* at Tellicherry; *Vannan* at Kalpatta; *Mara bale* at Virarajendrapet; *Gali bale* at Mangalore; *Kattu bale, Janaka bale* at Udipi.

This variety can be considered as the true indigenous banana of the Madras Province. It is found almost wild in many parts of Coorg, South Kanara and Malabar Districts. It is a hardy variety. The pseudostems are about 16 feet high with a girth of about 34 inches at the base. The leaves are about 10 feet long and about 28 inches broad. The petiole is thick and about two feet long. The margins of the petiole are about three-quarter inch apart. The bunches are fairly heavy. Fruits are unequally five-sided with a distinct apex. The colour of the ripe fruit is yellow when grown in the plains and greenish yellow when grown in the hills. The fruit is of medium quality. Green fruits are used as vegetable.

2. *Boothi bale (Musa paradisiaca* Linn., var. *boothi bale). Boothi bale* is the local name for this variety throughout the State. Outside the State this goes by the following local names:--*Bonnya bale* at Moodbidri; *Bonha bale* and *Gobra bale* at Mangalore; *Onakkan mannan* at Nileshwar; *Venneettan* at Kurumathur near Taliparamba and *Boothi bale* at Puttur (South Kanara).

This variety is almost confined to South Kanara, Coorg and Mysore State. It is also a hardy variety. The pseudostems are 15—22 feet high and often taller than *Kali* with a girth of about 30 inches at the base. The leaves are about eight feet long and about 33 inches broad. The petiole is stout and 18—21 inches long. The margins of the petiole are about quarter inch apart. The bunches are of medium size. Fruits are rather short and unequally five-sided with a short but distinct apex. The colour of the ripe fruits is dull yellow due to the glaucous nature of the unripe

fruits. The ripe fruits are of poor quality. Unripe mature fruits are used in making a preparation called "banana nuts" (peeled bananas are split longitudinally into two and each portion cut into pieces of about an inch in length and fried in coconut oil. These fried pieces are thereafter coated with raw sugar by a special process). The ripe fruits are said to relieve bleeding piles.

3. *Poovan (Musa paradisiaca* Linn., var. *poovan). Bengali* at Bangalore market; *Cheena bale* in Bangalore; *Kari gaddi* at Channapatna; *Kari rasa bale* at Kyatsandra; *Kari bale* at Palhalli; *Othu rasa bale* at Nagavalli; *Kari puttu bale* at Jayachamarajapura; *Mysore bale* at Kowsika, Ambuga and Jodi Kyathanahalli; *Vilayithi bale* at Kowsika; *Huli bale, Nanjangud bale* at Ambuga. Outside the Mysore State this variety has the following local names :— *Mysore bale* at Moodbidri; *Mysore* at Mangalore; *Mysore poovan* at Nilambur and Nileshwar; *Mysore vazhai* at Calicut; *Paleyangodan* at Trichur Farm and Alwaye; *Mysori* at Kumaranallur; *Vasana chettu* at Gopalpur; *Ginni* at Piridi; *Karpura chakkarakeli* at Rajahmundry; *Poovan* at Erode and Trichinopoly; *Adukku namarai* at Pannakkadu; *Pulippu kai*; *Korangu vazhai* at Pollachi: *Chakkarakeli* at Velpur near Tanuku; *Karpura* at Peravalli near Tanuku; *Rasthali* at Challapalle; *Soan mowze* at Kurnool; *Sugantham* at Kalava near Kurnool; *Yerra sugantham* at Giddalore; *Sugandhi* at Rampuram near Tungabhadra; *Rasa bale, Salem* at Hospet; *Bengala* at Allipuram near Nellore; *Yerra aratti* at Godugumuru near Chittoor; *Poo vazhai* at Modikuppam near Chittoor; *Navarai* at Madurantakam; *Raja vazhai* at Gudiyattam; *Dora vazhai* at Kallar near Mettupalayam; *Kallaththu vazhai* at Mettupalayam; *Erode poovan* at Coimbatore; *Kadali* at Thangachimadam; *Pulichan kadali* at Thisayanvilai; *Cheru kai* at Alwaye; *Mysore kadali* at Ponnampet and *Nallanti, Karuppu vazhai* at Kelamangalam near Hosur.

Most of the local names of this variety are the names of places wherefrom the variety has been brought to a new place. This indicates that it might be an introduced variety. It is not more than 50—60 years since this variety is being grown in the Madras Province. It is identical with the "Fill basket" of the foreign countries. This is the most economic of the various varieties of bananas under cultivation in this Province. It is largely used as fruit and to a small extent as vegetable also. It yields heavily and is excellent for "fig" making. People of the Telugu area consider this variety superior even to *Rasthali*. Being the most economic variety it is very largely cultivated. The pseudostems are 10—17 feet high and 24—36 inches in girth at the base. The leaves are about seven feet long and about 30 inches broad. The petiole is stout and about 21 inches long. The margins of the petiole are about half an inch apart. The bunches are closely packed and very heavy. Fruits are terete with a distinct apex. The colour of the ripe fruit is yellow. The fruit is of good quality. This variety manifests differently when grown in different soils and climatic conditions. The leaves are largely used as plate leaves for serving food.

4. *Rasthali* (*Musa paradisiaca* Linn., var. *rasthali*). *Nanjangud rasa bale* in Bangalore ; *Rasa bale* at Channapatna, Nagavalli, Palhalli, Nanjangud, etc. ; *Raja bale* at Muniswamy's Nursery, Bangalore. Outside this State it is known as *Poo bale*, *Rasa bale*, *Hoo bale* at Moodbidri ; *Aana poovan* at Kurumathur ; *Poovan* at Calicut ; *Ari poovan* at Nilambur ; *Nattu poovan* at Ponnani ; *Desi Pallu* at Gopalpur (Ganjam); *Mokiri* at Piridi near Bobbili ; *Amritapani* at Palteru near Bobbili ; *Rasthali* at Erode ; *Thella mokiri* at Panchadharla near Yellamanchili ; *Sugandhi* at Tirupathi and *Karkandu vazhai* at Sendamaram.

This is the variety occupying the second largest area under any one variety in the Madras Province. It is largely used as fruit and occasionally in the preparation of "banana nuts". The pulp of the ripe fruit is floury and has excellent taste and flavour. It is one of the choicest varieties of this Province. The plants have a strong root system ; consequently, they are not easily blown down by wind. The pseudostems are about 10 feet high and about 33 inches in girth at the base. The leaves are about seven feet long and about 28 inches broad. The right side lamina base is one and a half to two inches shorter than the left. The petiole is stout and about 19 inches long. The margins of the petiole are about three-quarter inch apart. The bunches are loosely packed and medium heavy. Fruits are terete and taper to a distinct apex. The rind of the well ripe fruit is golden yellow sometimes with red tiny spots on it. When heavily manured a sort of lumps appear in the pulp of the ripe fruits. When grown under normal fertility, the fruits develop the best taste and flavour but the size of the fruit will naturally be small.

5 *Ney poovan* (*Musa paradisiaca* Linn., var. *ney poovan*). *Elakki bale*, *Sugantham* in Bangalore ; *Puttu bale* at Kyatsandra ; *Hoo bale* at Ambuga. Outside the Mysore State this variety is known as *Deva bale* at Moodbidri ; *Kadali* at Mangalore ; *Nhani poovan* at Nileshwar, ; *Ney poovan* at Kurumathur ; *Rasa kadali* or *Ney kadali* at Tellicherry ; *Adakka poovan* at Kuttuparamba ; *Thekkan kadali* at Manantoddy ; *Kunnan poovan* at Kalpatta ; *Tirunelli poovan* at Calicut ; *Nhali poovan* or *Ari poovan* at Ponnani ; *Kadali poovan*, *Poovan kadali*, *Tirunelli poovan* and *Ney kunnan* at Kumaranallur ; *Vadakkan kadali* at Trichur Farm ; *Raja bale* at Rampuram ; *Karpurapu aratti* at Tambalapalle ; *Rasadala* at Madanapalle ; *Mysore rasthali* or *Velchi* at Kallar Government Gardens ; *Poo bale* at Vira-rajendrapet ; *Puttu bale* at Udipi.

Next to the four main varieties of the State, this variety is largely grown sometimes as a pure crop as in Kodagalli village near Bangalore City. It is invariably grown in the back yards of houses in South Kanara and North Malabar Districts. The pseudostems are 10-13 feet high with a girth of about 28 inches at the base. The leaves are about eight feet long and about 26 inches wide. Petiole is slender and about 20 inches long. The margins of the petiole are about a third of an inch apart. The bunches are fairly heavy. Fruits are closely set, terete and taper to a distinct

apex. The rind of the fruit is very thin and the colour of the pulp is pure white. Ripe fruits are very sweet. This variety is considered as one of the best South Indian varieties. Unless the irrigations are cut off when the bunches are nearly three-fourth full the fruits often crack. It is not one of the commercial varieties as it is not grown largely in any place.

6. *Monthan (Musa paradisiaca* Linn., var. *monthan). Akku bale* at Bangalore nursery; *Madhuranga bale* in Bangalore and at Nagavalli, Nanjangud, etc.; *Konga bale* at Channapatna; *Kalyana bale* at Jayachamarajapura, Kowsika, etc., and *Mara bale* at Ambuga. Outside the State it is known as *Silanti, Aunda bale* at Moodbidri; *Kilandi, Manga bale, Banga bale* at Udipi; *Sodari* at Kurumathur; *Thezhuthani* at Tellicherry; *Thenali* at Calicut; *Ponthan* at Kongad; *Ponnan* at Nilambur; *Chetti kaya* at Ponnani; *Naathangi monthan* at Erode; *Monthan* at Karur; *Erode monthan* at Kulitalai; *Kondai monthan, Yendra monthan* at Trichinopoly; *Trichinopoly monthan* at Negapatam; *Yenthala monthan* at Tanjore; *Erode ka* at Polambakkam; *Erode bonthan* at Pudupatnam; *Erode chedi* at Seevur near Gudiyattam; *Nadgangi* at Kallakurichi; *Bontha aratti* at Guntur; *Kalyana bale* at Kampli; *Basti* at Buchireddipalayam near Nellore; *Chinna bontha* at Atmakur near Nellore; *Nir bontha, Nielh bontha* at Conjeeveram; *Thoppul vazhai* at Thangachimadam; *Nattu monthan, Maanaattu monthan* at Tenkasi and *Kari bale* at Mercara.

A few plants of this variety are grown in all banana gardens. The fruits are mainly used as vegetable but occasionally used as ripe fruits especially in the Erode Taluq of the Coimbatore District. The fruits are very large and individual fruit may weigh up to a pound. The pseudostems are 10—14 feet high and about 30 inches in girth at the base. The leaves are about seven feet long and about 27 inches wide. The petiole is about 23 inches long and of medium thickness. The margins of the petiole are about quarter inch apart. The bunches are loosely packed and heavy. The fruits are nearly terete and taper to a very stout and distinct apex. The rind of the ripe fruit is yellow. The leaves are considered very good as plate leaves.

7. *Chenkadali (Musa paradisiaca* Linn., *var. chenkadali). Chandra bale* in Bangalore, Ambuga, etc: *Sakalathi bale* at Palhalli. Outside the State it has the following names:— *Chandra bale* at Kasaragode; *Chora kadali* at Tellicherry; *Chenkadali* at Calicut; *Chora poovan* at Alwaye; *Yerra aratti* at Simhachalam; *Yerra mokiri* at Panchadharla; *Chevvazhai* at Erode; *Yerra chakkarakeli* at Bhimadolu; *Lal mowze* at Kurnool town; *Kempu bale* at Rampuram; *Kunkuma bale* at Kampli; *Lal kel* at Kallar Government Gardens; *Chontha bale* at Virarajendrapet and *Sakalathi bale* at Mercara.

It is not largely cultivated due to the very long duration of the variety. It takes full 18 months for the harvest of the crop. In the State it is largely grown in the Palace Gardens. The fruits are solely used as ripe

ones. The ripe fruits have very rich flavour and taste. The purple colour of the unripe fruit turns red on ripening. It is one of the choicest varieties of the State. The pseudostems are about 14 feet high and about 36 inches in girth at the base. The leaves are about 10 feet long and about 35 inches broad. The petiole is stout and about 26 inches long. The margins of the petiole are about an inch and a half apart. The bunches are loosely packed and medium heavy. Fruits are terete having a distinct apex. There is a green sport in this variety which has green stem and fruits. The green fruit turns dull yellowish on ripening. Both these types are sometimes seen in the same stool. The taste and flavour of the pulp are the same in both.

8. *Chakkarakeli (Musa paradisiaca* Linn., var. *Chakkarakeli). Raja bale* in Bangalore. Outside the State it is known as *Chakkarakeli* at Rajahmundry; *Chakkara kadali* at Trichur Farm; *Godaveri Chakkarakeli* at Piridi near Bobbili; *Sajja aratti* at Simhachalam; *Shahaja* at Panchadharla near Yellamanchili; *Thella chakkarakeli* at Samalkota Farm; *Then kadali* at Erode; *Raja kili* at Pudupatnam; *Raja vazhai* at Gudiyattam Farm; *Mysore rasthali* at Mettupalayam; *Manchi chakkarakeli* at Vellatur near Bhattiprolu R. S.; *Pedda chakkarakeli* at Siruva Lanka; *Rasthali* at Srivilliputtur and *Aa bale, Raja bale* at Virarajendrapet.

