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EDITORIAL

Fertilizer situation in India The increased demand for fertiiizers that has arisen as a result of the inauguration of the Grow More Food campaign, has created a difficult situation. The problem has become rather acute during recent times as the import of artificial fertilizers which amounted to about 100,000 tons annually during pre-war times has almost ceased and India'a output which is very much limited cannot meet the growing demand to any tangible extent. With the phenomenal increase in the price of all agricultural commodities and more especially of the commercial category, farmers are eager to increase the output of all crops and thereby derive greater profits from their lands. They readily resort to a more liberal application of manures to their lands than they were accustomed to during the depression days of the pre-war period and vie with one another in procuring all available stock. Due to this increased demand and short supply, the prices of all artificial manures and their indigenous substitutes have sky rocketted and made them almost out of reach of the small cultivator.

In England, it is reported that to ensure adequate supplies of fertilizers to all farmers alike, restrictions tantamount to rationing have been imposed and advice given on the economic doses to be applied to particular crops, so that each farmer may draw up his fertilizer programme and stock only the required quantity. While it is difficult to lay down such a policy for a country like India, in view of the varying needs of individual crops and soils, we suggest State intervention in guaranteeing adequate quantities of the required fertilizers to crops whose quality or yield is known to be definitely dependant on the application of fertilizers. For this purpose it is necessary to provide facilities to import larger consignments and enhance internal production by encouraging the few concerns that have been started in this country, by making available to them the necessary raw materials. The war has profoundly disturbed the equilibrium of agricultural production all the world over and any increase in the output of food and other essential requirements should be treated as a war effort of the highest magnitude.

Side by side with the drive for increasing the output of artificial fertilizers, efforts should also be made to enhance the availability of all organic manures and conserve and use them on scientific lines. The lack

of export trade in oilseeds which cast a gloom over the country at the beginning of the war has turned ultimately to the benefit of India as it has developed the local oil crushing industry and made available to her agriculture the valuable oil cake which is a rich source of organic nitrogen and an excellent substitute for ammonium sulphate.

Cattle manure which has been acknowledged all the world over to be the best manure for almost all crops is indifferently collected and stocked or burnt away as fuel. We have also seen how farm and town refuse and wastes are burnt away instead of being composted and turned back into the soil to supply the humus which is so essential for keeping up soil fertility. In order to avoid wastage of such potentially useful material, the Government of India have on hand a scheme for training a number of biochemists in the 'Bangalore process' of converting town refuse into manure ; and to make such persons available for service in the Provinces and States. It is hoped that the various local authorities will co-operate whole-heartedly in this effort of organising on a large scale the composting of all refuse to produce " wealth from waste " and aim at a larger production target as an essential auxiliary to the Grow More Food campaign.

The World Conference on Food Stuffs The recent announcement in the press that the Government of India have deputed Mr. P. M. Kharegat, I. C. S., Vice Chairman of the Imperial Conncil of Agricultural Research, and Dr. W. R. Aykroyd, Director of Nutrition Research, as their representatives to the World Conference on Food Stuffs, to be held in May 1943 in the U. S. A. is to be welcomed. The conference is to discuss postwar problems connected with food stuffs and other essential agricultural products, including problems of nutrition. The representatives will be joined in America by the Agent General, Sir G. S. Bajpai and India's Trade Commissioner, Mr. H. S. Malik. We hope that the conference will pave the way for planning Indian Agriculture on proper lines so as to produce a sufficient supply of the requisite type of crops and other food materials to give its people a satisfying and nutritious dietary.

The Madras Provincial Agricultural Association We are glad to learn, and to bring to the notice of our readers, the formation of an association of persons interested in the agriculture of the Province. The subscribers to the memorandum comprise prominent landlords from different parts of the Province. Sri B. Ramachandra Reddi, C. B. E , Nellore, is the President and Sri D. Munikanniah, B.A., B.L., Madras, is the Secretary. The Aims and Objects of the Association cover a wide range of subjects pertaining to agriculture and rural problems. Such an association is a long felt need for a predominantly agricultural country like ours The membership is open to *bona fide* agriculturists in the Madras Presidency. We hope that many of our readers who are agriculturists will enrol themselves as members and persuade other agriculturists to join the Association, and strengthen the cause of agriculture. Particulars may be had of the Secretary, The Madras Provincial Agricultural Association, Mount Road, Madras.

A New Variety of *Dolichos Lablab* and Its Economic Value

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There are two varieties of *Dolichos lablab,* one the climbing variety commonly grown in the kitchen garden for its tender pods, and the other the field variety cultivated on the dry lands, as a mixture with millets and whose seeds only serve as a pulse food for man. The former is known as *Avarai* (Tamil) or *Chikkudu* (Telugu) and the latter as *Mochai* or *Anumulu.* These are similar to the "snap" and "shell" varieties in the pea[1] *(Pisum sativum)* and in the French bean[2] *(Phaseolus vulgaris).* Between the two varieties of lablab many marked differences exist, morphological as well as physiological, but those that concern the cultivator are :

	The Kitchen garden variety	*The field variety*
i.	Pod edible; not fibrous	Pod not edible, fibrous; seeds only can be used, ripe seeds as a pulse and unripe seeds as a vegetable
ii.	A typical climber; requires '*pandals*' or other support	Bushy to sprawling in habit; no support necessary
iii.	Needs frequent irrigation	A rain-fed crop
iv.	Heavy manuring necessary and constant attention essential during growth	A hardy plant that comes up well even on comparatively poor soils; practically no care required after sowing

At the Millet Breeding Station, Coimbatore, where collections of both these varieties from almost all parts of the Madras province have been studied and numerous crosses between them have been made, it was observed that although the two varieties cross readily, the subsequent generations suffer from varying degrees of sterility. One of these crosses however was found to be fairly fertile. Its parents were D. L. 250, a fleshy, tasty and high yielding kitchen garden variety, and D. L. 231, a strain of the field variety. Continued selection in the progeny of this cross has resulted in D. L. 1428, a strain that combines the desirable qualities of both its parents and is at the same time as fertile as either of them[3]. Its pods are non-fibrous and as tasty a food material as some of the best varieties of the typical kitchen garden lablab. There is a slight trace of the smell of the field variety pod which is disagreeable to some, but this disappears on cooking.

This variety was grown for seed multiplication in a limited area (40 cents) last season, and to estimate its yielding capacity 100 rows, each 25

links long were marked out at random in this area and the green pods harvested at intervals. In all, eight pickings were taken and the harvests lasted from December to February. The yield as estimated from these rows amounted to 6,070 lb. of tender pods per acre (standard error=177 lb.). The approximate cost of cultivation per acre is given below:

		Rs.	As.	Ps.
Preparatory cultivation				
One ploughing with Victory plough (2 pairs, 2 men)	...	3	0	0
Wooden *guntaka* worked thrice (1½ pairs, 1½ men)	...	2	4	0
Manures and manuring				
Cost of 5 cart loads of farm yard manure	...	10	0	0
Carting and spreading (½ pair, 2 men, 2 women)	...	1	14	0
Ploughing with the wooden plough (1½ pairs, 1½ men)		2	4	0
Seed and sowing				
Cost of 10 lb. of seed @ Re. 1 per lb.	...	10	0	0
Sowing and covering (1 pair, 1 man, 1 boy)	...	1	12	0
Harvest				
Picking 6,000 lb. of green pods (120 women)	...	30	0	0
Cutting vines and removing (12 women)	...	3	0	0
	Total	64	2	0
Income				
Price of 6,000 lb. of pods @ 4 pies per lb.	...	125	0	0
Profit	...	60	14	0

The harvest of the green pods is the costliest item of the cultivation bill. When the variety is cultivated on a small scale so that the members of the cultivator's household could attend to the periodical harvests, the cost under this head can be lessened and perhaps entirely saved. Similarly the cost of the seed can be saved by preserving the seed from the previous crop.

Summary By crossing the kitchen garden variety of lablab with the field variety, a new variety has been evolved which combines the desirable qualities of the two and yielding pods that are equal in quality to those of the typical kitchen garden lablab. It is a leguminous vegetable suitable for growing in dry lands and its cultivation is profitable.

Acknowledgment. My thanks are due to Sri C. Vijayaraghavan, Millet Specialist, for guidance in estimating the economic worth of this variety.

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A Short Note on the Cultivation of Elephant Yam (*Amorphophallus campanulatus*)

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Introduction When propaganda for reduction of area of commercial crops like groundnut and cotton is done, it is desirable that profitable substitute money crops, which are at the same time food crops also should be suggested to the *ryots*. The substitute crops should be those that can be cultivated by the ordinary *ryot* without much cultivation expenses and at the same time easily marketable. One such crop is Elephant yam. It is a nutritive 'root vegetable' which can he stored for a long time. Extension of cultivation of this will add to the vegetable production in the country and at the same time be profitable to the cultivator.