This variety may be termed as the king of bananas as the local name *Raja bale* indicates. It is undoubtedly the best banana in the world. The late Sir Arthur Hill, Director of the Royal Botanic Garden, Kew, Surrey, England, expressed the same opinion after tasting some ripe fruits of this. The pulp is very sweet and has very rich flavour. The fruit is ready for the table even when the rind is greenish yellow. The pedicels of the fruits are very strong and consequently they have to be cut and separated with a knife even when the fruits are well ripe. This variety has very poor keeping quality. The colour of the rind of ripe fruits is yellow but it is greenish in plants grown in Coorg and probably in similar altitudes. It is largely cultivated in the Godaveri District where there is a great demand for the fruits of this variety. The pseudostems are about 9 feet high with a girth of about 26 inches at the base. The leaves are about 7 feet long and about 3 feet broad. The petiole is thick and 10—12 inches long. The margins of the petiole are two to two and a half inches apart. In young plants they are bright red and revolute. The bunches are medium heavy and loosely set. Fruits are terete and taper to a distinct apex.

Other varieties rarely met with in the State are *Vamanakeli* known as *Kuja bale* and *Pacha bale* in Bangalore; *Sambrani monthan* known as *Boodhi bale* in Bangalore and *Boodhi madhuranga* at Palhalli; *Anai komban* known as *Naga bale* and *Haavu bale* in Bangalore; *Vannan* known as *Kadu Bale* at Palhalli and *Ela vazhai* known as *Ela bale* in Bangalore.

Some other varieties met with only with the seedsmen of Bangalore are *Thattilla kunnan* known as *Kaththe bale* and *Kullan* known as *Aana guja bale*.

The foreign varieties recently introduced by the State from Brisbane, Australia, are grown at the Sewage Farm, Bangalore and at the Kannambadi Dam Orchard. These varieties are "*Gros Michel*" (the famous banana of the West Indies), "*Ladies' Fingers*", "*Mons Mari*" and "*Giant Governor*", a tall form of *Vamanakeli*. Most of the varieties are thriving very well.

Diseases. 1. *Tharagumari*:— This disease was noticed at Nanjangud in the variety *Rasthali*. The leaves of the affected plants dry up from bottom upward even in grown up plants, the growth gets arrested and ultimately the whole plant dries up. A red streak was seen on one side of the trunk when the stem of a diseased plant was cut open and examined. It is a fungoid disease very similar to the "Panama disease" of the bananas in the West Indies.

2. *Sulikattuvadu*:—This disease was noticed at Jayachamarajapura, 4 miles from Chikkanayakkanahalli. It is common in *Rasthali* variety. Here the tops of the pseudostems get constricted, leaves fade and ultimately the plant dries up. It is very similar to the *Tharagumari* disease of Nanjangud and probably only a different name for the same disease.

3. *Katte roga* or *Palli roga*.—This was noticed at Kowsika, near Hassan. It is common in the variety *Boothi bale*. The disease starts with the yellowing of the bottom leaves and soon the central shoot is affected and the plant dries up.

The control method for all these diseases is more preventive. The affected plants should be removed with the entire rhizome with all the suckers and scorched. Suckers from affected plants should not be planted on any account.

Studies on *Diatraea venosata* Walk—A Pyralid Pest of Sugarcane in South India.

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Introduction. *Diatraea venosata* Walk. is a Pyralid borer attacking sugarcane in South India. It is found along with two other borers—*Argyria sticticraspis* Hampson and *Scirpophaga rhodoproctalis* Hampson—also belonging to the family Pyralidae. Ramachandra Rao (1930) and Ramakrishna Ayyar (1933) while considering *Argyria sticticraspis* Hampson as the most important pest, state that the other two are of minor importance only. Cherian and Subramanian (1937) have shown that *Scirpophaga* is not so unimportant as it was once considered to be. Detailed studies by the authors of *Diatraea venosata* Walk. with special reference to the symptoms of attack and incidence go to show that the borer is mainly responsible for reduction in tonnage and sucrose content in millable canes and

partly responsible for the loss of young shoots in the earlier stages of the crop, especially in the Coimbatore tract.

Distribution of the Pest. This borer is prevalent in almost all tracts where sugarcane is grown in the Madras Province; specimens have been collected from Chittoor, South Kanara, Vellore, Palur, Chidambaram, Aduturai, Musiri, Northern Circars and Coimbatore. Outside the Presidency, it is reported to be present in Mysore, Bihar and Bombay (Fletcher 1919; Isaac 1937).

Seasonal History. Damage by the borer becomes evident mainly from the third month, i. e., when the canes or stems are just beginning to form. The borer continues to be active till about the time of harvest; naturally, many broods are developed during the total period. Its activity is checked, however, to some extent during the North-East monsoon due to the rain water accumulating at the entrance of the larval burrow, and aiding the development of a fungus which attacks the larva in its tunnel. After the rains have ceased the pest incidence increases and continues till harvest As cutting and planting go side by side on different days in various cane fields, for over three months, there is scope for the pest to multiply without break.

Nature of Damage. The nature of damage to young shoots is different from that noticed in grown up or half grown up canes. As already explained, the pest starts about the time of formation of canes. In the young crops, the newly hatched larvae feed in the central leaf roll for about a week, and then go to the lower portions of the stem and bore on its sides to get into the tender fibrous joints. As a result of complete feeding of the rather thin small growing stems the central shoot begins to fade and dry and finally turns into a dead heart. The effect of feeding will not be plainly visible until after the leaves have opened out when excreta of the larva and the shot holes on the leaves come into view. Now all further growth of the shoot is stopped and unless there is tillering of the damaged shoot the result would be a gappy growth of the crop in the affected portions of the field. In the case of grown up canes whose stems are well above ground level the work of the larva cannot be easily located unless some of the semi dried leaf sheaths at the top are pulled off when the existence of the borer caterpillar inside the stem becomes evident by the presence of wet excreta at the entrance to the larval burrow and the leaf sheath covering it (Fig 9). In grown up canes more than one joint may be bored by the larva (Fig. 8) and except for the constriction of the infested joints (Fig. 7) the growth will not be seriously affected.

Extent of damage. As mentioned above, the damage to cane generally begins when the crop is about three months old. In the case of grown up canes examined at the time of harvest in 1938—39 and 1939—40 in the Central Farm, Coimbatore, the percentage of incidence in whole canes and joints has been very appreciable. Tables I and II below give the various details.

TABLE I.

Percentage of infestation by *Diatraea venosata* (crop at harvest) 1938—39.

Variety.	Total No of canes.	Total No. attacked canes.	Percentage of attack.	Total No. of joints.	Total No. joints attacked.	Percentage.
Co. 419	983	497	50 5	19359	1118	5·7
„ 417	734	492	67·9	14645	1321	9·2
J. 247	842	531	63·06	19203	1281	6·6
Co. 213	1605	695	43 3	31416	1169	3·7
Poj. 2878	551	358	64·9	10283	791	7·7
Co. 413	1006	506	50·3	17006	1276	7·5

TABLE II.

Percentage of infestation by *Diatraea venosata* (crop at harvest) 1939—40.

Variety.	Total No. of canes.	Total No. attacked canes.	Percentage of attack.	Total No. of joints.	Total No. joints attacked.	Percentage.
Co. 413	372	238	63·9	7700	458	5·9
Co. 419	403	212	52 9	6229	559	9·0
Co. 417	328	277	84 4	6231	763	12·2
Poj. 2878	348	222	64·3	5354	492	9·2

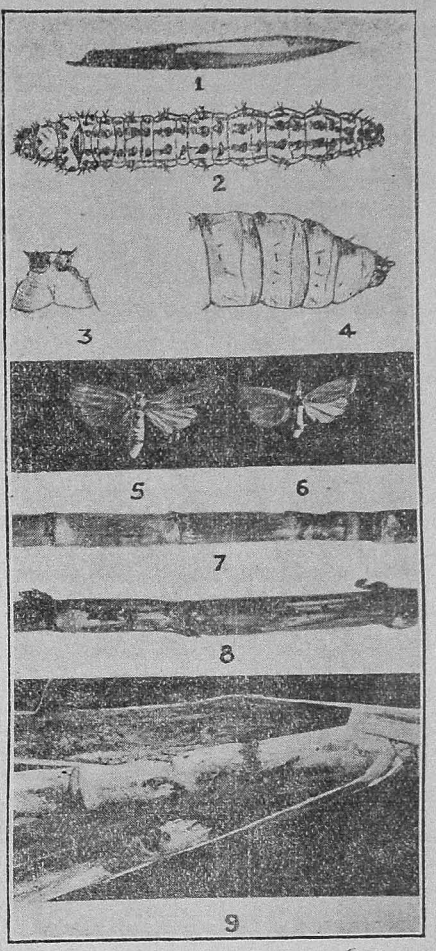
The results of analysis of infested canes as given by the Government Agricultural Chemist are given in Table III. It will be seen that there is appreciable decrease in the weight of the canes where the damage by the borers was pronounced.

TABLE III.

Results of analysis of samples of sugarcane attacked by *Diatraea venosata*.

Number of joints attacked.	Number of canes cut for analysis.	Average weight.	Extraction percentage.	On the weight of juice.			Glucose ratio.	Co-efficient of purity.	Acidity in terms of N/10 KOH per 100 c.c. of juice.	Ash in juice.
				Brix	Sucrose.	Glucose.				
		lb.								
One joint attacked sample	11	2·46	66·67	15·14	12·56	0·19	1·51	82·96	9 cc.	0·86
Three joints attacked sample	10	2·40	66·67	15·04	12·45	0·18	1·49	82·77	10 „	0·92
Four, five and six joints attacked samples	11	2·18	62·50	15·04	12·32	0·20	1·64	81·93	11 „	0·95
Seven and more joints attacked samples	7	2·14	66·67	14·10	11·23	0·18	1·61	79·64	12 „	0·99

Life History. The life history of the pest was studied in pot plants. For this purpose larvae were collected from harvested cane tops, reared into adults and then allowed to pair and lay eggs. When the caterpillars



Explanation of Plate.

1. Egg mass of *D. venosata* Walk.
2. Larva of *D. venosata* Walk. (Report Proc. III Ent. Meeting Pusa 1919.)
3. Pupa—anal segment, ventral surface. ,, ,, ,,
4. Pupa—posterior segment—lateral view. ,, ,, ,,
5. Adult female.
6. Adult male.
7. Cane showing constriction of joints due to the borer.
8. Empty tunnels in mature cane indicating infestation in more than one joint.
9. Place of pupation (top) and feeding (bottom) of the borer.

hatched out, the larvae were transferred to cane shoots and their behaviour noted. *Eggs* are deposited on both surfaces of the green leaves and occasionally on leaf sheaths and stems. In the field they are laid in small masses generally in rows of two, while in cages rows of three, four and five are found (fig. 1). The place selected on the upper surface is mostly the mid rib groove and on the lower surface near the mid rib. The eggs when freshly laid are flat, shiny, waxy white in color and lie one overlapping the other. Immediately before hatching, the larvae could be seen lying curled up inside the egg shell with its black head and prothoracic shield and orange colored body with setae. Hatched eggs are thin, transparent and are of the texture of tissue paper while parasitised eggs turn black in color. Ten to thirtyseven eggs in a mass are laid in the field. In the cages, the number of eggs laid varied from 2 to 60. In one case as many as 51 masses were laid by one female. The maximum number of eggs laid by one moth was 414. The egg period lasts from 5 to 8 days. *Larvae.* The larvae escape out of the eggs by clipping the shell with their mandibles. They are active, orange colored, with black head and prothoracic shield. The warts are distinct with fine hairs rising from them. In the early stages the caterpillars are essentially leaf sheath borers and later on turn to the stem for further feeding. They crawl down and bore from outside into the soft core of the stem either by riddling through the leaf whorl or getting right in between sheath and the stem, the latter being most common. Under laboratory conditions, they appear to develop gregarious habits. Not more than six larvae are found at a time inside the leaf sheath, though finally the number dwindles down to one. The caterpillar always feeds on the fibrous joint immediately below the growing point. That is the reason why the tops usually contain the live stages of the pest. When mature, the larva measures 1 to 1·25" long with black shining warts all over its body segments (fig. 2). This character is of great importance in differentiating *Diatraea* from other borers. *Diatraea* is a clean feeder and ejects all excreta from its tunnel. The larval period lasts 28 - 38 days. *Pupae.* The larvae do not pupate inside the burrows. They desert them and seek out situations whereunder they construct thin silky cocoons and transform into pupae inside (Figs. 3 & 4). They seem to prefer the half dried leaf sheaths for this purpose (Fig. 9). At this stage they are vulnerable to attack by natural enemies. The pupal period lasts from 9—10 days. *Adults* are dull, straw-colored, with a spot on each forewing. The males (Fig. 6) are somewhat smaller than the females (Fig. 5) and their forewings slightly darker. They are nocturnal and sluggish in habits. When disturbed they fly short distances only. Otherwise they quietly rest in some corner of the cage and allow themselves to be transferred from cage to cage easily. Emergence from pupae generally takes place at night. Eggs are laid continuously for 2 or 3 days. Successful oviposition takes place if the adults are confined to plants in wire gauze cages. The females outlive the males by one or two days On the whole, the longevity is short not exceeding 3 or 4 days. Sex-ratio is more or less equal, the males emerging in advance.

Alternate Host Plants. So far, the pest is found feeding in *Scacharum spontaneum* and maize. Fletcher and Ghosh (1919) have recorded sorghum, ikri, *cumbu* and Sudan grass as alternate host plants.

Parasites. This borer is subject to the attack of egg, larval and pupal parasites. Eggs are parasitised by *Trichogramma minutum*, R, and *Telenomus* sp. *Stenobracon deesae*, Cam ; *Xanthopimpla nursei* Cam., *Pimpla* Sp. *Rhaconotus roslinensis*, Lal and *R. scirpophagae* Walk *Goniozus indicus* Ash. and *Apanteles flavipes*, Cam. are found to parasitise the pest in its various stages of larval life. A fungus—*Isaria* sp.—has been noted on the larvae at Coimbatore. Pupae are attacked by *Tetrastichus ayyari* Roh and *Tricospilus diatraea*, Cherian and Margabandu (MSS).