This crop requires about 10 months to mature. It is usually planted in *Chitrai* (April—May) and harvested in *Thai* (January—February). A profit of more than Rs. 400 per acre can be secured in normal seasons by growing this crop. It is an exhaustive crop and can be grown in rotation once in three years in wet lands or garden lands. A short note on its cultivation is given below.

Soil Loamy soils rich in organic matter are often preferred for cultivation of this crop. Stiff clayey soils or soils with *korai* grass or *pasali* weed are often avoided as weeds cause a lot of damage to the growth of the crop.

Preparatory cultivation About 10 to 12 ploughings are usually given with the wooden plough. Ploughing is commenced as early as March so that soil may be brought into good tilth. The use of iron plough will be economical as the number of ploughings can be reduced.

Manuring About 50 cartloads of cattle manure are applied per acre and covered with the plough. Paddy husk, dried leaves or *varagu* straw are also applied, as much as available, at the time of ploughing and these get incorporated in the soil.

Seed-material Selection of seed material is the important item of work and should be done carefully, from the last year's crop left unharvested for the purpose. Yam has a face or front portion with a number of rings over the face, with a projection in the middle. These rings are places where from future plants germinate. A big yam is cut into small bits in such a way that each bit gets at least a small portion of this ring or germinating portion. There are also caruncle like projections, which are tender shoots ordinarly called *Arumbu*. These are broken before planting, as they do not give vigorous growth. An ordinary sized yam gives about 6 to 8 bits for planting. 'Depressed head' yam is always preferred for seed purposes.

As a preliminary treatment the cut pieces of seed material are dipped in cowdung water so that the cut portions are coated with cowdung. This is said to prevent evaporation of moisture from the cut seed bits. About 5000 to 6000 lb. of seed material is required to plant an acre.

Ridges are formed with the plough $1\frac{1}{2}$ feet apart, with irrigation channels for every 10 ft. of ridge. The seed material is distributed over the ridges and are planted on the sides of the ridges $1\frac{1}{2}$ feet apart in the row. The ring portion is planted downwards towards the soil, and earthing up of soil is done immediately with the plough. Irrigation follows after earthing up of soil.

Irrigation The second irrigation is done three or four days after planting and subsequent irrigations are done once a week or whenever the field needs or gets dried up. The planting is usually done in April-May; earlier plantings always give a good yield. *Ryots* are careful not to flood the crop when irrigating as they believe that flooding reduces the yield of the crop. Water, on the other hand, is allowed to stand in the furrows up to half the height of the ridges. About 16 irrigations are given from May to October; the moisture requirement during the rest of the period is made good with the occasional receipt of rains.

Weeding This operation is done almost once a month during the growing period, or as often as necessary, and for the entire growing period about six weedings are done. Earthing up of soil with the plough followed by irrigation is done after every weeding.

The plant begins to form corms or tubers from September onwards, five months after planting and grows to a height of 4 to 6 ft. in 8 months. It takes about one to one and half months for complete germination. Off shoots spring up from main shoots, the first one appearing in 3 to 5 months after planting. The second one appears in October and the third one in November. After the springing of the third off shoot, the crop is supposed to be ready for harvest. When the crop is mature the leaves turn yellow.

Harvest The crop is usually harvested from January onwards according to the demand in the market. Harvesting earlier results in reduced yields. The harvesting operations consist of cutting away the shoot portion and lifting up the underground corms.

Each plant gives about 6 to 8 lb. of corms. The normal yield per acre is about 21,600 lb. (18 cart loads). The present price is Rs. 38 per cart load of 1200 lb. Thus the gross income from an acre is Rs. 684.

Economics The economics of cultivation of this crop of an ordinary *ryot* who cultivates 33 cents or $\frac{1}{4}$ *kanni*, which is the normal area cultivated per holding, is detailed below. This gives a clear margin of profit of more than Rs. 400 per acre.

	Rs.	As	Ps.
12 ploughings at 4 as. each	3	0	0
Cattle manure 12 cart loads at 10 as. each cart load ...	7	8	0
Spreading manure	0	4	0
Two ploughings for covering manure	0	8	0
Forming ridges and furrows	0	6	0
Cutting seed	0	4	0
Spreading seed and planting on the ridges	1	0	0
Earthing up furrows	0	12	0
First irrigation—3 men	1	0	0
Second irrigation	0	8	0
Subsequent irrigations—16 for 7 months (May to October) ...	11	4	0
Weeding 6 times and earthing up	6	0	0
Harvesting at 8 as. per cart load	3	0	0
	35	6	0
Cost of seed material 1600 lb. at Rs. 38 per cart load of 1200 lb.	51	0	0
Add assessment for 33 cents	3	15	0
Total expenditure ...	90	5	0
Yield—6 cart loads or 7200 lb.			
Value—Rs. 38 per cartload (1200 lb.)	228	0	0
Net profit for 33 cents or ½ *kanni*	137	11	0
Net profit for one acre	413	0	0

The yield taken is normal and it goes up to 10 cartloads depending upon manuring and field conditions

Preliminary Trials with *Trichogramma* Parasites for the Control of the Cotton Boll Worms

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Introduction Species of *Trichogramma* are well known egg-parasites used extensively in biological control of some of the major pests of crops the world over. Their distribution is world-wide and their range of hosts varied, comprising several orders and families. Their life-cycle is short and they can be bred in very large numbers with comparatively little cost. The breeding technique is simple and manipulation of the parasites in the field easy.

These parasites have come into prominence since the time of their being used against the sugarcane borer *Diatraea saccharalis* (Fabr.), one of the most serious pests of sugarcane in many of the American States, West Indies, Hawaii etc. They are also used in the control of the codling moth *Cydia (Carpocapsa) pomonella* (L); the Oriental fruit moth *Cydia (Grapholitha)molesta* (Busck); and the European corn-borer, *Pyrausta nubilalis* Hbn. in America. In Russia they are used extensively against the American

boll worm of cotton *Heliothis armigera* Hbn., the oriental fruit moth *Cydia (Grapholitha) molesta* Busck and the cabbage pest *Barathra brassicae* L. In Africa they are used in the control of the American cotton boll worm *Heliothis armigera*. In India no attempt has so far been made in the liberation of these parasites for the control of crop pests except the sugarcane borer in Mysore (Subrahmanyam 1937).

The two commonly known species of *Trichogramma* are *T. minutum* (Riley) and *T. evanescens* Westw. The validity of their being styled as distinct species is doubted and the opinion seems to gain ground that these are two races of one and the same species. Till this is settled by systematists, the one referred to in this paper will be termed *T. minutum* (Riley). It has so far been obtained in nature from eggs of the sugar cane borers *Argyria sticticraspis*, and *Diatraea venosata* and the paddy stem-borer *Schoenobius incertellus*. Hussain and Mathur (1923) record it on *Earias* eggs. This paper gives an account of the *Trichogramma* parasite liberation work done at Coimbatore during the season 1941—42 in the control of the two cotton boll worms *Earias* and *Platyedra*.

Laboratory Studies 1. On *Earias fabia* eggs. Series of experiments were devised to obtain information on the life-cycle of *Trichogramma* parasites, effect of age of host on the degree of parasitism, number of parasites that emerge from a single host etc.