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A Note on a Synthetic Tetraploid in Asiatic Cotton

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It is frequently observed that when a wild species of cotton is crossed with the cultivated species, there is either very little setting or the hybrid is sterile. A number of workers like Mendes (1939), Beasley (1940), Harland (1940), Amin (1940, 1941), Stephens (1940), Zhebrak and Ozaev (1940) and Kasparyan (1940), have shown that it is possible to induce chromosome doubling in cotton and also to make sterile hybrids fertile when the sterility is due to failure of chromosome pairing as a result of the absence of homologous partner chromosomes. Attempts to induce chromosome doubling in the sterile hybrids of cotton were made for two seasons, at the Cotton Breeding Station, Coimbatore. This note records the details of the trials made to transform a partially fertile hybrid between *G. anomalum* Wawra-et-peyr, (an African wild cotton with 26 somatic chromosomes) and *G. arboreum*, L (strain K. 1. with 26 somatic chromosomes)

The treatment consisted in wetting the shoot tip of an young plant bearing 4 to 5 leaves, with an aqueous solution of colchicine (0·08%). The wetting was done at intervals for a period of 12 hours and the shoot tip was subsequently washed with distilled water. The treated shoot bore malformed leaves. A branch that arose beneath the last malformed leaf appeared to bear normal leaves, but they had much broader lobes than the

control. The lobes overlapped one another and presented a characteristic twisted appearance. The leaves were darker in colour and leathery in texture. The treated shoot grew to a height of about 12 feet before it began to flower and eventually produced a number of bolls.

It was observed that the leaf lobes, stomata, bracts, pollen grains, bolls and seeds in the treated shoot were distinctly larger than those of the diploid hybrid (vide Table 1), as were reported by the authors quoted above.

Cytological examination of the pollen mother cells collected in the new branch showed 26 bivalents at division I and 26 chromosomes at division II. Frequently multivalents and univalents were also noticed. Anaphase I was regular and cases of lagging chromosomes were rarely seen. When the pollen mother cells from untreated plants were examined, the chromosome pairing was found to be very variable, the number of univalents ranging from 0 to 14. In a few pollen mother cells, 13 bivalents were also noticed indicating that the type of pairing was mostly allosyndetic. The mean chromosome conjugations in the untreated and treated shoots were as follows :—

	Univalents.	*Bivalents.*	*Trivalents.*	*Quadrivalents.*
Untreated	3·70	10·70	0·10	0·15
Treated	0·40	22·67	0·42	1·25

It is obvious that the increased fertility noticed in the treated shoot is due to the reduction in the number of univalents present during meiosis. These showed clearly that the treated branch had been turned from a diploid to a tetraploid condition.

The seeds secured from the treated branch were germinated. The seedlings had stout radicles, in contrast to those raised from the seeds of the untreated hybrid which were tiny or medium sized. As they grew old, the mature plants resembled the parent plant in leaf shape, hairiness, flower colour, boll shape, seed size and lint qualities. This phenomenon of progenies of F_1 breeding true to the parent indicated that the type of pairing in the new shoot must be autosyndetic. The existence of autosyndesis to a certain degree in cotton was pointed out previously by Skovsted (1935) in the F_1 hybrid between *G. sturtii* × *G. Davidsonii* where the parental chromosomes differed considerably in size and which could be identified at meiosis. Amin (1941) also reported that in the three F_1 hybrids viz. *anomalum* × *arboreum*, *anomalum* × *herbaceum* and *anomalum* × *Davidsonii*, that F_1 bred true in crosses when their chromosomes were doubled.

From a breeder's point of view, autosyndesis would be advantageous if the resulting reaction of the complements of the parental species would prove of economical value. Unfortunately in the present cross, the lint of the F_1 was coloured, the ginning percentage was poorer and the plant was late maturing when compared with the *arboreum* parent.

The complement of 52 chromosomes in the synthetic tetraploid should, however, be considered as a distinct advantage as it would increase the degree of crossability with the cultivated 52 chromomed New World species.

TABLE I. Figures denote the mean values of the characters.

Serial No.	Characters.	*G. anomalum* 2n=26.	*G. arboreum* (k.1) 2n=26.	*G. anomalum* × *G. arboreum*. F1 2n=26.	*G. anomalum* × *G. arboreum*. F1 2n=52	Remarks.
1	Leaf Index.	1·32	1·25	1·48	1·16	From the main leaves on the monopodial branches.
2	Length of the guard cells of the stomata of the leaves in μ.	21·5	25·6	28·1	36·1	Readings taken from the lower epidermal cells of the mature leaves.
3	Bract:— Length in mm. Breadth in mm.	15·8 5·3	28·4 29·9	36·2 22·6	46·3 30·1	Measurements taken on the date of flower opening.
4	Petals:—Length in mm. Breadth in mm.	37·6 37·1	36·6 30·5	42·9 43·0	53·0 49·6	Do.
5	Pollen grain diameter in μ (air medium without cover glass).	102·1	103·3	94·5	128·5	From fresh flowers between 10-11 A. M.
6	Percentage of shrivelled pollen grains.	3·0	8·7	73·3	33·8	
7	Boll:—Length in mm. Breadth in mm.	24·7 14·0	28·0 22·3	21·6 13·7	34·8 23·6	Measurements taken from 4-locked bolls.
8	Weight of 100 seeds in decigrammes.	19	51	40	70	
9	Weight of lint for 100 seeds in decigrammes.	2	21	11	19	
10	Lint length in mm.	6·2	26·2	23·0	26·2	Halo length.
11	Seed size.	Small with short fuzz.	Medium with very short fuzz.	Medium with medium fuzz.	Big with long fuzz.	
12	Diameter of the fibre in μ.	—	22·0	—	18·9	
13	Fibre weight.	—	1·85	--	1·22	

Crossings were actually tried with a number of strains and species, viz., with (1) *G. hirsutum* (strains Co. 2; 4383 and U4); (2) *G. barbadense* (Sea Island, Quebra and Ishan): (3) *G. religiosum* (strain R. A. 8/4); and with (4) B. C. 10, which is a fertile tetraploid synthesised at Surat by crossing a strain of Dharwar American (D. A. Ron. 4) with an Asiatic *herbaceum* (1027 A. L. F.) and backcrossing to the Darwar American parent. Setting was good in all the cases and it was better when the new tetraploid was used as the female parent.

Progenies of the above crosses were raised. In the cross with Co. 2, where Co. 2 was the female parent, the hypocotyls of the new seedlings were very hairy in contrast to the glabrous condition found in pure Co. 2 seedlings proving that the seedlings were real crosses. The hybrid plant grew vigorously and flowered profusely but the bolls did not set seed. Cytological examination of the flower buds showed that the sterility was due to the formation of a large number of univalents (ranging from 7—17) in all the pollen mother cells. Sterility of a similar nature was reported by Amin (1941) and Stephens (1940) in their hybrids. However Harland, (1940) and Beasley (1940) were able to obtain fertile hybrids in the cross (*G. arboreum* × *G. thurberi*—F_1 doubled) × New World cotton. Such a phenomenon indicated that only in crosses between certain species, it would be possible to get synthetic tetraploid suitable for crossing with the cultivated tetraploids.

Attempts to induce chromosome doubling were also being made in the following sterile F_1 hybrids: *G. arboreum* (K1) × *G. stocksii* (2n = 26), *G. hirsutum* × *G. armourianum* (2n = 39). In the latter hybrid, one of the treated plants set one boll, but the plant died of *pempheres* attack. Cytological examination of the pollen mother cells showed 39 chromosomes at interkinesis at each pole and indicating thereby that the chromosome number of the plant had doubled. Another treated plant showed abnormal leaves and flowers. The anthers failed, however, to dehisce. A similar non-dehiscence phenomenon had been reported by Beasley (1940) in some of his colchicine treated plants.

My thanks are due to Rao Bahadur Sri V. Ramanathan, Cotton Specialist, Coimbatore, for affording facilities to carry out this work and to Mr. R. L. N. Iyengar, Technological Assistant, for determining the fibre properties of the treated plants.

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SELECTED ARTICLE

Economic Aspects of the Problem of Nutrition in India

By W. R. AYKROYD

Within the last 30 years science has reached definite conclusions as to what constitutes a *good* diet for human beings. The principles of correct feeding are fairly well understood and "optimum" dietary standards based on these principles have been drawn up by League of Nations Commissions and other authoritative organisations. Now generally speaking a "good" diet—i. e., a diet which approaches or attains the physiological optimum—costs more than a diet which fails at various points to satisfy human nutritional requirements, and consequently there is a close correlation between the economic status of a family or population group and the physiological value of its diet. In a sense this is a platitude, perhaps better expressed in a simple phrase such as "the poor can't afford to buy enough of the right sort of food to eat". But a more detailed analysis of the relation between income and diet than such a phrase provides helps in the understanding of the problem of nutrition in India.

Dietary Standards. The League of Nations "optimum" type of diet is rich in first class proteins and in all the essential vitamins and mineral salts. In terms of actual foods, this means a high intake of milk and milk products, meat, fish, vegetables and fruit, and a relatively low intake of cereals. The staple grain foods of mankind—rice, wheat, maize, etc.,—are relatively deficient in certain essential food constituents required by human beings and must be adequately supplemented by other foods—in general more expensive foods—which are richer in these necessary constituents A diet composed exclusively, or almost exclusively, of cereals will not support proper growth in young animals.

Let me illustrate the above point by reference to Indian diets. In Table 1, a typical "ill-balanced" Indian diet is compared with a "well-balanced" diet which more nearly approaches the League of Nations standard and in the same table the chemical composition of the two diets is given.

Table 1.

A Typical "Ill-balanced" Diet and a "Well-balanced" Diet (both yielding 2,600 calories)
(ozs. per consumption unit per day)

Food.	"Ill-balanced" diet.	"Well-balanced diet.
Cereal	23	17
Pulses	0·5—1·5	3
Milk	None or negligible amounts	8
Leafy vegetables ...	0·5—1·0	2
Non-leafy vegetables ...	2·0—5·0	4
Fruit	Negligible	2
Vegetable fats and oils ...	Less than 1·0	2
Fish, meat and eggs ...	0·5—1·0	2—3 (if no milk is included)
Approximate Chemical Composition (assuming the cereal to be milled rice)		
Calories	2,600	2,600
Protein (g.)	55	80
Fat (g.)	25	70
Calcium (g.)	0·25	1·00
Phosphorus (g.) ...	0·90	1·20
Vitamin A (International units)	1,100	3,000
Vitamin C (mg.)	60	150

The well-balanced diet is much richer in the very important B_2 group of vitamins than the ill-balanced one. Both the diets have the same calorie content or energy value; 2,600 calories represents approximately the daily energy requirements of an average Indian male. Both therefore will satisfy hunger. But the more varied "well-balanced" diet, containing less cereal and more of everything else, is infinitely more satisfactory in quality, and the health and development of a population consuming this kind of diet will be superior to those of a population whose diet resembles the "ill-balanced" diet.

The "ill-balanced" diet shown in the table will cost from Rs. 2/- to 3/- per adult per month, depending on the nature of the cereal and of course on differences and fluctuations in food prices. The cost of the "well-balanced" diet may be estimated as Rs. 4/- to 6/- per adult monthly. A family containing four consumption units—i. e, the equivalent of 4 adult males—must therefore spend Rs. 16/- to 24/- per month on food, or let us say, Rs. 240/- annually to obtain a diet of this satisfactory standard, and rather more if allowance is made for an intake of 8 ozs. of milk daily on the part of children. An ill-balanced diet, sufficient in quantity but defective in quality, will cost, let us say, Rs. 10/- monthly for a family of the same size.

These figures may be set against actual income levels in India in so far as these can be determined. The income of urban or industrial groups can be assessed with fair accuracy; for example, the average monthly wage of an unskilled urban worker, such as a peon, is about Rs. 12/-, or Rs. 144/- annually, But when agricultural families are concerned the assessment of real income on a monetary basis is a very difficult matter. A number of attempts have been made to estimate income in terms of cash in village groups, and some of these may be quoted, though with considerable reserve. Average total annual income per family in Bengal has been estimated as Rs. 150/-[1], in a group of very poor rural families in Madras as Rs. 100/-[2], and Rs. 125/-[3] in families in the Kangra Valley in Punjab. The following analysis of net income per family in a rural area in Mysore, with a population of about 50,000, was made by the Closepet Health Training Centre[4] in 1935. The survey included 11,142 families, giving an average family membership of about 5 individuals.

Family Income per Month Rs.	*No of Families*	*Percent of all Families*
0—5	2,597	23·3
5–10	3,417	30·7
10–15	2,344	21·0
15–20	1,142	10 3
20–30	968	8·7
30–40	559	5·0
40–50	115	1·0
Total	11,142	

In more than half the families estimated annual income per family was below Rs. 120/-.

Estimates of national *per capita* income must also be regarded with a dubious eye, because the basic statistics necessary for such calculations are not fully available. One of these may be quoted -that of V. K. R. V. Rao[5], who has worked

[1] Azizul Huque—*The Man Behind the Plough*. Book Co., 1939, (Calcutta).

[2] Aykroyd and Krishnan—*Indian Journal of Medical Research*, 1937; 24: 668.

[3] Punjab Public Health Dept., "An Inquiry into Diets, State of Nutrition and Factors Associated Therewith, in Relation to Health in the Kangra Valley, Punjab, 1939."