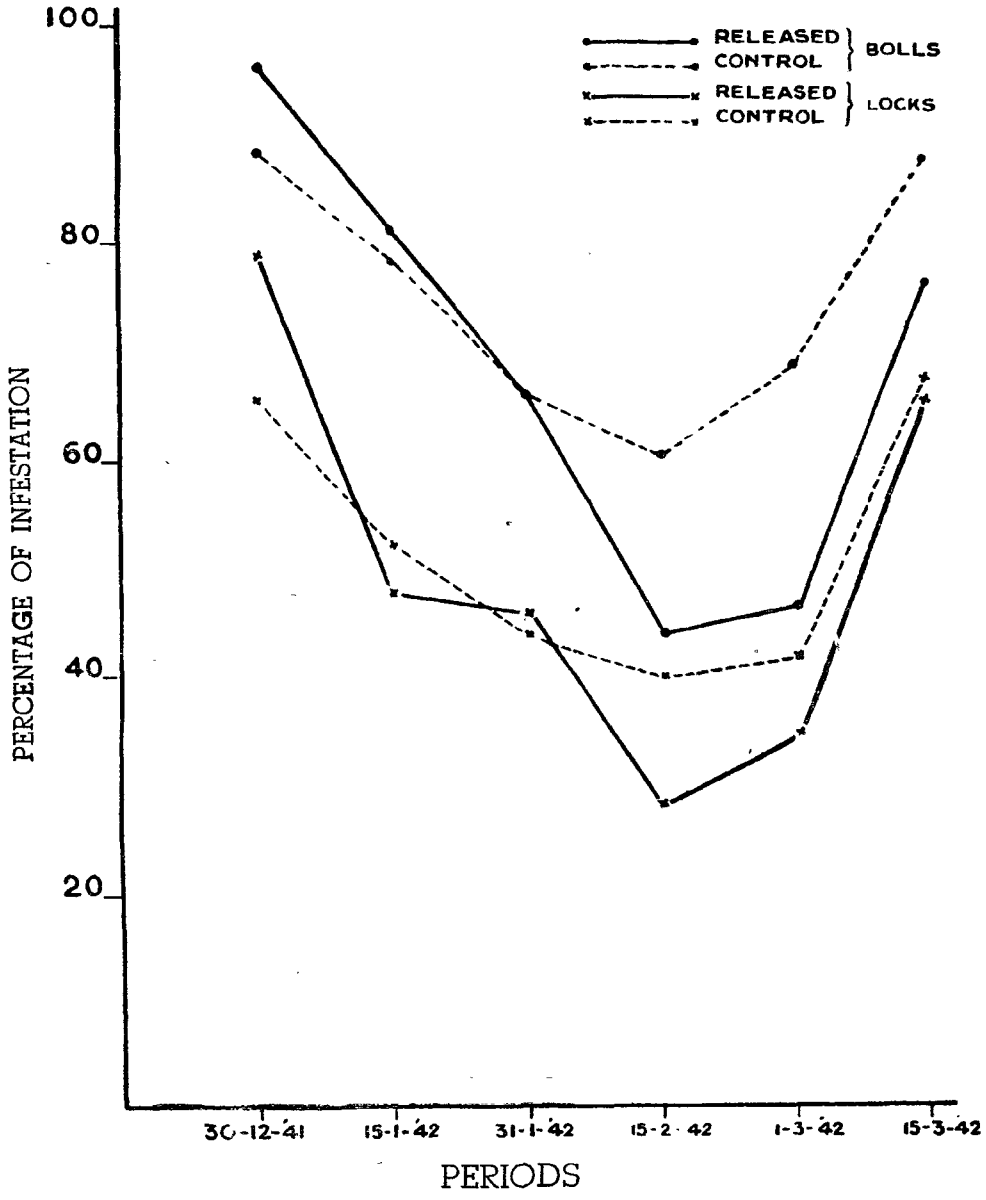
Degree of parasitisation and age of host eggs Out of 23 trials with one-day old eggs in 14 cases there was 100 % parasitisation and in 3 cases 75 %, 78 % and 98 %. In the case of two-day old eggs, for a total of 14 trials there was complete parasitisation in seven cases and in 3 cases 75 %, 87 % and 87 %. In 3 days old eggs out of 7 trials there was complete parasitisation in 3 cases and in 3 other cases 60 %, 95 % and 95 %.

Preferential oviposition on host eggs of different ages Host eggs—one, two and three days old—were given to one lot of parasites in one container and the degree of parasitism for one, two and three days old eggs in one trial was 100%, 59% and 71% respectively ; and for the second trial it was 83%, 86% and 100% respectively. Thus it is possible to get high degree of parasitisation irrespective of the age of the host egg.

Number of parasites that emerge from a single host egg Individual parasitised eggs were put in tubes to see the number of parasites emerging out of a single egg. Out of the 13 cases under observation, in 7 there was one parasite per egg and in 6 two per egg.

Duration of life-cycle of the parasite from egg to adult within the host egg The duration of life-cycle has been found to vary from 6 to 9 days based on initial emergence, 6 being very rare. The average works out to 8 days for 55 trials.

The period of maximum emergence from host eggs In most cases the maximum occurs either on the first or the second day and the emergence itself is almost complete during these two days.



CURVES SHOWING THE INCIDENCE OF BOLL WORMS IN PICKED BOLLS AND LOCKS IN TRICHOGRAMMA LIBERATED AND CONTROL FIELDS, 1941-'42

Egg-laying capacity of parasites In one case the female lived for 11 days and laid 125 eggs, the average per day being 11 eggs. The maximum number of eggs laid in a day was 20 as judged by the number of parasites emerging from the host eggs. In another case where the female lived only for 8 days the maximum number of eggs laid in a day was 53.

2. *On Platyedra gossypiella eggs* The percentage of parasitism for 8 trials is as follows:— 20, 38, 60, 63, 67, 75, 85 and 96. The duration of life-cycle is nearly 7 days Out of 51 parasitised eggs of *Platyedra* kept in individual tubes in all the cases only one parasite was got from each egg.

Field studies *Material and methods* Eight cotton fields sown during August—September on the Central Farm, Coimbatore, were selected for the experiments. In four fields half-acre blocks were marked centrally and parasites liberated at various points to uniformly cover the whole area. Four other fields served as control. The liberations were done once in four days at 5000 parasites per half acre per release. The liberations commenced from 17th December 1941 and were carried to the end of February 1942 till the completion of the first flush. There were 18 liberations in all. In order to note the effectiveness of the liberations, burst bolls were collected from treated and control plots and examined for boll worm infestation. In this way 80,947 burst bolls comprising 325,218 locks were examined. The parasites for release were bred in the laboratory from *Corcyra cephalonica* eggs.

Results of trials The incidence of attack in the treated (released) and control fields is given for fortnightly intervals in the statement and curves appended. It will be seen (i) that the incidence of attack is appreciably reduced during February, (ii) at one period the reduction in the percentage of attack of bolls by the release of parasite is as high as 22% (vide statement) and (iii) the effect of release is seen both in the bolls and locks.

Statement showing the fortnightly incidence of the boll worms in the picked bolls and locks in released and liberated fields.

			Total examined.*	Total affected.	Percentage of incidence.
BOLLS	Released.	30–12–41	1228	1179	96
		15—1—42	3320	2716	82
		31—1—42	5708	3769	66
		15—2—42	13271	5857	44
		1—3—42	10219	4749	47
		15—3—42	3943	3021	77
	Control.	30–12—41	1462	1297	89
		15—1—42	2540	1998	79
		31—1—42	12988	8506	66
		15—2—42	11933	7220	61
		1—3—42	10325	7076	69
		15—3—42	4010	3574	89

LOCKS	Released.	30-12-41	5154	4061	79
		15-1-42	13308	6441	48
		31-1-42	22778	10415	46
		15-2-42	54752	15179	28
		1-3-42	41080	14221	35
		15-3-42	15488	10282	66
	Control.	30-12-41	6269	4151	66
		15-1-42	10765	5574	52
		31--1-42	53092	23157	44
		15-2-42	47428	18925	40
		1-3-42	49635	16617	42
		15-3 42	15469	10544	68

* The figures represent the total of the 4 released and 4 control fields.

Acknowledgments The authors wish to thank Sri Y. G. Krishna Rao Naidu, Superintendent, Central Farm, Coimbatore, for affording facilities for the experiments and Sri S. N. Venkataraman, Assistant Marketing Officer, for going through the data.

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SELECTED ARTICLES

Some Biological Discoveries of Practical Importance*

By Dr. C. H. WADDINGTON

There are two main spheres in which biology is of practical importance to society. One is medicine in the widest sense, which it would perhaps be more accurate to call human biology, and the other is food production or agriculture, also in the widest sense.

I do not propose to discuss the first of these fields in any detail, although new discoveries and new applications of old discoveries are always being made. Among recent new discoveries one may perhaps mention the bacteriocidal and bacteriostatic substances which are now being obtained from lower organisms. Penicillin, extracted from a mould related to the ordinary bread mould, is being investigated at Oxford and elsewhere and seems likely to prove one of the most powerful aids in dealing with infected wounds, a matter of the greatest importance at the present time. It may, however, be rivalled by gramicidin, a substance prepared by American workers from certain types of bacteria which grow in soil; but perhaps the more optimistic view will prove justified and the two substances be found to attack rather different kinds of germs and thus to supplement each other. As an example of a new technique of utilizing old biological knowledge, one may mention the treatment of various diseases, chiefly cancer in some of its forms, by radio-active substances artifically prepared with the aid of new physical apparatus such as the cyclotron. Radio-phosphorus and radio-iodine are differentially absorbed by different tissues in the body; their radio-activity causes the destruction of the tissues in which they become located and the surgeon can in this way bring about a localized inhibition of particular tissues which are proliferating too rapidly.