[4] *Handbook of the Rural Welfare Centre*, 1939, Closepet, Mysore.

[5] *The National Income of British India*—(1931—1932), Macmillan, 1940.

out a figure of Rs. 65/-, with an error of 6 per cent, for annual *per capita* income in British India. His estimate is somewhat higher than those made by various other investigators.

Such figures, approximate and open to criticism though they may be, serve at least to indicate the gulf between possible and desirable expenditure on food. It is clear that a well-balanced diet of the kind shown in Table 1 is far beyond the means of a large section of the population. Having established this point, we can proceed to consider the problem in greater detail.

Diet and Economic Status —The following passage, which refers to England in 1933, is illustrative of the subject under discussion.

"Amongst the lowest income groups are still some who suffer from actual hunger, but these are a declining element which could and should be lifted out of their present situation without delay. Immediately above is a much larger group, estimated to cover between 10 and 25% of the population, who can afford enough food to fill their bellies, but cannot afford a diet of the type and quality now known to be essential as a safeguard against malnutrition and disease. On the next step upwards, measured by incomes, comes another large group which commands enough purchasing power to obtain an adequate diet for the whole family, provided that this purchasing power is completely spent on the lines suggested by such applications of modern research as the report of the British Medical Association Committee on Nutrition. Actually many of the incomes in this group, and especially the lower ones, are often unwisely spent, at any rate from the strict standpoint of nutrition, and thus a further large number of families falls, for practical purposes, into the zone of malnutrition. The higher the income and the more money spent on food, the smaller this risk becomes, but there is a reason to suppose that even among supertax payers a standard based upon the optimum established by recent research would disclose the presence of malnutrition due to a faulty diet.,'[6]

The same groups exist in India but the proportion of the population falling into each is very different. The lowest group includes a much greater percentage, and the higher groups a much smaller percentage. It is impossible to estimate accurately the percentage of population which "suffers from actual hunger", but certainly it is a large one. Over 70 diet surveys of groups of families, both urban and rural, have been made in various parts of the country within recent years, and in about 30 per cent. of the groups average daily calorie intake per consumption unit was below 2,300—i. e., below any reasonable standard of requirements. In various surveys in villages and industrial areas an approximately similar proportion of families was found to be underfed by the same standard. These observations cannot legitimately be generalised into a statement about the extent of under-nutrition in India, because the sample of the population—about 1,500 families—investigated was small and cannot in a strictly statistical sense be taken as typical of the country as a whole. But there can be no possible doubt that many millions in India never get enough food to eat and this fact is of fundamental importance in connection with agricultural policy. "Enough food" takes precedence over "the right sort of food". The principal aim of agricultural policy must be to produce *more* food. India cannot afford to import food in large quantities. Agricultural departments and research institutes, and other departments concerned with food supply, should never lose sight of this primary need, or dissipate the major part of their energies in prosecuting schemes of secondary importance, however useful and attractive.

[6] *Political and Economic Planning*, Broadsheet No. 44, 1935.

One step out of the abyss, and we have the group which "can afford enough food to fill their bellies, but cannot afford a diet of the type and quality now known to be essential as a safeguard against malnutrition and disease". This includes those whose diet resembles the ill-balanced but quantitatively sufficient diet shown in Table 1, costing Rs. 2/- to 3/- per consumption unit per month. Certainly a much higher proportion than 10 to 25 per cent. of the population falls into this category—it is futile to attempt a precise estimate. The higher groups, with sufficient "purchasing power to obtain an adequate diet for the whole family", are correspondingly reduced in comparison with the English classification. Ignorance as well as poverty operates strongly in extending the zone of malnutrition. Plenty of people in India, who could afford to consume an excellent diet and feed their children on an excellent diet, do not in fact do so because of ignorance of the elementary principles of nutrition.

Analysis of Expenditure.—Comparison of the cost of various kinds of diet with estimates of total income are illuminating but crude, because they do not take into consideration other expenditure items in the family budget. A number of detailed family budget enquiries have been carried out, mainly by Labour departments, among industrial groups in various Indian cities; these valuable studies, all too little known to the educated Indian public, throw further light on the subject under discussion. Industrial workers in towns and cities are a relatively highly paid class; it is the prospect of what appears to be a high wage which attracts the villager from the countryside into the squalid slums of Bombay or Ahmedabad. Family budget enquiries based on field investigations among rural groups not in receipt of regular wage, and in fact for the most part not living on a cash basis, are obviously more difficult than similar enquiries in towns and cities, and few rural studies have been made in India.

Adyanthaya[7] carried out a family budget enquiry on a miscellaneous group of labourers and coolies in Madras City, using standard International Labour Office methods. Some of the data obtained in this investigation are shown in Table 2 on the following page. Various interesting points emerge from this Table. We may note first of all that monthly expenditure on food, even in the lowest group, was slightly above that necessary to purchase an ill-balanced diet sufficient in quantity. Presumably, therefore, the majority of families were above the starvation level—they had *enough* to eat. The percentage of total income spent on food averaged 52·6 per cent. in all families.

As income rises, so does the number of consumption units per family. A rise in total income per family does not therefore necessarily result in a rise of similar proportions in income *per consumption unit.* This means that workers who are in receipt of incomes above the lowest levels gather needy dependents and may themselves lose much of the advantage of superior pay—a striking illustration of the poverty of India and the strength of family ties which gives the destitute the right to share in the meagre goods of relations a little better off than themselves. I do not think that a regular increase in the number of dependents with increasing income occurs in industrial groups in England and U. S. A. Apart from other factors, a cold climate and a higher standard of housing would discourage the crowding in of extra dependents. Probably, however, a similar trend could be observed in China and Japan. In any group consisting of poor families at approximately the same economic level, families including the largest number of dependents naturally tend to be the worst fed ; this is always strikingly apparent in diet surveys in India and has been observed in similar surveys in other countries. But it is clearly not the

[7] *Report on an Enquiry into the Family Budgets of Industrial Workers in Madras City* Dept. of Industries, Govt. of Madras, Govt. Press, 1940, Madras.

same thing as a steady growth in the number of dependents with rising income. These facts have a bearing on the population problem, and the question of family limitation, discussion of which is outside the scope of this article.

Table 2.

Income and Expenditure of Labourers in Madras City (1935).

Income per family.	Below Rs. 20/- per month.	Rs. 20/- to 30/-	Rs. 30/- to 40/-	Rs. 40/- to 50/-	Rs. 50/- to 60/-	Rs. 60/- to 70/-	Above 70/-	All families
No. of families ...	47	167	198	118	69	20	20	639
Per cent. in each income group...	7·4	26·1	31·0	18·5	10 8	3·1	3·1	
No. of consumption units per family ...	3·03	4·19	4·89	5 26	6·15	7·63	6·08	4·92
Monthly income per consumption unit ...	Rs. 5-12-6	6-0-8	6-15-6	8-8-7	8-13-4	8-7-2	12-3-3	7-9-6
Monthly expenditure per consumption unit on food ...	Rs. 3-5-0	3-5-8	3-8-1	3-14-8	3-12-0	3-10-2	5-3-6	3-10-8
Percentage of total income spent on food ...	57·06	56·34	54·93	50·41	49·25	48·81	48·58	52·63
Expenditure on milk per consumption unit.	Rs. 0-1-2	0-2-4	0-3-5	0-4-7	0-4-1	0-4-0	0-7-11	0-3-6

Consumption units were calculated on Lusk's sale.

Another point of great importance is that expenditure on food per consumption unit did not rise proportionately to income per consumption unit. While the incomes per consumption unit of families with incomes of Rs. 40/- to 70/- were definitely above those of families with total incomes below this level, only the highest income group spent enough on food to purchase a well-balanced diet. There was a rise in expenditure on milk with increasing income but this was small until the highest income group is reached. The probable explanation is that an ill-balanced diet is the normal diet of the poor in South India, and poor families will not readily make sacrifices in other items of expenditure to purchase a diet of superior quality. It is only when income reaches a level which allows needs other than food to be fulfilled with relative ease that more money is devoted to buying a better diet.

Very similar tendencies were elicited in family budget enquiries carried out in Ahmedabad[8], Sholapur[9], Howrah, Bengal[10] and Bombay[11], on industrial

[8] *Report on an Enquiry into Working Class Family Budgets in Ahmedabad*, 1928, Labour Office, Bombay, Govt. Press, Bombay.

[9] *Report on an Enquiry into Family Budgets of Cotton Mill Workers in Sholapur City*, 1928, Labour Office, Bombay, Govt. Press, Bombay.

[10] *Report on an Enquiry into the Standard of Living of Jute Mill Workers in Bengal*, 1930, A. C. R. Choudhury. Govt. of Bengal, Commerce Dept., Secretariat Book Depot.

[11] *Report on an Enquiry into Working Class Family Budgets in Bombay City* 1935, The Labour Office, Bombay, Govt. Press, Bombay.

workers with monthly income ranging from below Rs. 20/- to Rs. 80/- or thereabouts per family. The percentage of total income devoted to food ranged from 50 to 60 per cent. Mitra[12] has surveyed a group of families in Jharia, Bihar, with monthly incomes of Rs. 5—2—0 per consumption unit or below, in which 73 per cent. of total income was spent on food. In general the results of family budget enquiries in India confirm Engel's "law" that percentage expenditure on food falls with increasing income. In all these urban groups rent was a relatively important item of expenditure. It is of interest to note that even when poverty is extreme 15 to 25 per cent. of the budget is almost invariably devoted to miscellaneous items including recreation and amusements. To prefer luxuries to necessities is characteristic of the human species.

Improvement in Diet with Increasing Income

A detailed investigation of the relation between diet and income in Great Britain has been carried out by Sir John Boyd Orr[13]. The population was divided into six income groups, and by means of the study of family budgets and diet surveys average expenditure on food in the various groups was estimated. The various groups were as follows:—

	Income per head per week (shilling)	*Estimated average weekly expenditure per capita on food (shillings)*	*Percent of population*
I	Up to 10	4	10
II	10 to 15	6	20
III	15 to 20	8	20
IV	20 to 30	10	20
V	30 to 45	12	20
VI	Over 45	14	10

The type of diet consumed by each group was compared with optimum standards of intake. It was found that the consumption of the more valuable foods, e. g., milk, butter, cheese, meat, fresh eggs, fruit and vegetables, rose with increasing income. A steady increase in the intake of protein, fat, vitamins, and mineral salts was observed in passing from the lowest to the higher income groups.

In India interesting investigations of the same type but on a much smaller scale have been made by Mitra (*loc. cit.*), Nutrition Officer in the Province of Bihar. Mitra carried out diet surveys among industrial workers in Bihar by the method of daily visits and weighing of food which provides more accurate data about food intake and expenditure than family budget enquiries conducted by means of questionnaires. He was able to correlate income level and the amount of each kind of food consumed. Data obtained in an enquiry in Jamshedpur, Bihar, in which the works of the Tata Iron and Steel Company are situated, are given in Table 3 given on the next page.

The proportion of ghee in the item "oils and fats" rose with increasing income and in group 4 ghee was the chief source of fat. This is one of the reasons for the relatively high expenditure on food per consumption unit in this group, which probably paid somewhat more for most articles of food including rice because articles of better commercial quality were demanded.

Mitra's figures again demonstrate the increase in dependents in the higher income groups. This is not quite as striking as in the families in Madras City. Jamshedpur is a relatively isolated town to which labourers migrate from other districts. In Madras City, families in receipt of regular wages are more

[12] Mitra, K., *Ind. Jour. Med. Res., 1940, 27:* 887

[13] *Food, Health and Income*, 1936, Macmillan,

accessible to penurious relatives. Similarly Bhave[14] recorded a considerable difference between the number of consumption units per family in a group of cotton mill operatives in Nagpur, the capital of the Central Provinces, and that in another group of workers employed in a manganese mine in a small town, Tirodi, in the same province. While total income per family was higher in the Nagpur families, income per consumption unit was considerably lower because of the greater number of dependents, and the diet consumed by these families compared unfavourably, both in quantity and quality, with that of more poorly paid families in Tirodi.

The main point of interest in Table 3 is that it clearly demonstrates *an improvement of diet in the right direction* as income rises above very low levels. Intake of pulses, non-leafy vegetables, fruits, milk products, meat and sugar in general rises with income and the same is true of intake of protein, fat, calcium and certain vitamins. There was a corresponding *reduction* in the percentage of calories from cereals. The diet of Group 4 resembled the well-balanced diets recommended by nutrition workers more closely than did that of Group 1. This does not, of course, mean that the better-paid families arranged their budgets and food expenditure to the best possible advantage, but it indicates a general tendency of great importance. In India, as in England and other countries, an increase in income leads in general to a change in diet which is to some extent in conformity with the principles of sound nutrition. It follows that an increase in the material prosperity of the country—a rise in the national *per capita* income—will *per se* tend to improve standards of nutrition and with them the health of the population.

Table 3.