But the great tasks of medicine in the immediate future are concerned with the application of knowledge which we already possess. These tasks can be

* Substance of a lecture delivered at the Royal Institution on Feb. 12, 1942.

summarized under three heads; first, the attainment in practice of optimal standards of nutrition, of housing, of industrial hygiene, and so on; secondly, the conquest of tropical diseases and the improvement of the health of tropical populations until they have an equal chance with the peoples of the temperate zones to play their part in world civilization, and thirdly, a task in which social biology must collaborate with political and other agencies, is the reversing of the general fall in the reproductive rate in industrial countries. New discoveries may, and very probably will, be made which will assist in the carrying out of these tasks, but the main problems are certainly the administrative and political ones of applying existing knowledge.

When we turn to the field of food production we find a great body of existing knowledge which is in process of being put into practice. Such developments of farming practice as the system of ley farming and the increased use of silage are examples. But there are also a number of biological discoveries which may have very revolutionary effects on the whole of our food production system, and it is primarily a summary of these more far-reaching possibilities that I propose to discuss.

We may mention first some new uses for old crops. Straw is bound to be produced in large quantities along with any cereal crop, but, except for some oat straws, it is itself of little value for feeding animals. It has recently been shown that a treatment with caustic alkali breaks down the hard tissues of the straw sufficiently to allow of its being digested by cattle, and a very considerable new source of feeding stuffs has thus been placed at the farmer's disposal. A more striking innovation would be the direct use of grass protein for human consumption. Grass is much our biggest crop; we produce about 60 million tons a year. It is too full of indigestible fibre to be eaten by man in the raw state, and the methods by which we use it are still those which were invented in the Stone Age; we feed it to cattle and sheep and ourselves eat the beef, mutton, milk, etc., which they produce. They can, it is true, digest the fibres with which the human intestines cannot deal, but they are relatively inefficient in making use of the proteins. Now it is comparatively easy to grind up the grass and squeeze out some 30 per cent of the protein for our direct use. The remainder of the protein remains with the fibres, the whole mass still representing a better cattle food than ordinary hay. The technical problem of making the grass protein into a really attractive and palatable product should not long remain beyond the capacities of our biochemists. When it is pointed out that the total quantity of grass protein grown in Great Britain is something like ten times our normal protein requirements, the potential importance of the direct utilization of even a small fraction of it requires no further emphasis; but the economic and agricultural problems of employing the process on a large scale require further study.

Let us consider now some new technical possibilities in the cultivation of our crops. Much publicity has been given recently to tank culture or hydroponics. By this is meant the cultivation of plants in culture solutions the concentration and composition of which can be accurately controlled. Such methods are, of course, by no means innovations in the laboratory; it is only their utilization on a large scale for commercially grown greenhouse crops which would be a new departure. It does not, however, seem by any means certain that this technique has any great advantages, at least in the climate of Great Britain, over the method of soil sterilization which was introduced some years ago and is now becoming very widespread.

Another technical innovation from which much can be expected is the use of the recently discovered plant hormones. Knowledge in this field is still growing

rapidly but we already understand something of the part played in the growth of a plant by very small quantities of certain essential substances, some of which are in fact identical with the vitamins which we hear so much about in our own diet. Some of the hormones are already quite widely employed to encourage the rooting of cuttings: but there are many more possibilities emerging in the laboratories of the world—for example, the growing of long-fibred stems in textile plants such as flax and hemp, the production of seedless fruits from unpollinated flowers treated with suitable hormones, the controlling of the opening of flower buds until the danger of severe frost is past, and so on. Moreover, new hormones are still being discovered, some, such as a new pollen extract recently described by the United States Department of Agriculture, controlling growth, while others are concerned with various other phases of a plant's development.

These studies have not yet been brought into relation, although they soon must be, with another very important development which has arisen in practical crop management. Russian biologists in particular have devoted great attention to the investigation of the time of ripening of plants, with the view of developing types which can either survive their rigorous winter or which can crop in a single year after planting in the spring. They have developed a rather elaborate theory of the succession of various phases in a plant's development, which they distinguish sharply from its growth. In general a plant first passes through a temperature phase, in which it requires a certain length of exposure to particular low or high temperatures; this, they claim, is succeeded by a light phase, in which the plant must be subjected to particular conditions of long or short daily periods of illumination. The practical application and indeed the practical basis of this theory is the technique known as vernalization, in which the germinated seeds are artificially given the treatment needed to complete the first phase of development before being sown. Thus a winter variety of wheat, which is normally sown in autumn and lies in the ground over winter, starting to grow in the following spring, may be artificially cooled for the required time and then planted in the spring to crop in the same year. Such methods would be of some value even in England and may be of very great importance in countries with the severe climatic conditions of Soviet Russia, where many million acres have been sown with vernalized seeds. Workers in other countries are not so convinced of the practical value of the method, and the details of both theory and practice are still under discussion. But there seems little doubt that the basic phenomena are quite real and that our understanding of the matter will rapidly become much more profound. It has already been shown that, in certain plants substances capable of diffusing from a stock into a grafted scion are concerned in controlling whether flowering takes place in the first or second year, that is, with or without subjection to cold and short daylight, and it therefore seems most probable that the whole vernalization question will in time be brought into relation with the discovery of plant hormones already mentioned.

Some Soviet authors have claimed that a single vernalization treatment is sufficient to alter the hereditary constitution of the plants, so that its effects are permanent. Most biologists are likely to doubt the possibility of such a direct action, but it may well be that the Soviet workers have actually discovered a phenomenon of great importance. Since the development of a plant, as we have seen, is profoundly influenced by the early treatment of the seed, a single artificial treatment which causes the plant to mature at an abnormal season may have some effect on future generations owing to the altered conditions under which the seed will be formed. Similarly, another phenomenon on which the Russian scientific workers have laid great stress is the effect of a host plant on

the hereditary constitution of a graft ; again, the effect may not be a direct one on the hereditary elements as normally understood, but it may be a real phenomenon based on the transmission of something in the nature of a virus.

This brings us to the subject of plant breeding, one of the fields in which the most spectacular advances are likely in the near future. The breeding of disease resistant varieties, which, for example, trebled the yield of sugar cane in Lousiana between 1926 and 1929, will probably score some new successes but it cannot be considered a new technical advance. On the other hand, the practical employment of hybrid vigour is a development of the last few years in maize growing. At the present time something like twenty-five million acres are sown with hybrid corn in America, and increases in yield average about 20 per cent. Probably there are similar benefits to be obtained in other crops. The John Innes Horticultural Institution, for example, has prepared hybrid tomato seed with very considerably enhanced productivity.

The most important advances, however, are likely to come from two fields which are still being intensively investigated. The first is the study of the wealth of forms available in Nature for our use. Until recently the range of types employed by the plant breeder has been getting progressively narrower as he concentrated on the improvement of ever more specialized varieties. But it has been realized that much may be gained by the introduction of new hereditary material and it has come as something of a shock to discover how rich is the stock of forms available. Not only are there very numerous local varieties of cultivated plants, each probably with many defects by modern standards although with one or two points of advantage, but there is also a hitherto unexpected variety of wild forms related to the cultivated species. For example, all the cultivated potatoes of the Old World derive from a single species and probably from a very few individuals. We know now at least thirty species, forming a polyploid series, all of which were thought worthy of cultivation by some tribe in South America and there are also related wild species. They include frost-resistant and short-day forms and varieties resistant to various diseases. It is not too much to hope that we shall fairly soon be able to develop potatoes suitable for the Arctic and for the tropics. The profound results of such a spread of the potato belt do not need to be emphasized.

The second major source of new varieties may be found in the very recent technique of artificially doubling the number of chromosomes in hybrids, thus rendering them fertile and comparatively stable in hereditary constitution. Nearly all our most important crop plants have arisen by a chance occurrence of a similar process in Nature. Now that we have discovered substances the most important of which is the drug colchicine, which allows us to double chromosome numbers with fair regularity, it is almost inconceivable that we shall not be able to manufacture completely new types of plants of the greatest importance. It is too early as yet to name any examples with complete confidence, but the hybrids of wheat and rye and of wheat and couch grass may be mentioned as instances of promising beginnings.

An advance of another kind is the recent success in hybridizing yeast. Until recently it was thought that if a single yeast cell was isolated it must give rise to a pure colony. But single yeast cells may be either haploid with one of each kind of chromosome or diploid with two. In the latter case haploid cells will be formed during the growth of the colony and the segregation of different types will occur, so that the final colony is mixed. Winge, in Denmark, has succeeded, by a fine technique of micro-manipulation, in isolating single haploid cells, hybridizing them and finally isolating the segregants from the hybrids. This is the first application of modern breeding methods to some of man's oldest

plant collaborators, his assistants in the manufacture of such staples as bread and beer.

If we turn now to the animal field, many of the methods which seem to promise best among plants do not appear very feasible. Thus there are great technical difficulties in making such a full use of hybrid vigour although some promising results have been obtained with fowls. Again, only the very first steps, in which I have myself shared, have been taken towards doubling the chromosome number in animals, and the difficulties to be surmounted before we can produce fertile hybrids in this way are rather overpowering in prospect.

Perhaps the most important new technique which is just passing from the laboratory into general practice is that of artificial insemination. If the sperm of a selected male is artificially introduced into the female, the greater degree of control over the process makes it possible to employ much smaller quantities than Nature provides and the number of offspring which can be obtained from a single male may therefore be multiplied some hundreds of times. This makes it possible to ensure that only the very best animals are used as fathers and the constitution of poor stock may thus be quite rapidly improved. The method has already been tested out on quite a wide scale and it has been found possible to send the sperm of desirable males for very considerable distances by air. The method has a very great part to play in the immediate post-war world when we are confronted with the problem of restoring the scorched earth of eastern Europe.

A development of the technique of artificial insemination which seems likely in the next ten or twenty years is the artificial determination of sex by the separation of male and female determining sperm. Such a possibility is, of course, a favourite theme of all kinds of charlatanry and psuedo-science. But some recent work particularly in the U. S. S. R., indicates a serious possibility that the problem will be solved by the method of electrophoresis, that is to say the passage of an electric current through a suspension of sperm, causing an accumulation of the female determining sperm at the anode and of male determining at the cathode. There are still many technical details to be worked out, such as the most favourable salt solutions, temperature, etc., but it would be a bold man who denied the possibility of fairly early solution of the problem. The importance of such a method for the dairy and poultry industries would be profound, but its application to human affairs obviously presents aspects of great difficulty.

It would be in the highest degree desirable to bring about a similar increase in the reproductive capacities of the females of domestic animals. This may be too difficult a task but some increase can already be envisaged. The administration of suitable hormone preparations, for example, can bring a female into the breeding condition at a time of year when she would normally not be ready to receive the male. Some success has already been achieved in obtaining in this way two crops of lambs a year instead of one. Again, when a female is ready to breed the number of ova produced, and thus the number of young born is rather restricted in many of our domestic animals, and treatments are being worked out which should make it possible to cause the formation of more ova. This will, in the first instance, enable us to cause a regular production of twins by our beasts. For particular purposes of breeding from exceptionally favourable females it may prove possible, by a technique which has already been used in rabbits, to increase the number of ova many times and to transplant some of them to uteri of other females, which would then act as foster mothers from the very earliest stages of the animal's development.

The control over developmental processes given us by the use of hormones may play a part in several other ways. We are beginning to have some understanding of the role of such substances in lactation: We know there are hormones

which control the initial development of the mammary glands as well as the intensity of their secretion, and again it has proved possible to influence to a significant degree the content of milk in several important constitutents. All these investigations, still essentially laboratory matters, are likely fairly soon to reach the point where we can begin to apply them in practice, when they may open up great possibilities of control over our milk supply, particularly in the difficult winter months.

A somewhat more speculative possibility is the employment of hormones for the control of size. In some animals at least, for example, the rat, it has been possible to obtain considerably increased growth by suitable hormone injections. Further, the embryo of a mammal is in a somewhat similar position as regards its mother as the plant grafts mentioned earlier; an effect exerted primarily on the mother may, by influencing the early development of the foetus, produce an alteration which will affect the development of the next generation of young and thus be transmitted potentially for ever. That such an influence of the mother on her offspring of the first generation is a possibility is known from crosses between large and small breeds of horse, in which the size of the mother has a great effect on the size of the foal. An effect in more remote generations has been suggested by some workers using extracts of the thymus gland on rats. The matter is still very uncertain, but if it can be put on a firm basis very important results might be obtained. A further and still more speculative possibility may perhaps be worth mentioning; it has been claimed that the very early administration of growth-promoting extracts has a differential effect on those organs which develop most rapidly at early stages, particularly the brain. It is not clear whether the swollen-headed rats so produced were any cleverer than usual, but the possibility of such an effect may be worth considering, if only as a day-dream to solace the despair to which most educators are from time to time reduced. Let us hope, however, that man is already intelligent enough to use, for his benefit and not only for his destruction, the gifts which science offers, without waiting for a hormonally induced enlargement of his brain. (*Nature No. 3800, August 29, 1942.*)

What's doing in All India—Madras

BY C. VIJAYARAGHAVAN,

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Madras is conducting a vigorous campaign to increase the production of food crops. To stimulate production, the Government granted a number of concessions to the cultivators and the Agricultural Department is doing intensive propaganda for growing crops by improved methods. In addition to meeting the farmers personally, agricultural officers arranged nearly 3,000 exhibitions and meetings. Propaganda is directed mainly towards (i) bringing new areas under food crops, (ii) adopting intensive methods of cultivation, and (iii) reducing the acreage under commercial crops and using the areas so saved for the growing of food.

Increasing area under food crops In Tanjore, the premier rice growing district, the Government provided irrigation water from rivers and channels by about three weeks earlier to enable the cultivator to begin paddy cultivation early and take two crops of paddy from single crop paddy land. The Government also removed the minimum of Rs. 5 charged as water rate for the second crop land and levied only half the single crop assessment. Landowners, taking advantage of these concessions, put 20,000 acres of the single crop area in Tanjore district under double cropping. In addition to this, the early supply of water

enabled, a large area so far considered as dry to be brought under single crop paddy cultivation. Similar attempts have been made in other rice growing areas to increase the number of crops and to bring the suitably situated dry areas to wet cultivation.

The Government permitted the growing of food crops free of assessment on assessed Government land, unassessed land or disafforested areas in which crops had not been grown in Faslis 1349 and 1350. In the Tanjore and Trichinopoly districts permission was given for food crops on certain land unoccupied for 18 months. Permission was granted for the cultivation of tank beds free of charge provided the crops are removed before the tank is required for storing water. In the allocation of land preference is given to the deserving poor not already owning land. Arrangements have also been made to lease out railway land for cultivation. Permission for the revenue free cultivation of land around schools, churches, etc. has been granted. The Agricultural Department made every effort to see that these concessions are fully availed of by the cultivators. Dry food crops like sorghum, *cumbu* (*Pennisetum typhoides*), and *tenai* (*Setaria italica*) are suitable for most of these areas and improved seeds are distributed. Steps were taken to see that all Government office compounds are sown with food grains or vegetable seed. Advice was given in some cases to utilize the space between fruit trees in orchards for food crops. For example in Malabar and South Kanara dry paddy has been advocated in fruit gardens and coconut plantations are being interplanted with tapioca, sweet potato, yams and other vegetables.

Intensive methods of cultivation To increase the yields, rice growers were induced to use improved seed, reduce the seed rate, adopt economic transplanting of seedlings and apply manure liberally. For the multiplication of pure paddy seed on an extensive scale the Government sanctioned four schemes, one in the Cauvery delta, one in the Godavari delta, one in the Kistna delta, and another in the South Arcot district. In most places seed farms have been started by the Department for the supply of improved seed. Agricultural improvement co-operative societies are helping in the production and distribution of pure seed. Vigorous propaganda for reducing seed rate resulted in the saving of paddy seed and production of healthy plants. In the Tanjore district the cent nurseries in which 2½ lb. of paddy seed is sown in a cent of nursery have become very popular.

The Agricultural Department has done intensive propaganda for the increased use of green manures. One of the difficulties in growing green manures have been the lack of sufficient quantities of seed. Growing of green manure for seed in orchards, palmyra groves and on field edges is advocated. Villagers are requested to gather seed and sell it to the Agricultural Department. Large quantities have been bought from available areas and distributed all over the province. In Tanjore, attempts were made to induce village children to gather green manure seed and earn small sums of money. The Department has a number of approved green manure plants—*dhaincha* (*Sesbania aculeata* Pers.), *kolinji* (*Tephrosia purpurea* Pers.), *pillipesara* (*Phaseolus trilobus* Ait.) *sunn hemp* (*Crotalaria juncea* L.), and indigo (*Indigofera Anil* L.). In addition to these, the Department distributed seeds and advocated the planting of several leaf-yielding trees on porombokes, canal bunds, etc.

Groundnut cake is another manure extensively advocated. Efforts are being made to buy cake and distribute it to farmers at reasonable prices. The government sanctioned a considerable sum of money for this purpose.

Loans for seed and manure The Government empowered District Agricultural Officers to grant loans up to Rs. 25 to deserving cultivators for buying seed and manure. A large number of them sought the help of Agricultural Officers

to secure this concession. In the Kistna district, the District Agricultural Officer granted in July 1924 nearly 1,500 loans amounting to Rs. 40,000.