Income and Diet in an Industrial Group
(Jamshedpur, Bihar, 1939)

Group.	1	2	3	4
Monthly income	Up to Rs. 30/-	Rs. 30/- to 45/-	Rs. 45/- to 90/-	Rs. 90/- and above
No. of families	110	35	19	13
Percent in each group	62 1	19·8	10 7	7·3
No. of consumption units per family	3·35	3·93	4·46	7·82
Monthly income per consumption unit	Rs. 6–2–0	Rs. 9–12–0	Rs. 15–0–0	Rs. 25–15–0
Monthly expenditure on food per consumption unit ...	Rs. 3–12–0	Rs. 5–9–0	Rs. 7–10–0	Rs. 10–1–0
Daily intake (ozs.):—				
Cereals	23·9	24·4	27·1	21·0
Pulses	2·4	3·1	3·8	3·4
Non-leafy vegetables ...	2·3	2·7	5·5	6·2
Green leafy vegetables ...	1·2	1·0	0·3	0·1
Fruits and nuts	0·1	0·3	0·9	0·9
Oils and fats	0·5	0·8	1·3	1·8
Milk	0·5	1·4	2·6	5·7
Meat, fish and eggs	0·6	0·7	1·3	1·0
Condiments	0·7	1·0	1·6	1·6
Sugar and jaggery	0·2	0·3	0·7	0·8
Calories	2940	3190	3250	3330
Percentage from cereals ...	83·9	74·9	68·0	61·8
Protein	68	78	85	85
Fat	21	35	45	68
Calcium	0·41	0·51	0·55	0·92

[14] Bhave, P. D., *Ind. Jour. Med. Res.*, 1941, *29*: 99.

In Mitra's groups there was a fairly steady rise in the consumption of most non-cereal foods from Group 1 to Group 4, and the rather sudden rise in expenditure on food per consumption unit at a certain level of income, apparent in the Madras group, was less evident. Comparison between the two groups as regards this point is, however, made difficult by the difference in income classification and possible difference in the real value of wages, depending on the cost of living and other factors. More detailed investigations would be required to establish the suggestion previously made that an abrupt change for the better in diet tends to occur when the income reaches a certain level. It is, however, probable that the low paid worker will insist on his quota of so-called non-essentials or luxuries, even at the cost of consuming a cheap and ill-balanced diet. But once his wages attain a level at which his "non-essential" needs can be reasonably satisfied, leaving a fair margin for other requirements, he will improve the quality of his diet.

Table 3 brings out another point of significance. Consumption of one valuable food—green leafy vegetables—was in inverse relation to income. Green leafy vegetables are a rich source of certain vitamins, minerals and salts. The better paid families tended to despise this food, which they could easily afford, and actually intake of pro-vitamin A, a constituent abundantly present in leafy vegetables, was lower in Group 4 than in Group 1. This shows that while a *general* tendency for diet to improve with increasing income may exist, prejudice may operate in the opposite direction, and incidentally provides an illustration of the part which education could play in improving dietary habits. Although the diet of higher income groups was in many respects superior to that of the lower income groups, it was far removed from the ideal.

Mitra[15] has demonstrated approximately similar relationship between income and the proportion of various foods in the diet in another industrial group in Bihar. Probably these are relatively uniform in urban areas throughout the country, but further investigations on this point are necessary. Change in dietary habits would therefore appear to be a useful index of change in economic status. If in 20 or 30 years time it can be shown that the national diet has changed in the direction indicated by these figures, it can be assumed that an improvement in economic condition has taken place.

The possibility of Progress.—The nutrition research worker in India is often told, in effect, that he is wasting his time. The cause of malnutrition is poverty, ignorance, population pressure and so on, and no amount of research on food values and the causes of deficiency disease, no experiments on rats and guinea pigs, however pretty and ingenious, will enable the poor to obtain a proper diet. But in order to solve a problem it is necessary first of all to define it. Knowledge of the nature and defects of Indian diets, and how the latter can most easily be corrected, is a necessary basis for effective action. Even in existing economic circumstances much can be done. Nutrition work can be included in the programmes of Public Health departments, school medical services, rural reconstruction agencies, and so on. The development of agriculture, animal husbandry, and fisheries can be influenced by knowledge of dietary requirements.

Health education, which naturally includes education about diet, can be extended. Improve health and you increase energy and economic capacity; the vicious circle, poverty, malnutrition, ill-health, poverty, is broken and replaced, so to speak, by an ascending spiral. Take, for example, malaria. Malaria causes a million deaths annually in India and an untold amount of physical debility; it is a direct cause of malnutrition because victims of the disease, languid from

[15] Mitra, K., *Ind. Jour. Med. Res.* 1941; 29: 143.

impoverished blood, cannot cultivate their land properly and improve their lot. Vigorous anti-malarial measures will thus tend to improve food supply and the national diet, and the same is true of many other public health activities Health education has not yet been developed to any extent in India. Recently the writer put two questions to a senior class of boys in a High School. These were: What is t e cause of malaria? Do you know anything about the nutritive value of different foods? Blank silence greeted both questions; the boys had not heard of these subjects, of vital importance to their own welfare and that of their country. Every school child should be taught some elementary facts about health diet and disease.

A detailed discussion of the various means of improving standards of nutrition—of the various aspects of public health nutrition work—would be outside the scope of this article. Numerous reports of the League of Nations and the International Labour Office have dealt with these questions. But one interesting and remarkable possibility may be briefly referred to in conclusion. Normally, when we are considering the improvement of diets, we think in terms of ordinary familiar foods—more milk, more vegetables, and so on—a point illustrated in Table 1 But within recent years, the chemical composition of a number of the important vitamins has been discovered and some of these can now be manufactured in large quantities. Vitamins produced in this way are just as valuable to the body as vitamins contained in foods.

Further developments in research and industry may make it possible to manufacture vitamins at very low cost. In England pure synthetic vitamin B_1, costing about four shillings per gramme, is being added to refined wheat flour to bring its nutritive value nearer to that of whole wheat. Human daily requirements of vitamin B_1 are one to two thousandths of a gramme (1–2 milligrammes). This is a war measure, perhaps unnecessary in normal times when there is less danger of the diet of the population being deficient in this particular vitamin. But considerable discussion is at present taking place in America about the value of "fortifying" foods such as bread with synthetic vitamins, although the American diet has not been restricted by the war. Similarly, certain essential mineral elements, such as calcium and iron, could be given in the form of a pill or capsule, as an addition to the diet. Consumed in this form they produce the same effect in the body as when they are taken as ingredients in ordinary foods.

In some of the Southern United States there is a great deal of malnutrition among the poor whites and negroes—economically depressed and backward groups. It has been found that supplying such people with the vitamins they lack, in the form of daily doses additional to their ordinary diet, may produce an immediate improvement in their general health and shake them out of the lethargy engendered by malnutrition. Dispirited and chronically wretched individuals, it is claimed, may be thus transformed into healthy and active citizens. The cost of the necessary synthetic vitamins is even now not very great.

The idea of giving malnourished school children in India a daily capsule containing more than their daily requirements of various essential vitamins and minerals at present seems rather outlandish. But to any one unfamiliar with discoveries in bacteriology and immunology, the idea of preventing various diseases by the systematic inoculation of thousands or even millions of people would seem equally peculiar. In this instance the state produces the vaccines—against the small-pox, plague, cholera, enteric, etc.—very cheaply and the people have learnt, or are learning, to take advantage of them. A few properly staffed and equipped "vitamin factories" might produce vitamins by the ton and the cost of per capita requirements might work out at a low figure.

These speculations are perhaps somewhat out of tune with existing realities. But they may serve to emphasise the fact that science, so to speak, usually has a few aces up her abundant sleeve. Failure to produce results is not characteristic of the scientific method. An impartial analysis of the economic aspects of the problem of nutrition in India may leave little ground for optimism. But it is surely true that if the resources of science are brought to bear on the problem, progress can be made, however formidable the obstacles of poverty and ignorance.

(*The Indian Journal of Social Work*. Vol. II, December 1941).

EXTRACTS

Industrial Prospects for P. I. Rice. When we consider rice, however, particularly as it is used in the Philippines, we find that its century old uses have not increased. We still harvest the palay leaving the stubble in the fields to be burned before the next planting season. We still thresh the grain from the straw and just leave most of the straw to waste. We still mill the palay to get the polished rice and leave the hulls as a municipal nuisance and the best use we make of the bran and screenings is for animal feed.

Stalk and straw for building boards, paper. Once upon a time when the agricultural and industrial stage of the United States was at a level comparable with what we have in the Philippines now, the only use for corn was for feed. So we dare prophesy that in the future when the Philippines will have progressed much farther in her agricultural and industrial development, the utilization of rice will follow the trends enumerated below. Instead of cutting the rice at harvest time leaving a stubble varying from one to two feet, machines will probably be used to cut the rice plant close to the ground for the best recovery of the stalks and the straw. After threshing the grain the stalk and straw will probably be baled in the fields and deposited in central locations for ready transportation to factories. As we see it at present, the use will be in the building board and in the paper industry. The past three years of research undertaken by the NARIC have shown that building boards can be made on commercial machines from Philippine rice straw at a cost that will enable the finished product to meet open competition against similar products now in the market. These researches were not ordinary test tube experiments although, of course, they had their beginnings in a chemical laboratory. But after the work outgrew the test tube stage, studies were made in a commercial pilot plant in the United States with a firm of consulting engineers and chemists. A full report has been made and all that is now necessary is patience and courageous outlook to visualize future implications. For example, to make all the insulating wall-boards used in the Philippines the past year, a factory capable of making 50,000 square feet of board a day would be required. This would utilise the straw produced in at least 2,000 hectares plus the rice hulls produced in a mill area twice the size of Cabanatuan. The quantity of boards used in this country last year was almost double that used in the year before and almost four times that used three years ago. Building boards of this kind are so convenient and so logical for Philippine conditions that the use will no doubt extend farther and farther. Especially so if we can manufacture special kinds of boards for sidings, for floor and for roofings. It has been shown that these boards can be made from rice straw and rice hulls or a mixture of the two. As in most grain producing countries, our rice areas are already denuded of forests, and therefore construction lumber in these places is costly. Nipa roofing has grown into disfavour and people are more and more turning to galvanised iron roofings.

Uses of the hull. The above scheme of manufacturing building boards from straw includes hulls, especially for fuel. But the rice hull, in its own right, has

varied uses that promise commercial importance. As the need for certain chemicals like acetic acid, acetone and methyl alcohol increases the use of hulls in making these chemicals through destructive distillation will increase. As the milling of rice becomes decentralized into smaller units in the farm centres, and as our knowledge of gas producers as primary mover increases, there will be a more intimate tie-up between destructive distillation process to recover the chemical and the use of the resulting charcoal in the gas producers. Out of these gas producers will come out a mineral ash that has been shown to be appropriate in the production of silicates of soda of wide use in air-conditioning and in the packaging of perishable food products.

Valuable bran or tiki-tiki. After the milling to separate these hulls we still have the broken rice and the bran. The synthesis of the vitamin predominant in the rice bran has made available a very cheap vitamin product and has opened wide uses for it not only in medicine but also in agriculture. The varied research on uses of this chemical will no doubt open up still further fields for application. Fortunately for the rice industry this wide use will demand, as it now demands, the production of the vitamin extract from tiki-tiki, the natural source, because no matter how cheap the synthetic chemical is, a school of thought persists in the belief that the product from plant sources is more potent than the synthetic chemical. And so this scheme will most likely come to pass. The tiki-tiki as it passes out from the cones will go into treating chambers to preserve its fresh state. When needed it will be withdrawn from its storage bins into oil extraction plants. A solver will take out the oil content leaving a dried edible meal. Portion of this meal will be used in the manufacture of certified feeds in a granulated form for most efficient use. Another portion will be used in the extraction of vitamins leaving a product that is highly rich in protein and carbohydrates and of convenient adaptability in the making of plastic moulding powders. The oil extracted will be refined and sold as salad oil, or it may be hardened by hydrogenation and sold as such for mixing with refined coconut oil to make vegetable shortening. This scheme has been tried out in a measure much larger than laboratory scale and is practical and feasible Extraction of the oil by pure mechanical pressure has been done in our laboratory. Refining and hydrogenation were done in a laboratory in Chicago, Illinois.

The screenings. The screenings go to the fermentation industries either for alcoholic beverages or for industrial alcohol; to the food industries either as rice flour of which the demand is increasing or as rice starch for which particular uses have been found in the United States and the manufacture of which is an established industry.

So the possible future trends in the rice industry will be the complete utilization of the rice plant from the straw to the hulls to the by-products and the present waste products of milling and polishing. After three years of NARIC research work, the individual units or processes in this scheme have been worked to as near practical feasibility as possible. In the near future the tie-up of these individual units will have been solved and we look forward to the complete industrial utilization of the rice plant.

Industrial possibilities a necessity. This is not only a glorious dream; it is a necessity. The results of the activities of the NARIC, the anniversary of the establishment of which it celebrated last April have shown that between the farmers and the consumers of rice, the monetary equivalent of the difference between the raw and finished product has become less and less. It is necessary for the rice milling industry to have a wider margin in order to assure its perpetuity. It is necessary for the attainment of that wider margin to have profitable

utilisation of the products that now go to waste. This has been the fundamental philosophy behind all utilization researches not only with the NARIC these past years but with all the industries in the highly industrialized countries like the United States. At times the results seem not worth the expense and effort. It has always been demonstrated, however, in cold monetary value that research, no matter how far-fetched from the immediate objective, always pays.

And so we say that one of a researcher's feet is up in a cloud of dreams and the other on the hard, solid ground of reality. (*The Naric*, the Official Organ of the National Rice and Corn Corporation, Vol. 1, No. 2, July 1941, Manila, Philippines).