The Government allowed the cultivation of the backyards of houses free of assessment provided vegetables or food grains are grown and the Agricultural Department made every effort to induce householders to utilize their backyards. Large quantities of vegetable seeds were distributed. All the Government farms were growing vegetables to multiply seed for distribution among cultivators. Seeds of several varieties of improved vegetables were made available. The Millet Breeding Station, Coimbatore, distributed in June 1942 over 100 lb. of improved vegetable seeds, including seeds of three leguminous vegetables that are capable of being grown under rainfed conditions.

Efforts were made to convince the farmers of the desirability of growing food crops in preference to non-food crops. The area under cotton, groundnut, etc. was decreased and cereals were sown. In places where the commercial crop is sown as a mixture with a cereal like the Italian millet, larger proportions of the cereals were advocated.

A factory designed for the manufacture of 36,000 lb. of malt food per annum from sorghum grain has started production at Coimbatore. The process for making malt food from sorghum and other locally available cereals was developed at the laboratory of the Government Agricultural Chemist after several years of research. Tests in the laboratory have shown that sorghum malt food is as high in value as other popular malt foods. Clinical tests carried out in 27 Government and private hospitals have proved that this product is suitable for all classes of hospital cases and is specially indicated in cases of gastro-intestinal disorders.

A technique for the manufacture of malt extract has also been perfected. This product is a viscid, light coloured liquid capable of being blended with shark liver oil to give a vitamin-rich concentrate. Arrangements for its commercial production are nearing completion.

Campaign against soil erosion Soil erosion is a problem nearly all over the province. As a preventive, bunding has been widely advocated. The Research Engineer's 'bund former,' a simple but efficient implement designed in the workshop of the Agricultural College, Coimbatore, has been found very satisfactory for this purpose. Levelling, terracing and the planting of trees are other methods suggested. Contour planting of potatoes on the Nilgiri hills has been found to check erosion.

Spacing experiments with paddy showed that close planting of seedling 4 in. and 6 in. apart as against wide planting 12 in. apart contributed to increase of the yield of grain and straw. The exact closeness 4 in. or 6 in. was indicated by the duration of the varieties. The work on pre-sowing treatment of seed paddy by alternately germinating and drying periodically to induce resistance to drought is in progress. It was found that up to a limit germinated seeds when sun dried and resoaked germinated normally.

Burying of coconut husks and leaves in trenches has improved the condition of coconut palms in the red loamy soils of Kasaragod, South Kanara. Apart from the increase in the number of functioning leaves, the palms showed significant increase in the production of female flowers and in the setting percentage resulting in higher yields. This treatment, however, was not as beneficial as a general dose of manure supplying nitrogen, potash and phosphoric acid. From the coconut nursery experiments it was found that the position of the nuts in the seedbed has no relation to the total germination, and that nuts having little or no water in them are not fit for seed purposes.

Studies of the broom-rape of tobacco are in progress. So far mechanical methods of control have proved more economical than chemical methods. The

transmissible nature of cotton sterility (small leaf disease) has for the first time been established. Cultures of ergot of rye are being grown on the Nilgiris for producing this valuable drug. Infusions of *Acorus* rhizomes, *Tephrosia* seeds and pyrethrum flowers are found to be efficient against aphids in a concentration of 1 oz. per gallon of water. Studies are in progress on the control of the sugarcane borer by the mass breeding of its egg parasite, *Trichogramma minutum*

Powerful indigeuous insecticide Investigations carried out by the Government Entomologist to determine whether the insecticides that are now difficult to obtain could effectively be substituted by any of the locally available plant poisons have resulted in the discovery of a powerful contact insecticide in the kernels of *Thevetia neriifolia*. A native of South America and the West Indies, this plant has been grown in India for many years. It comes up well in South India and is commonly grown as a hedge plant. Aqueous extracts of its kernel prepared by mashing or grinding and then steeping in cold water for 24 hours have been found to be highly toxic against a wide range of insects. Optimum strengths for soft and hard bodied insects have been studied. A strength of $\frac{1}{4}$ oz of the kernel in one gallon of water is enough to kill plant lice, thrips and leaf hoppers. Half an ounce in one gallon of water is required against the defoliating caterpillars like the moringa hairy caterpillar and the castor semi-looper, while one ounce of the kernel in one gallon of water is necessary for the control of mealy bugs and scale insects. To obtain maximum effect, the addition of soap equal in quantity to that of the kernel used is necessary. Plants sprayed by aqueous extracts of the kernel have been found to be immune from insect attack for short periods. No injury is done to the foliage when the concentration is less than one ounce per gallon. In addition to the kernel, the cake and oil of *Thevetia neriifolia* have been observed to possess toxicity of varying degrees. *Thevetia* oil has been found to act as a deterrent against termite attack. (*Indian Farming Vol. 3, No. 12, December 1942.*)

Gleanings

Chemical elements needed for plants Healthy plants, like good steel, need the addition of minute amounts of a number of chemical elements. Some of them are the same as those required for modern steel making, including manganese, molybdenum and copper. The story of these "micro-nutrients" was the subject of the address of Professor D. R. Hoagland, of the University of California, president of the Pacific Division, American Association for the Advancement of Science.

The need of plants for these minute traces of certain elements was completely unknown until a few years ago and even now it is not certain that the list of micro-nutrients is complete. Of most of them, only a few parts in a million of soil solution are needed to maintain plant health, yet without them the plant sickens and perhaps dies.

Lack of some of these elements produces plant diseases that might formerly have been ascribed to the attack of sub-microscopic viruses. Fruit trees in soils without zinc, for example, produce symptoms known as 'little leaf' and 'mottle leaf'. Most soils have sufficient quantities of the micro-nutrient elements for all practical purposes but where they are lacking it is important to detect which ones are short and to remedy the defect.

Bearing on this subject also are relations between the nutrition of plants and that of the human beings and animals that eat them. Some of the micro-elements in plants are of as great physiological importance indirectly to animal life as they are directly to the life of plants. This field of research is only beginning to be explored. (*Science, June 26, 1942.*)

Hormone sprays for fruit The recent rapid developments in the investigation of growth-promoting substances have been closely followed by widespread attempts to apply the so-called plant hormones in horticultural practice. The use of synthetic growth substances to facilitate the rooting of cuttings became a craze almost overnight and there is no doubt that remarkable results were achieved in many cases. There are still, however, species which resist all attempts to make them produce roots readily enough to make this method of propagation practicable on a commercial scale.

Other uses for growth substances have now become the centre of interest, and these form the subject of a review in the *American Fruit Grower* of June 1941. Perhaps the most successful application has been the use of naphthalene acetic acid and naphthalene acetamide to control the pre-harvest drop of apples. Spraying with dilute solutions of these substances by delaying the formation of the abscission layer, enables fruits to be kept on the tree until a desirable degree of colour and maturity is reached. Fruit dropping from pears, plums, apricots, oranges and cherries has also been reduced, and, in the case of the latter, the sprayed fruits showed a lower acid and higher sugar content than the controls. Satisfactory results with some English varieties of apple have been obtained by similar methods at the East Malling and Long Ashton Research Stations. The method appears to be of particular value in combating the effects of strong winds. Also of interest is the checking of bud development by hormone sprays. By this means the risk of frost injury to fruit blossoms in spring may be reduced. Indole butyric acid, applied unilaterally to growing shoots of young apple trees, causes more rapid growth on the treated side. By this means the development of narrow-angled and therefore structurally weak crotches can be avoided. (*Nature, July 4, 1942*).

New uses for cotton If the cotton industry is to hold its position in the future as a major industry, scientific research must be intensive in several major fields. There is need for three lines of research on lint cotton ; (1) on the chemical and physical properties of the individual fibres ; (2) on the mechanical processing of cotton and its manufacture into various products, and (3) on chemical finishes for cotton products. Most cotton products in use today were developed through trial and error.

New and improved cotton products developed as a result of research work by various organizations in many fields include an inexpensive cement shingle using cotton fabric as a reinforcing membrane, a method of making cotton pile fabrics for automobile and furniture seats, a process by which cotton webbing and resins are used to form felts for industrial use, a way of making disposable towels, wrinkle-resistant finishes, flame-proofing and water-proofing treatments to increase serviceability of cotton products.

The Southern Regional Research Laboratory has contributed directly to the war effort in its cotton research in the development of means for cutting cotton to uniformly short lengths so that it can be used with existing commerical equipment to supplement linters for making smokelss powder, and in providing a list ofeffective treatments for protecting sandbag fabrics from attack by soil micro-organisms.

Other laboratory cotton research objectives of importance are: plastic coated or impregnated fabrics for replacing rubberized fabrics ; an unlined cotton fire hose to replace linen hose of the same type ; improved mesh fabrics for use as a base for nonshatterable transparent plastic substitutes for window glass ; and the development of cotton products to replace those made from certain imported fibres which are difficult or impossible to obtain.

Research efforts on products of cottonseed include development of adhesives for plywood, paper-coating material to supplement casein, synthetic wool-like

fibres, modified cottonseed oil to replace olive oil in the textile industry and palm oil in the tin plate industry and to replace certain imported waxes. *D. F. J. Lynch, Director, Southern Regional Cotton Laboratory. (Agricultural Situation, August 1942.)*

Research Items

Brachiaria distachya Stapf and *B. miliformis* Chase—two species or one?

Brachiaria distachya Stapf (Telugu–*Koranna gaddi*; Kanarese–*Hambu harakahullu*) is one of the commonest pasture grasses of the Madras Province and is met with in almost all the districts. It resembles Hariali grass (*Cynadon Dactylon* Pers.) in the growth habit and gives the characteristic matting surface to the soil. C. E. C. Fischer in the Flora of the Madras Presidency splits this into two species viz., *Brachiaria distachya* Stapf and *B miliformis* Chase, with the remark that they are very similar to one another and are often confused. The two specimens in the Herbarium which were collected from the west coast viz., Kuttuparamba in Malabar and Kudlu near Kasaragod in South Kanara district and stamped at Kew, England as *B. miliformis* Chase show differences from *B distachya* Stapf only in the comparatively glabrous nature and larger size of the plant and leaves. By a critical study of these two species the writer has come to the conclusion that both these species are one i. e., *B. distachya* Stapf and the variations as regards the puberullus or the glabrous nature of the peduncle and the larger size of the plant and leaves on which the classification was based are as usual with many other plants due to climatic and soil conditions.

The Herbarium,
Agri Res. Institute, Coimbatore,
24th March 1943. } K. Cherian Jacob.

Freaks in Arecanut

Tillering is a rare phenomenon in areca palm (*Areca catechu*, L). At the Agricultural Research Station, Taliparamba, a number of arecanut seedlings were planted in 1936, along the wetland bund. Three years after planting one of the plants developed two more shoots at its base, which have by now grown into good sized trees, and nearly as big as the originally planted one. Although some of the others planted along with this are on flower none of these three have begun to produce flower In 1940, three more sprouts originated, one by the side of each of the existing tillers, making a colony of six individuals where only a single seedling was originally planted.

In the arecanut inflorescence, the female flowers which develop into nuts are normally located towards the base of the spikes. But in one instance a ripe nut developed at the extreme end of one of the spikes. The nut was normal except that it was smaller in size than an average nut of the bunch.

Agricultural Research Station,
Taliparamba, 24th Feb 1943. } P. Narayanan Nayar.

Hints for Bee-keepers

For May

The main source of pollen during the month is *Chitrai* (irrigated) *cholam* and that of nectar tamarind. Appreciable quantities of honey are available for extraction in localities where these two exist; otherwise the condition of the colonies is generally unsatisfactory. Other sources of pollen pasturage are avenue trees such as *Poinciana regia*, stray trees of *Peltophorum* etc. Scanty supplies of nectar may be available from straggling flowers of cotton. A steady dwindling of the population of the colonies may occur in unfavourable localities.

The supers and superfluous combs of such colonies should be removed and stored carefully.

As the month happens to be the fag end of the honey season, a review of the common bee pasturage plants may not be out of place. They are enumerated below in the order of importance. Among the pollen yielders the more important are maize, *cholam*, *cumbu*, palmyra, avenue trees such as *Peltophorum*, *Holoptelia integrifolia*, *Ailanthus excelsa* and *Korukkapalle*, castor, vegetables such as gourds and onions, ornamental plants like *zinnia*, sun-flower and *cosmos*, and even such weeds as, *Lagasca mollis* and *Tridax procumbens*. Cotton, tamarind, margosa, coriander, wood-apple, *pungam*, rain-tree, white babool, *Albizzia Lebbeck*, drumstick and ornamental plants like sunflower, balsam, fiddlestick (*Citherexylon subserratum*), *Antigonon* etc constitute the common sources of nectar. The list is by no means complete, and a more comprehensive account is given in the Departmental Bulletin No. 37 with the approximate months of flowering of the different plants. The varied and luxuriant flora of our jungle areas, hilly and sub-montane regions also offer splendid scope for bee-keeping.

Bees exhibit remarkable powers of discrimination in selecting their sources of food material. The criterion for the selection appears to be the quantity of food available per trip, especially in the case of pollen. The graminaceous plants mentioned in the previous paragraph contain a large quantity of the powdery material within a compact flower-head and bees prefer these to more imposing sources like *Peltophorum*, *Poinciana regia*, etc. which, though more showy contain much less pollen. The time of visit by bees to the different crops is equally interesting. Cotton and tamarind are visited practically throughout the day, if the weather is mild. Nectar is collected from margosa flowers by day break and from *daincha* during the afternoons. Bulk of the pollen collection is made in the mornings only. M. C. Cherian and S. Ramachandran.

Crop and Trade Reports.

Cotton Raw in the Madras Presidency The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 2nd April 1943 amounted to 56,953 bales of 400 lb. lint as against an estimate of 393,900 bales of the total crop of 1942—43. The receipts in the corresponding period of the previous year were 72,631 bales. 97,865 bales mainly of pressed cotton were received at spinning mills and 639 bales were exported by sea while 42,286 bales were imported by sea mainly from Karachi and Bombay *Director of Agriculture.*

Moffussil News and Notes

Agricultural Exhibition in Anantapur and Cuddapah districts Four Agricultural Exhibitions on a small scale were held in Alladapalle, Proddatur Taluk, Athirala, Rajampet Taluk, Ananthapuram of Royachoti Taluk and Banukota in Pulivendla Taluk of Cuddapah District. Practical ploughing demonstrations were conducted and green manure crops and specimen crops of various improved strains were exhibited. B. S. M.

Good farmers and Green manure week, East Godavari The prize distribution function for "good farmers" and for service rendered in grow more food campaign and the inauguration of the "green manure week" in the East Godavari District was held at the Agricultural Research Station, Samalkot on the 7th April 1943. Sri Rao Sahib M. A. Kuttalalingam Pillai, B. A., District Collector, East Godavary, presided and distributed the prizes. Prizes were awarded to pioneers in agricultural progress for well run holdings. Certificates were also presented to individuals who have spread improved agricultural methods. A

sum of Rs. 550 from the discretionary grant was utilised in granting the following prizes viz., 20 wooden grinders, 30 bee-hives, 8 honey extractors, 32 quarter bags of improved paddy seed and 2534 vegetable seed packets. Dr. S. Rangaswamy, L. M. S. & D. T. M. spoke on the advantages of wooden grinder rice. The District Agricultural Officer, Sri S. Sitarama Patrudu spoke on the progress of Research, the importance of green manure and the extent of work done in connection with increased food production. An attractive show particularly of green manure seeds and crops was arranged. The meeting was attended by a large number of *ryots* from the various parts of the district.

Agricultural Exhibition, Karavalur (Avanashi Taluk An Agricultural Exhibition on a fairly large scale was held at Karavalur from the 23rd to 27th March 1943 during the local Mariamman festival when a large number of *ryots* of this taluk and of adjoining taluks attended. A special feature of the exhibition was the impetus given to the "Grow More Food" campaign by offering prizes to those who gave preference to food crops in their cultivation programme. P. S. A.

Agricultural Exhibition at Perdur, Udipi Taluk Under the auspices of the Agricultural Association, Perdur, an agricultural exhibition was conducted by the Agricultural Demonstrator, Udipi, on the occasion of the annual car festival of Perdur temple, when over 10 000 pilgrims congregate from all parts of the district and the State of Mysore. The Exhibition was subsidised by the discretionary grant of Rs. 20 from the Collector of S. Kanara, which amount was utilised for the award of prizes to *ryots* of Perdur centre who had adopted the improved methods of agriculture and to those persons who had exhibited agricultural produce of outstanding merit. The Exhibition was held from 13-3-43 to 17-3-43. K. S. S.

Exhibition at Puthiyara-Calicut An exhibition was held in a prominent place in the most crowded area on the main road near the Trichambaram temple (Taliparamba) on the 15th and 16th March 1943. Exhibits covering all aspects of agricultural improvements and food production were on show. At a modest estimate not less than 10,000 people visited the exhibition during the two days. A. G. N.

Exhibitions and shows—Tellicherry An Agricultural Exhibition was organised by the Agricultural Association, Tiruvangad, with a subsidy of Rs. 50 from the Collector of Malabar for awarding prizes to the best exhibits of food products, livestock and products of cottage industry A number of exhibits were put up by the local people. The exhibition was opened by the Revenue Divisional Officer, Tellicherry, on 17—2—'43 and it remained open to the Public till midnight on 24—2—'43. More than a lakh and half of people from all over Malabar who attended the Jagannath temple festival, visited also the exhibition stall. A. G. N.