Composition of Ass's milk. By C. P. Anantakrishnan. (*The Journal of Dairy Research*, Vol 12, No. 2, pp 128–129). The total solids of samples of ass's milk ranged from 7·80 to 9·10, the solids-not-fat from 7·14 to 8·50, and the fat from 0·54 to 0·71 %. The nitrogen distribution in ass's milk is: casein 39·5, albumin 35·0, globulin 2·7 and non-protein nitrogen 22·8 % of the total nitrogen. Ass's milk contains: casein 0·70, albumin 0·62 and globulin 0·07 %. The total protein content is 1·39 %. Ass's milk is therefore characterized by a low casein, a low globulin and a high albumin content. The non-protein nitrogen consists of amino nitrogen 8·1 urea nitrogen 24·3 and uric acid 0·7 mg / 1000 ml of milk. The urea content is twice that present in cow's milk. The mean chloride and lactose contents of the milk samples are 0·037 and 6·1 % respectively. The average calcium and phosphorus content of ass's milk are 0·081 and 0·059 % respectively. Half the calcium is ionic, and half is in colloidal form. The phosphorus distribution is: total acid soluble 84·0, acid soluble organic 33·5, easily hydrolysable ester 27·4, inorganic 46·0, and colloidal inorganic 23·0 % of the total phosphorus. The ratio of CaO: P_2O_5 is 1:1. 46 % of the total phosphorus is in ester form; this is high when compared with only 12 % in cow's milk; most of the phosphoric ester forms soluble barium salts, which is a distinguishing feature of ass's milk. The total sulphur content is 15·8 mg. / 100 ml. The fat has a penetrating odour and is coloured orange-yellow. It has an iodine value of about 86, which is much higher than that for human milk fat. The Reichert (9·5) and Kirschner values (5·7) are low. In general, the composition of ass's milk resembles that of human rather than of cow's milk.

Press Notes.

A short note on Economic Planting and Manuring of Paddy.

The population of the Madras Province has increased during the past twenty years from 42·3 millions in 1920 to 48·4 millions in 1940, while during the same period the area under food crops, including paddy, went down from 28·333 million acres to 27·345 million acres. In 1920 paddy occupied 10·89 million acres and in 1939–40 it was reduced to 9·88 million acres The area under paddy, however, went up to 10·46 million acres in 1940–41 due to the improvement in prices of rice as a result of the war conditions. In any case, there is a definite decrease in the area of food crops, including paddy per head of the population and the deficit of rice was made good to some extent by the increase of acre yields but mainly by imports from Burma, Siam and Cochin China. Foreign imports have, however, considerably diminished during the past few months and are likely to diminish further in view of the extension of the present war to Burma. If, therefore, the Madras Province is to be prevented from the danger of the shortage of food grains, it is the duty of every cultivator to produce more yield by every possible means.

Confining our attention to the paddy crop, its production can be increased in two ways, viz., by the extension of irrigated area and by enhancing the yield per acre by better cultivation and better seed. The scope for expansion of the area under paddy is limited and the only way left is to explore every possible means of increasing the output per acre in lands already under cultivation. This can be achieved by growing better yielding varieties, by raising healthy seedlings and transplanting them at proper distances and by manuring the crop.

Better yielding varieties. It is admitted on all hands that the improved varieties distributed by the Agricultural Department yield decidedly better than the local varieties. Due however, to want of proper agency for the distribution of seed on mass scale the area covered so far by them does not exceed 25% of the total area sown to all varieties of paddy. Improved seed up to 95% purity is always available either with the Agricultural Department or with the cultivators and is, therefore, easily obtainable, provided the cultivators take a little trouble to make enquiries for it. The improved varieties give 5 to 15% more yield than the local varieties. By growing improved varieties alone the average yield of paddy can be easily raised up to 10%. Another important feature of these varieties is that they respond more readily to better cultivation and manuring than local mixtures.

Raising healthy seedlings. The local seed rate is 100 lb. and more per acre. The seed is usually sown very thick in nurseries and the weak thin seedlings are transplanted in bunches at the rate of 10 to 15 per hole. This practice results not only in big wastage of seed but also in the reduction of yield. The seed rate need not exceed 25 to 40 lb. per acre for growing a good crop. The seedlings raised with 25 to 40 lb. of seed in 8 to 10 cents of a well manured nursery, are healthy and robust and are enough to transplant one acre. A large number of ryots have now reduced seed rate; but the practice of higher seed rate still continues in many localities.

Transplanting. In paddy cultivation the distance at which the seedlings are transplanted has an appreciable influence on the yield of grain and straw. The optimum distance varies from 4 to 10 inches according to the season, the variety of paddy, fertility of the soil and the amount of manure applied, the main principle being that the crop, when it is fully grown, should be thick enough to cover the ground. In poor soils the plant does not tiller profusely and transplanting should therefore be limited to about four inches apart. In rich soils spacing can be given upto 10 inches. Further, distance does not result in high yield though the crop would look attractive with big clumps and long ear heads but it is not dense enough to give heavy yield On the whole, it is better to err on the side of closer spacing than wider spacing.

The local practice of transplanting seedlings in bunches of 10 to 15 per hole is uneconomic and results both in waste of good seed and reduction in yield. Where wider planting is to be adopted, there is no special advantage of transplanting in singles, as one seedling cannot tiller as much as two or more seedlings. It is therefore, safer to plant 2—4 healthy seedlings per hole.

Invest more money on Manuring. There is no farmer who does not know that manuring increases the yield of crops. The important principle that should be observed in manuring a crop is that the extra yield obtained from its application should not only cover the cost of manure, but leave a clear margin of profit. At present, due to war conditions, the price of paddy is fairly high, while the locally available manures such as oil cakes, bone meal and fish manure are selling at reasonable rates. This is a rare opportunity for all cultivators to apply manure liberally to their paddy crops and obtain good yields.

An average crop of paddy removes from an acre of land 48 lb. of nitrogen, 23 lb. of phosphoric acid and 41 lb. of potash. It therefore stands to reason that unless these plant foods are returned to the soil every time a paddy crop is taken from it, the land is bound to become gradually impoverished and gives poor yields. The paddy lands of our province are, however, well provided by nature with enough potash to last for centuries, and it is unnecessary that they should be applied with potash in any form. Phosphoric acid also is present, but not to the same extent as potash. It is therefore necessary to apply it at the rate of about one hundredweight of superphosphate or bone meal per acre. It should, however, be remembered that either of these manures gives best results when it is applied at the time of planting over the application of an organic manure, cattle manure, oil cake, fish manure, etc. Nitrogen, on the other hand, is least available in the soil, though it has the greatest influence on the yield. It can be replaced by the application of the above organic manures or chemical fertilizers like ammonium sulphate but the combination of a chemical fertilizer and an organic manure gives better yield than when either of them is applied singly. Organic manure, particularly, green manure, improves the texture of soil to encourage better root development and if therefore a part of nitrogen is applied in the form of green manure and the remaining in the shape of any concentrated manure like oil cake in two doses, one at the time of planting and the other at the time of weeding or about a month before flowering, a much better yield can be expected. To supply 48 pounds of nitrogen the quantity of manure to be applied is 4,000 lb of green manure, 600 lb. of ground-nut cake or 900 lb. of fish manure or two hundredweights of ammonium sulphate. The cheapest of these manures is green manure and oil cake comes next. Ammonium sulphate is the costliest and it is economical to use it in combination with either green manure or oil cake instead of using it alone.

The results of a manurial experiment on the application of green leaf, oil cakes before planting and sulphate of ammonia a month after planting conducted for three second crop seasons at the Agricultural Research Station, Pattambi, are given below :—

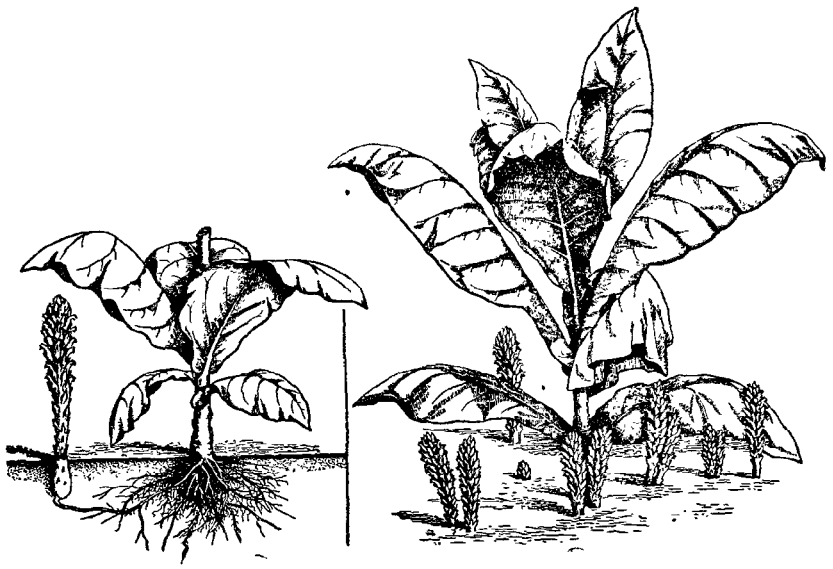
Results of Manurial Trials at Pattambi (South Malabar).

Treatment.	Kind of manure and quantity per acre (lb.)		Yield per acre (lb.)	Percentage increase over no manure plot.
Manures applied singly	1. Neem cake	600	1738	19
	2. Castor cake	500	1843	26
	3. Green leaf	4,000	1873	28
	4. Groundnut cake	400	1876	28
	5. Ammonium sulphate	80	1872	28
No Manure (control)		—	1461	
Organic manure used in combination with mineral manures.	1. Neem cake	600		
	Ammonium sulphate	80	2363	55
	2. Castor cake	500		
	Ammonium sulphate	80	2324	59
	3. Green leaf	4,000		
	Ammonium sulphate	80	2324	60
	4. Groundnut cake	400		
	Ammonium sulphate	80	2384	63

A review of the figures given above clearly indicates that the yield of paddy is considerably increased by the combined use of green leaf or oil cakes and sulphate of ammonia. The application of groundnut or castor cake gives the same yield as green leaf manure. In localities where green leaf is scarce and

not easily procurable, oil cakes can be freely used to manure the paddy crop. In every part of the province green leaf and oil cakes have given definite increase of paddy yields. As far as possible, effort should be made to grow green manure crops in one's own holding.

At the present time, when the war is almost at our doors, it is the sacred duty of every cultivator to manure his paddy crop and increase its production to make good the shortage of rice formerly met by imports from Burma and other countries.



A Menace to Tobacco Cultivation (contributed).

Broom-rape (*Malle* or *Bodu* in Telugu) is a flowering plant parasite which attacks tobacco, brinjal and tomato. In recent years it has become a serious menace to the tobacco industry in the districts of Guntur and Kistna. Very recent reports show that the parasite is spreading to Godavari district also. The loss to tobacco growers in Guntur district alone in 1940 has been estimated to be about Rs. 35 lakhs. Tobacco growers are therefore advised to take prompt measures for its eradication.

Malle grows on the roots of the tobacco plant. Being a parasite which is not capable of drawing its food from the soil, it robs the tobacco plant of large quantities of food and water. Attacked tobacco plants lose their vigour, become flaccid and show a stunted growth. The yield is reduced and more than anything else, the quality of the cured leaf is very poor. When a field is badly infested it does not pay even to harvest the crop.

It is imperative, therefore, that every tobacco grower should be able to recognize *Malle* in the field and not only pull it out as soon as it shoots out of the ground, but also carefully collect all *Malle* and destroy them either by fire or by burying them deep in a pit. The parasite spreads from field to field and from season to season by means of tiny seeds which are produced in large numbers and shed into the soil. The tiny seeds are known to lie dormant in the field, but readily sprout and grow only when tobacco, brinjal, tomato etc., are grown.

Leaflet No. 95 of the Department of Agriculture (obtainable free from the nearest Agricultural Demonstrator) gives full details of the parasite and the

methods of controlling it. Neglect on the part of tobacco growers to remove the parasite before it sets seeds and carelessly throwing about collected *Malle* without destroying them, will lead to a hundredfold multiplication of the parasite each year. Goats and sheep graze on *Malle* and the seeds of *Malle* pass through their bowels without injury. The use of manure collected from these animals is another source of infection. Government have recently passed a law making it incumbent on every tobacco grower in the Circars to look for *Malle* in their fields, collect them before seeding and bury them deep in a pit. This is a simple remedy which men, women and children in a household can do with ease. Failure on the part of growers to carry out this simple operation renders them punishable with a fine of Rs. 50 or imprisonment.

A Short Note on Pyrethrum Cultivation.

Introduction. Insects such as flies, mosquitoes, bugs, fleas, locusts, lice and other annoying vermins not only carry disease and death to animal kingdom but also cause damage and destruction to vegetation which is the basic food of animals. The insect-borne epidemics as malaria, filariasis, yellow fever, typhoid, cholera, plague, etc., are too well known. Hence the necessity to seek economic remedies to destroy these dangerous insects is quite obvious.

A very good remedy is found in one of the cheapest and most effective insecticides called 'Pyrethrum' obtained from the flowers of a hardy perennial herb, Pyrethrum, widely cultivated in Japan, Dalmatia and other countries. It is a Chrysanthemum-like plant flowering profusely and seeding freely. The flowers of this herb, and to a less degree the leaf and stalk too, contain the insecticidal principles. If those countries could so easily grow this plant and commercialise its product, why not we grow this Pyrethrum in our soils and prepare the valuable insecticide ourselves?

Cultivation. With this object in view, the Imperial Council of Agricultural Research, Delhi, obtained Pyrethrum seed from other countries and distributed the same for trial in different Agricultural Stations in India in 1937, and from its performance thus far, it may now be said that this hardy herb of Pyrethrum can be recommended for cultivation in a wide range of soil at elevations of over 3,000 feet. Like potato, Pyrethrum thrives best in equitable climate and so hills appear to be better suited than plains for its cultivation in the tropics.

As Pyrethrum does less well under very wet conditions, the seed may be sown in raised beds, preferably in warm or dry months. About ½ lb. of seed will give sufficient seedlings for planting an acre. If sown early in March after the cold weather the seedlings may be pricked out by the end of April and transplanted in July in previously prepared beds at 18 inches apart each way. Subsequent operations consist of weeding and watering at intervals during dry weather. Light manuring during wet weather helps the plants to grow with the rains. Further propagation may also be done vegetatively from suckers after the harvest of flowers.