Agricultural Exhibition at Tiruvarur A fairly large scale Agricultural exhibition was staged at Tiruvarur during the Rudrapatham Festival for a week from 15th to 21st of March 1943. The exhibition, was opened by the Sub Collector, Negapatam, on the 15th. Besides the Departmental exhibits private exhibitors also participated in the show. It is estimated that about 10,000 people visited the stalls during the week the exhibition was on. M. A.

Paddy strain—Adt 19 Sri G. Venkatachalapathi, Secretary, Grow more food committee and Member, Agricultural Association, Peruvalanallur, writes: I am pleased to bring to your notice that I grew Adt. 19 paddy strain in my village during the *Kar* season of 1942—43 in an area of one acre and got an increased yield of 25% over the local *sarapali*. This strain is so popular and the demand for the seed is now so great that I have distributed about 16 bags in my village. I am sure that within 2 or 3 years the whole village of Peruvalanallur will begin to grow this strain only.

Estate News and Notes

The College The College was closed for the mid summer vacation on the 1st April and on the same date the University examination for the B. Sc. Ag. degree commenced.

Back to Madras The offices of the Director of Agriculture and Provincial Marketing Officer which were located on the Estate have been shifted back to Madras, with effect from 26th April '43.

Our Graduates We offer our congratulations to the following students who have been awarded the Diploma of the Imperial Agricultural Research Institute, New Delhi (Assoc. I. A. R. I) Messrs. P. Thothadri (Agricultural Chemistry), Anantarama Panda and A. Seshachalapati Rao (Entomology).

Imperial Dairy Research Institute We are glad to learn that the Imperial Dairy Research Institute, Bangalore, has been authorised by the Government of India to entertain Honorary Research Workers, who are graduates of Indian and European Universities and who are desirous of carrying out research work at the Institute. Such candidates as are suitable and well qualified for dealing with a problem within the purview of the work and activities of the Institute will be selected The number of workers to be admitted will be limited to two at present and their period of research work will not ordinarily exceed one year. The workers will be exempt from payment of any fees for the period of the research work; but they will have to make their own arrangements for board and lodging.

Departmental Notifications

Gazetted Service—Postings & Transfers

On relief by P. H. Rama Reddi, Esq , Director of Agriculture, Sri P. Venkataramayya is reposted as Principal and Government Agricultural Chemist, Coimbatore.

Sri H Shiva Rao, officiating Government Agricultural Chemist, on relief by Sri P. Venkataramayya, is reposted as Assistant Agricultural Chemist.

Sri C. R. Srinivasa Ayyangar, temporary Principal on relief by Sri P. Venkataramayya to continue as Paddy Specialist, Coimbatore.

On return from leave Sri S. Jobitha Raj D. A. O to be D. A. O. Tanjore.

Sri R. Chokkalingam Pillai, D. A. O. Madura to officiate as Cotton Specialist, Coimbatore.

Sri C. M. John, Oil Seeds Specialist to be Oil Seeds Specialist and Geneticist vice V. Ramanatha Iyer granted leave.

Sri N. Subramania Ayyar, D. A. O. Sattur to be D. A. O Madura.

On return from leave Sri A. Ramaswamy Ayyar to be Asst. Marketing Officer, Madras.

Sri T. S. Ramakrishna Aiyar, Assistant in Mycology, II Grade is appointed to act as Assistant Mycologist, A. R. S. Nanjanad.

Leave

Sri K. Raghava Acharya, D. A. O. Cuddalore, l. a p. for 2 months and 11 days from 3—5—43 preparatory to retirement.

Sri M. Anandan, D. A. O. Tanjore, l. a. p. for 2½ months from 10—4—43.

Sri Rao Bahadur V. Ramanatha Ayyar, Cotton Specialist and Geneticist, Coimbatore, l. a. p. for 3 months from the date of relief.

Sri P. N. Krishna Ayyar, Asst. Entomologist, Coimbatore, extension of l. a. p. for 1 month from 24—3—43.

Subordinate Service—Appointments

S. M. Muhammad Sulaiman Sahib, is appointed as Upper Subordinate, Agricultural Section and is posted to Tirchengode as Junior Agricultural Demonstrator for Cotton Seed Multiplication Scheme.

Promotions

Sri N Narayana Ayyar, Asst. A. D. V Grade to IV Grade with effect from 14—3—43.

The following four fieldmen have been selected for promotion as officiating Upper subordinates in the Madras Agricultural Subordinate Service to take effect from 1—4—43.

Sri G. V. Brahmayya, fieldman, D. F. S. Hagari, to be F. M. D. F. S. Hagari.

Sri C. Venkata Naidu, fieldman A. R. S. Siruguppa, to be Asst. in Chemistry A. R. S Siruguppa.

Sri M. K. Lingiah, fieldman A. R. S. Aduturai, to be F. M. A. R. S. Aduturai.

Sri M. Mukundan, fieldman A. R. S. Pattambi, to be Asst. in Paddy, Pattambi.

Transfers

Name of officer	From	To
Sri A. Chidambaram Pillai,	(On leave)	A. D. Conjeevaram.
,, T. K. Mukundan,	F. M. Central Farm, Coimbatore,	A. D. Rasipuram.
,, S. Suryanarayana,	A. D. Kirlampudi,	A. D. Vizagapatam.
,, M. Satyanarayana,	F. M. A. R. S. Samalkota,	F. M. A. R. S. Guntur.
,, Ambikacharan,	A. D. Kanigiri,	A. D. Nandyal.
Janab K. Fazlullah Khan Sahib	A. D. undergoing training at Palladam,	Temporary Asst. in Fruits, Coimbatore.
Sri Ch. Venkatachalam,	A. D. Kovvur,	A. D. Tadepalligudem.
,, S. Lakshminarayana Pantulu,	A. D. Pattikonda,	A. D. Kovvur.
,, P. N. Muthuswami,	A. D. (Sugar Excise Fund) Podanur,	A. D. Udumalpet.
,, V. K. Kunhunni Nambiar.	A. D. Udumalpet,	A. D, Cheyyar.
,, G Kameswara Rao,	A. D. Tadepalligudam,	A. D Kurnool.

Leave

Name of officer	Period of leave
Sri S. Krishnamurthi, Asst. College Orchards, Coimbatore,	L. a. p. for 31 days from 31—3—43.
,, N. Krishna Menon, Asst in Entomology, Coimbatore,	L. a. p. for 4 months from 5—5—43.
,, M. P. Gourisankara Iyer, A. D. Devakottai,	L. a. p. for 3 months from the date of relief.
,, T. Ramanujulu Naidu, A. D. Venkatapuram,	Earned leave on full pay for 35 days from the date of relief.
,, K. Govindan Nambiar, A. D. Palghat,	L. a. p. for 3 months from 5—4—43.
,, A. Chidambaram Pillai, Secretary, South Arcot Market Committee, Cuddalore,	L. a. p. for 5 weeks from 1—4—43.
,, K. V. Natesa Iyer, Supdt. Groundnut Market, Tindivanam,	L. a. p. for 1 month from 1—4—43.

Sri M. Subba Reddi. A. D. Venkatagiri,	L. a. p. on m. c. for 2 months from 18—3—43.
„ T. V. Srinivasacharlu, A. D. Sriperambudur,	L. a. p. for 2 months from 15—4—43.
„ C. Raghavendrachar, Asst. in Chemistry, Coimbatore,	L. a. p. for 2 months from 5—4—43.
„ K. Sitarama Aiyar, A. D. Attur,	L. a. p for 3 months from 7—4—43.
„ C. S. Sankaranarayana Ayyar, A. D. Pelur,	L. a. p. for 2 months from 7—4—43.
„ M. B. Venkatanarasinga Rao, Asst in Paddy, (Temporary Technical Asst. under the I. C. A. R.)	L. a. p. for 2 months and 15 days from 1—4—43.
„ M. M. Krishna Marar, Asst. in the Groundnut Scheme, Coimbatore,	Earned leave for 50 days from 12—4—43.
„ B. L. Narasimhamurthi, Asst. in Millets, Anakapalle,	L. a. p. for 20 days and half average pay for 40 days from 9—3—43.
„ S. Bhima Raju, A. D. Chandragiri,	L. a. p. for 4 months from 18—4—43.
„ D. Bapaiah, F. M. A R. S, Guntur.	L. a. p. for 3 months on m. c. from 11—3—43.
„ Bhagirathy Padhy, A. D. Palaconda,	L. a. p. on m. c. for 1 month from the date of relief.
„ S. Ramaswami Raju, Sub Asst in Botany, Coimbatore,	L. a. p. for 1 month from 26—4—43.
„ S. V. Parthasarathy, Asst. in Botany, Coimbatore,	Earned leave for 36 days from 26—4—43.