When the crop is about sixteen months old the flowers begin to appear and they are collected weekly with about 10 inch stalk. The proper signs for harvest are the flattening of the petals and opening of two to three outer florets in the disc. The flowers are cut from their stalk and both these dried in the open separately in thin layers for a few days and then indoors. The drying is complete when the flowers crumble on pressing and the stalks break on bending. While storing, care should be taken to keep the produce free from mould, so that the insecticidal property may be maintained. The yield of dried flowers is estimated at about 400 lb. per acre.

Uses. As the Pyrethrum leaves contain insecticidal principles in small quantities, the leaf dust is added to the flower-powder to give bulk. The dried flower-stalks are mixed with a little quantity of dried flowers and finely ground. This powder is added to cinnamon leaves and sufficient glutinous powder mixed therewith to stiffen them into sticks which are familiarly known as 'Mosquito coils'. These coils, when lighted, burn slowly and the fumes choke the mosquitoes to death, thus deterring them from approach.

Hand-dusters are filled with Pyrethrum flower powder and worked against the plant parts affected by insects, just as sulphur is dusted against 'fig rust' and 'grape mildew'.

Liquid extract mixture of Pyrethrum is sprayed against lice and vermin. Pyrethrum petrol extract is used to destroy dust and dirt carriers like house flies.

Commercial value. It was generally believed that insecticides can be prepared only through powerful chemicals which are rare and expensive. Of late these costly chemicals have been almost completely replaced in Japan by this simple insecticide 'Pyrethrum'. Further, that country is now in a position to export large quantities of this insecticide far and wide, successfully competing with other chemical insecticides.

Conclusion. The Agricultural Department having once opened the eyes of the public on the commercial importance of this cheap and easy crop, it is now the duty of the public to commercialise it with due State Aid. It is interesting to note that some planters have already taken to cultivation of this valuable crop on the Nilgiris and the success noticeable therefrom is sure to result in extensive cultivation of this simple herb for commercial production of its 'Pyrithrin' to meet the daily increasing demand of this valuable vegetable insecticide.

Crop & Trade Reports.

Statistics—Crop—Sugarcane—1941—Third and final report. The average of the areas under sugarcane in the Madras Province during the five years ending 1939-40 has represented 2·9 per cent of the total area under sugarcane in India.

The area planted with sugarcane in 1941 is estimated at 112,110 acres. When compared with the corresponding estimate of 161,850 acres for the previous year and the actual area of 161,716 acres according to the Season and Crop report, the present estimate reveals a decrease of 30·7 per cent. in each case. The estimate of the previous year was practically the same as the actual area being greater than it only by 0·08 per cent.

The present estimate of area exceeds the second forecast by 7,120 acres. The excess occurs mainly in East Godavari, Kistna, the Central districts and Madura.

The estimated area is the same as that of last year in Tinnevelly and Malabar. A slight increase in area is estimated in South Kanara and a decrease in area in the other districts of the Province, especially in Vizagapatam (−5,770 acres), Bellary (−4,770 acres), South Arcot (−11,520 acres), North Arcot (−4,870 acres), and Trichinopoly (−6,200 acres). The decrease in area is due mainly to the low price of jaggery at the time of planting.

The present estimate includes an area of 8,520 acres under ratoon sugarcane in the districts of Vizagapatam (6,300 acres), West Godavari (900 acres), Bellary (150 acres), Chingleput (50 acres), South Arcot (150 acres), Chittoor (550 acres), Salem (30 acres), Coimbatore (260 acres), Trichinopoly (50 acres), Tanjore (40 acres) and Malabar (40 acres).

The crop suffered to some extent from insufficient rainfall in parts of the Circars and from cyclone early in December in Chingleput, South Arcot and North Arcot. The condition of the crop is generally satisfactory in the other districts. The harvest has just commenced. The yield per acre is expected to be above the normal in Salem (120 per cent) owing to the replacement of local varieties by improved strains and in Ramnad (105 per cent), normal in Guntur, Anantapur, Tanjore, Madura, Tinnevelly and South Kanara and below normal in the other districts. The seasonal factor for the Province as a whole is estimated at 95 per cent. of the average as against 97 per cent in the previous year according to the Season and Crop report. On this basis, the yield is estimated at 3,021,670 tons of cane or 327,440 tons of jaggery (gur) as against 4,430,030 tons of cane or 484,760 tons of jaggery (gur) according to the final figures of the previous year. The present estimates reveal a decrease of 31·8 per cent. of cane and 32·5 per cent. of jaggery (gur) as compared with the previous year.

The wholesale price of jaggery per Imperial maund of 82 and $\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 26th January 1942 was Rs. 5—8—0 in Vizagapatam, Rs. 5—5—0 in Trichinopoly, Rs. 5—4—0 in Rajahmundry and Cuddalore, Rs. 5—2—0 in Vellore, Rs. 4—15—0 in Adoni and Salem, Rs. 4—8—0 in Cocanada, Rs. 4—7—0 in Chittoor Rs. 4—2—0 in Vizianagram, Rs. 4—1—0 in Bellary and Rs. 3—12—0 in Coimbatore. When compared with the prices published in the last report, i e. those which prevailed on 8th December 1941, these prices reveal a rise of approximately 49 per cent. in Salem, 27 per cent. in Bellary, 20 per cent. in Cuddalore, 17 per cent in Vellore, eight per cent in Chittoor, six per cent in Rajahmundry and five per cent in Coimbatore and a fall of approximately 10 per cent in Trichinopoly and three per cent in Vizagapatam and Cocanada, the prices remaining stationary in Vizianagram and Adoni.

Statistics—Crop—Gingelly—1941-42—Intermediate condition report. Sowings of late gingelly are in progress in most districts and the germination is reported to be satisfactory outside Ramnad and Tinnevelly where the crop is reported to have been affected by insufficient rainfall in December 1941.

The wholesale price of gingelly per Imperial maund of 82 and 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on the 2nd February 1942 was Rs. 7—4—0 in Tinnevelly, Rs. 6—15—0 in Cuddalore and Trichinopoly, Rs. 6—12—0 in Tuticorin, Rs. 6—10—11 in Cocanada, Rs. 6—6—0 in Salem, Rs 6—3—0 in Ellore, Rs 6—1—0 in Rajahmundry and Rs. 5—14—0 in Vizagapatam and Vizianagram. When compared with the prices published in the last report, i. e., those which prevailed on the 5th January 1942, these prices reveal a rise of approximately one per cent in Trichinopoly and a fall of approximately eight per cent in Rajahmundry, seven per cent in Cocanada and Tuticorin, three per cent in Cuddalore and two per cent in Vizagapatam, the prices remaining stationary in Vizianagram, Ellore, Salem and Tinnevelly. *Director of Industries and Commerce*, Madras.

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1941 to 31st January 1942 amounted to 645,424 bales of 400 lb. lint as against an estimate of 503,500 bales of the total crop of 1940—41. The receipts in the corresponding period of the previous year were 541,922 bales. 646, 852 bales mainly of pressed cotton were received at spinning mills and 61,986 bales were exported by sea while 139,666 bales were imported by sea mainly from Karachi and Bombay.

The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st to 13th February 1942 amounted to 4,091 bales of 400 lb. lint as against an estimate of 441,100 bales of the total crop of 1941—42. The receipts in the corresponding period of the previous year were 10,546 bales. 20,323 bales

mainly of pressed cotton were received at spinning mills and 395 bales were imported by sea from Bombay, while exports by sea were nil. *Director of Agriculture*, Madras.

Mofussil News and Notes.

Chidambaram. An Agricultural Exhibition was held during the *Arudradarsanam* festival between the 27th December '41 and 2nd January '42. Improved strains of paddy, sugarcane, groundnut, gingelly and castor, grafted and budded citrus and mangoes, fodder grasses, green manure seeds and tillage implements were exhibited. Malt making, shelling paddy in wooden grinders and trapping fly maggots were demonstrated daily. Models of ideal cattlesheds, manure pits and urine earth shed attracted a number of visitors. Illustrated posters detailing all the improvements advocated by the Department were a feature. Lantern lectures were delivered daily in the nights. T. G. M.

Sriraugam. An Agricultural and Industrial Exhibition was held under the auspices of the Trichinopoly District Agricultural Association during *Vaikunta Ekadasi* festival, near the Srirangam Railway Station. The Exhibition was opened by Dr. T. S. S. Rajan, Ex-Minister. Paddy strains suited to the tract with charts and plants showing the superiority of the strains occupied the central portion, while improved strains of millets, oil seeds and cotton occupied one wing and posters showing the method of controlling insect pests and diseases and charts on apiculture and poultry occupied the other wing. The method of grading eggs and rice were demonstrated and the advantages of purchasing "Agmark" graded articles and of marketing the produce through the marketing societies were explained to the visitors. Specimens of green manure and fodder crops were also grown in a plot adjoining the stall; model manure pits and cattle shed were erected, and improved ploughs and other useful implements were also exhibited. An agricultural drama "*Useful Ryot*" was staged by the District staff on the 5th January 1942, which was greatly appreciated by the large number of visitors who attended the play. T. G. A.

Alatur—Palghat. An exhibition was held in the Alatur High School from 14th to 17th January 1942 (inclusive) on the occasion of the Science Exhibition held in aid of the war fund. Samples of improved paddy seed, green manure seeds, posters on improved crops and control of insect pests and diseases were all put up with explanatory notes. Improved ploughs and sprayers were also put up. The extraction of honey and the maintenance of bees in the colonies were actually demonstrated. A. G. N.

Pulivendla. An Agricultural Exhibition was held during the *Mahasivarathri* festival. Improved ploughs and implements both for dry and garden lands, improved strains of paddy, millets and cotton, and green manure crops, oil cakes and other fertilizers were put up. Interesting posters in Telugu were prominently exhibited and leaflets on agricultural topics were widely distributed. Horticultural implements, bee-keeping appliances, and machinery used in the control of plant diseases, models of manure heaps and pits and specimen crops in pots were also on show. S. V.

Estate News.

Students' Corner—Club Activities. There was a lecture on "Indian Rural Credit" under the auspices of the students' club on the 19th January by Sri N. Subrahmanyam, Advocate, Coimbatore, with Sri T. Nataraj, Assistant Lecturer in Agriculture, in the chair.

There was a second lecture on the 23rd January by Sri Rao Bahadur B. Visvanath, Director, Imperial Agricultural Research Institute, New Delhi, with Sri Rao Bahadur G. N. Rangaswami Ayyangar, the Principal, in the chair. The lecturer dwelt at length on soil fertility, statistical interpretation of experimental results, plant breeding, etc The hall was packed to full capacity with officers of the department, the students and the public and the lecture was listened to with rapt attention.

"Our Indian villages" formed the subject of a third lecture that was delivered by Sri Rao Bahadur Dr. Sir T. S. Venkataraman, the Imperial Sugarcane Expert, on the 2nd February; Sri K. R. Narayanaswami, student of Class I occupied the chair. The lecture was accompanied by lantern slides and lasted for nearly an hour and a half, and was very interesting.

The Annual Club Day was celebrated on Saturday, the 21st February, 1942 with great eclat and enthusiasm. It was a day of great joy to one and all the students. The sports and tournaments connected with the Club Day had been concluded earlier. The celebration commenced with "Tea" as usual at 4-30 P. M. There was the fancy dress competition, a regular feature of every Club Day which provided great amusement to visitors. After tea, the guests and students adjourned to the beautifully decorated Freeman Hall, where a meeting was held with A. S. Panchapagesa Ayyar, Esquire, M. A (Oxon), Bar-at-Law, I. C. S., District & Sessions Judge, Vellore, in the chair. Mrs. Y. G. Krishna Rao Naidu distributed the prizes.

Essay Competition. The annual essay-writing competition was held on 19—1—1942 in the Freeman Hall. The subject was "Does the Bombay Pentangular Cricket Tournament foster communalism?" Messrs. C. L. Sundararajan, T. M. Venkataraman and H. Gurubasavaraj were the successful candidates in the order of merit.

Elocution contest. "Are scientific inventions conducive to the welfare of humanity?" was the subject for the general annual elocution contest held at 5—30 P. M. on 3—2—1942. Messrs. H. Gurubasavaraj, C. L. Sundararajan and C. Srinivasan were declared first, second and third respectively.

Inter-tutorial competition. "What are the present day requirements of a social welfare organisation?" was the subject for inter-tutorial oratorical contest in which C. Narasimha Ayyangar's wards won for a second time, the C. Ramaswami Cup.

Cricket—Rhondy Shield. Our College played a match with the Palghat College on 28—1—1942. We had first tenancy of the wicket and scored 163 in all (C. N Babu 88 and Sankara Rao 43) while our opponents were all out for 87 runs (Kothandaraman 6 for 20). In the final match that was played on 13—2—1942 between our College and the local Arts College, we scored 151 for 9 [the veteran H. Shiva Rao, (the Deodhar of this College) 68 and C. N Babu 25] while the Arts College were skittled out for 87, thanks to the glorious performance of Kothandaraman (the Sarwate of this College) who took 7 wickets for 18 runs, and thus annexed the Shield for the fifth time in succession.

Foot-ball. B. M. Lakshmipathi's wards beat K. M. Thomas' wards.

Tennis. G. Suryanarayana won the singles title after a keen fight with A. Subbaraju.

Handicap Doubles. G. Suryanarayana and P. Y. Chintamani beat T. Chellappa and D. Sreedhara Sastri.

Half-yearly Conference of the District work officers, Coimbatore and the Nilgiris Districts. This Conference was held at the Freeman Hall, Agricultural College,

Coimbatore, from the 16th to the 21st February (both days inclusive) when the District Agricultural Officers, Coimbatore and the Nilgiris, and all the demonstrators of the two districts were present. There were five sittings with visits to the Research Sections, Breeding Stations, Central Farm and the P. S. G. Industrial Institute, Peelamedu.

The Madras Agricultural Students' Union. The members of the Managing Committee and Editorial Board of the Union entertained at Tea Mr. R. C. Broadfoot, N. D. A. C. D. A. (Hons.), the retiring Principal and the President of the Union, on the 27th January 1942. Sri. Rao Bahadur G. N. Rangaswami Ayyangar, B. A., F. N. I., I. A. S., the incoming President and Principal, was also present. Mr. Broadfoot while thanking the hosts impressed on the fact that agriculture is the most important of the industries and it has been recognised as such especially today when on account of the present war, the need for sufficient supply of food has been felt by one and all the nations of the world.

Agricultural College Officers' Club. The annual general body meeting of the Agricultural College Officers' Club was held on Thursday, 29th January 1942, with the President Sri H. Shiva Rao in the chair. To start with, a resolution was passed congratulating Dr. Sir T. S. Venkataraman, C. I. E., I. A. S., one of the Life members of the club, on the well merited honour of knighthood conferred on him. The office bearers for the year 1942 were elected:— Messrs. H. Shiva Rao, C. Balasubramaniam and S. V. Parthasarathy were elected as the President, Secretary and Treasurer respectively for a second time in succession. Dr. K. Narayanan was elected as the Vice-President.

The Fieldmens' Association. At the annual general body meeting of the Association held in December 1941 Sri. A. Raju Pillai was elected President and Sri. C. S. Narayanaswami Ayyar, Secretary.

Scouting. On 27th December 1941 the scouts of the Ramakrishna Scout Group went on a days' outing. The boys enjoyed the camp thoroughly and are now clamouring for another camp in the immediate future. The Group celebrated "Parents' Day" on 31st January 1942 with Rao Bahadur Sri G. N. Rangaswami Ayyangar, Principal, Agricultural College, presiding. There was a large and distinguished gathering present, and the displays which the boys gave won universal praise. In token of his appreciation of the work of the Group, Rao Bahadur Dr. T. A. Raja, M. B. E., District Scout Commissioner, has agreed to bear the expenses for a cubs' camp to be undertaken in February 1942.

Association of Economic Biologists. Under the auspices of the Association, a lecture was delivered on 31—1—1942 at the Freeman Hall by Dr. R. Sankaran, M. A., Ph. D., Cotton Botanist, Mirpurkhas, Sind, on "Cotton Cultivation in Sind."

Visitors. P. H. Rama Reddi, Esquire, the Director of Agriculture, Madras, Dr. G. W. Padwick, Ph. D., the Imperial Mycologist and Dr. R. Sankaran, M. A., Ph. D., Cotton Botanist, Mirpurkhas, Sind, visited the Agricultural College and Research Institute, during the month.

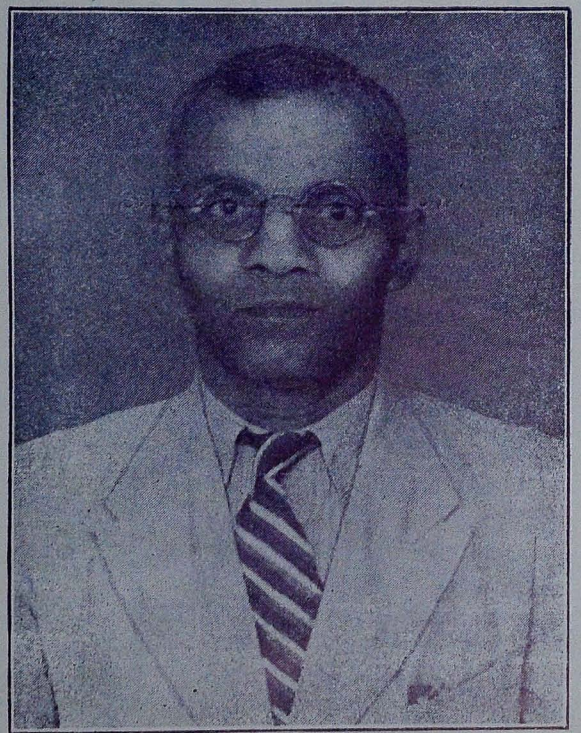
RETIREMENT

R. C. Broadfoot.

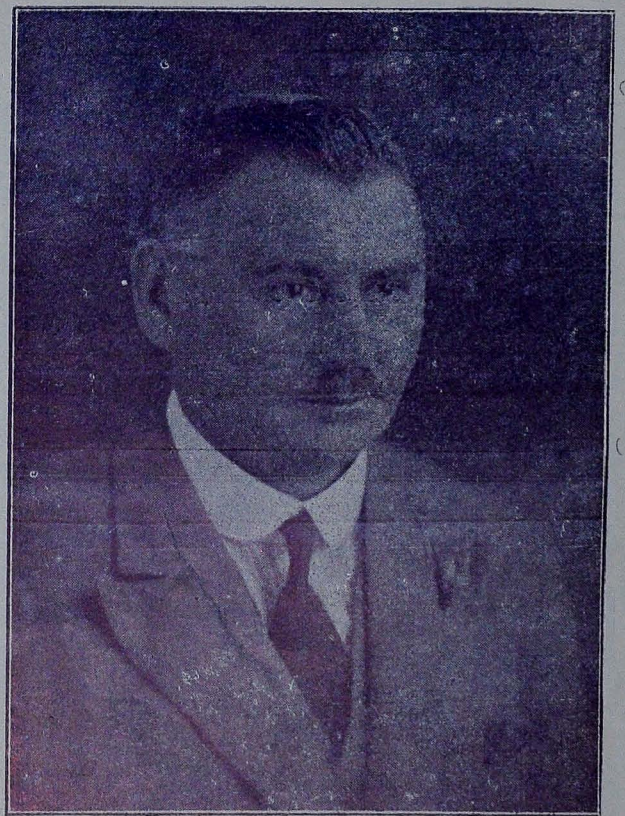
Mr. Robert Campbell Broadfoot, Principal, Senior Lecturer in Agriculture and Superintendent, Central Farm, Agricultural College and Research Institute, Coimbatore, retired from service this month.

Broadfoot was born at Nether Cairn, Kirkconnel, Dumfriesshire, Scotland, on 5th February 1887. As the second son of a farmer, he was reared on the farm and from birth had therefore strong predilections for Agriculture. He was educated at the West of Scotland Agricultural College, Glasgow and the Dairy School of Scotland, Kilmarnock, during the years 1913 to 1916. Bright as he was, he gained the College Diploma in Agriculture with Honours in 1916, and became distinguished as the Dux and Agriculture Gold Medalist in the final year. He took the National Diploma in Agriculture at Leeds in 1916 and won the first rank, thereby becoming distinguished once again, as the winner of the Fream prize in Agriculture. In October 1915, Mr. Broadfoot started life in the Army reserve where he served for six months and then entered active service where he passed a period of about three and a half years. He arrived in India in 1916 with the Royal West Kent Regiment at Jubbalpore and was appointed Manager, Military Farms Department, Bagargi, Sind in 1917. He took charge of the Military Farms Probationary Managers classes in 1917—18 and '19. He was appointed to the Indian Agricultural Service and joined in Madras on 19th May 1919. On the 1st June 1919 he became Deputy Director of Agriculture and Superintendent, Central Farm and from October to end of November in the same year, he functioned as Assistant Professor of Agriculture in addition to his own duties. He was Deputy Director of Agriculture at Madura for various terms between 1920 and 1932 and at Coimbatore in '29 and '34 and he was Deputy Director of Agriculture Headquarters, Madras, for about a year in 1934--35. He was also Cotton Specialist in '24, '28 and '31. Though he officiated as Principal in addition to his own duties as Cotton Specialist in 1924, he became the full time Principal in June 1935 and had the additional duties of Senior Lecturer in Agriculture and Superintendent, Central Farm, in 1938, when teaching and research became amalgamated and he held these posts till the date of his retirement. He was appointed Member of the Indian Central Cotton Committee, Bombay, in April 1924.

Mr. Broadfoot is a gentleman in the full sense of the term. Born of a simple farmer's family, he has inherited all the noble qualities characteristic of such families which may be expressed concisely in two words, namely, plain living and high thinking. Simple and thrifty in his habits, he used to have a love for everybody and was ever covered with a smile. He has never been seen, in all his life, to frown or fret at anything or anybody, and



Sri K. Unnikrishna Menon.



Mr. R. C. Broadfoot.

used to exhibit a remarkable capacity for a calm and collected disposition under all circumstances. As the Principal of the College, he was ever a friend, philosopher and guide of the students and evinced a very great interest for all the activities connected with students. Owing to the prevailing war conditions, Mr. Broadfoot is unable to go back to his native land and is now spending his well-earned rest in our midst. He continues to be a member of the Union, and as Principal he was ex-officio President for a number of years. His interest in the Union has always been very great. On behalf of the Union, we wish him a long, happy and peaceful time in his retired life.

Departmental Notifications.

Gazetted Services.

Appointment.

Sri. K. Jagannatha Rao, Agricultural Demonstrator, Badvel, is appointed to officiate as District Agricultural Officer, and is posted to Vellore *vice* Sri. A. Ramaswami Ayyar, proceeding on leave.

Posting.

Sri. V. T. Subbayya Mudaliar, D. A. O. on leave, is posted as Junior Lect. in Agri. & Asst. Supdt., Central Farm, Coimbatore.

Leave.

Sri. K. Raghavacharya, Junior Lect. in Agri. & Asst. Supdt., Central Farm, Coimbatore, l. a. p. for 6 months on m. c. from the date of relief.

Subordinate Services.

Transfers.

Name of officers.	From	To
Sri. V. Kumaraswami,	A. D. Kandukur,	A. D. Vayalpad.
,, P. R. Subramania Ayyar,	A. D. Tiruttani,	A. D. Kandukur.
,, C. Vadamalai,	A. D. Vayalpad,	A. D. Tiruttani.
,, T. K. Balaji Rao,	A. R. S. Aduturai,	Asst. in charge, A. R. S. Pattambi.
,, S. Ramachandran,	A. D. Koilpatti,	A. D. Ponneri.
,, K. L. Ramakrishna Rao,	A. D. Ponneri,	A. D. Badvel.

Leave.

Name of officers.	Period of leave.
Sri. K. M. Venkatachalam Pillai, South Arcot Groundnut Market Committee, Cuddalore,	L. a. p. for 4 months from 2—1—'42.
,, V. Achyutaramayya, A. D. Jami.	Extension of l. a. p. on m. c. for one month from 28—1—'42.
,, Bhagirathi Padhy, A. D. Palakonda,	L. a. p. for 1 month from 16—3—'42.
,, P. M. Appaswami Pillai, A. D. Attur,	Extension of l. a. p. for 2 months from 15—2—'42.

Sri. S. Ramachandra Ayyar, Asst. in Entomology, Coimbatore.	Extension of l. a. p. on m. c. for 6 weeks from 10—2—'42.
,, R. Kolandavelu Naicker, A. D. Peravurni.	Extension of l. a. p. for 1 month from 7—2—'42.
,, K. L. Ramakrishna Rao, A. D. Ponneri,	L. a p. for 3 months from the date of relief.
,, P. Kesavanunni Nambiar, F. M. A. R. S. Taliparamba.	L. a. p. for 1 month from 1—2—'42.
,, T. Gopalan Nayar, F. M. A. R S. Taliparamba.	Extension of l. a p on m. c. for 1 month from 26—1—'42
,, P. S. Narayanaswami, Asst. in Chemistry, Coimbatore.	L. a. p. for 1 month and 1 day from 20—1—'42.
,, K. Narayanan Nair, A. D. Namakkal.	L. a. p. for 4 months from 1—2—'42.
,, M. P. Gowrisankara Ayyar, A. D. Lalgudy,	L. a. p. for 4 months from 1—2—'42
,, S. Mayandi Pillai, Cotton Asst. A. R. S. Nandyal.	Extension of l. a. p on m. c. for 1 month and 15 days from 13-1-'42.

OBITUARY

John A. Muliyil.

With profound sorrow, we record the demise of one of our esteemed colleagues and friends Dr. John A Muliyil, B. A., Ph. D. He was born in 1891 as the first son of Professor Joseph Muliyil of the Madras Christian College. He had his education at the same institution where his father served, and graduated in the year 1915. For some time after graduating he worked as a tutor in his "Alma Mater". He joined the Entomological Section of the Madras Agricultural Department in 1917 and rose to the Gazetted rank in 1931. In 1934 he left for Ireland where he took the Doctorate degree in Dublin under Professor Katenby and returned to India in 1936. He acted as Lecturer in Agricultural Zoology at the Agricultural College, Coimbatore, till 1938, when he left for Delhi as Biological Control Officer of Sugarcane Pests under the Imperial Council of Agricultural Research.

Dr. Muliyil was a born good soul. A man of versatile activities, he achieved not a little success in his scientific works. He was associated with the control of *Pollu* beetle, biological control of *Nephantis* and of sugarcane pests. In society Dr. Muliyil always made his mark as an entertaining conversationalist. He was full of humour and pleasing manners and won the regard and esteem of his friends and the respect and love of his students as an impressive teacher.

He passed away on Saturday, the 21st February, after a prolonged illness patiently borne. He leaves behind three sons and a daughter, besides his brothers and sisters to mourn his loss, his wife having predeceased him. In the death of Dr. Muliyil we have not only lost one of our best friends but a sincere worker in the Department. The Madras Agricultural Students' Union extends its sympathies to the members of the bereaved family.