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EDITORIAL

The Agriculturists' Place in future Planning At no time before was the dependance of the world on agriculture for the well-being of the people more clearly and widely realised than at present. There is shortage of food caused by the war and every thinking man, and even the unthinking man, wants more food to be produced. Agriculture is, therefore, front page material in the press, the platform, the relevant departments of Governments and all phases of human activity. So many plans are being drawn up for the present and the future—the post-war period. Plans and schemes are alright and most of them are marvels of perfection. How far the objects of the plans would be realised, time alone can show. However perfect the plans may be, however clever and foresighted the people who design the plans are, and however well the various pieces may be fitted into the picture, it must not be forgotten that the plans are subject to human limitations—the limitations of the individual designers. We are not pessimistic, but human beings are not and cannot be infallible and will have their limitations Probing into the past bears testimony to this. The Indian peasant also has a place in this plan or picture and could not be brushed aside, as being insignificant.

Here is one point of view. At the time of the debate on this year's finance bill in the Central Assembly, Sir Cowasji Jehangir emphasised that the primary producers were causing the inflation in this country as they were not paying enhanced land taxes or excess profits tax, like the industrialist. He was indignant that they were not forced to lay by just like the industrialists for the future and suggested that they be compelled to lend to Government amounts equal to twice the land assessment. He characterised the statement of Dr. Bannerji that most of peasants had no food as 'Bunkum'. One may ask whether this is not wishful thinking and whether the class interest is not, may be subconsciously or unconsciously, at the back of all this type of thinking. We could only tell the knight that where there is no surplus, it is not possible physically to put by something for the morrow. The Indian agriculturist has been right through the beast of burden; he has been doing the most strenuous work and has been recompensed the least, especially when compared to the industrialist. He should

be an object of pity and human sympathy and not be heaped with undeserved invectives. He now gets for his produce, no doubt, more than during the pre-war period, but his requiremets—labour, manure, seeds, implements, clothing and other necessities of life—have all gone up 300 and 400 per cent in prices. It is not difficult to see that he cannot be extremely prosperous, though one may wish it or imagine it to be so.

The peasants form the foundation of the prosperity of India, be it little or great. India has to trace its well-being or otherwise to the agriculturists and how great is the disparity between them and others needs no emphasis. The *Indian Sugar* points out in its issue of February 1944 that out of the total currency expansion of Rs. 622 crores between September 1939 and November 1943, Rs. 519 crores have been deposited in the scheduled banks and the Imperial Bank of India. The deposit has not been made by the village peasants, but by others and represents the war-earned wealth, earned or squeezed out by a few people. After all, what is distributed of the increased currency in the country is only a fifth, 103 crores (622 minus 519 crores) among 400 million people, or two and a half rupees per head during a period of four years. That the agriculturists are not absorbing the expanded currency and causing the inflation in the country and are not well off, as is painted by a few, is further borne out by the fact that the Government have been forced to grant various concessions to the agriculturists in diverse forms, including the enlargement of credit facilities to the cultivators, with the object of stepping up the production of food in the country.

This then sets the problem for those who have the welfare of India at heart—that of making not only the country, but also the people, prosperous. This requires to be strongly emphasised, lest the various plans catch the shadow and miss the real substance in their hurry, enthusiasm or shortsightedness. The industrialists, the mercantile community and labour have been organised systematically and find politicians readily to vociferously make out and argue their case, while agriculturists have been suffering and continue to suffer by default. That the armies march on their bellies is an important lesson the present war has taught the belligerent countries. So do the nations and the whole world is what all people have to learn and remember. It is only then that the agricultural industry and the agriculturists will be rehabilitated and a new era of prosperity will be born.

Birth-day Honours P. V. Ramiah Esq, M.A., B Sc. (Edin.), Principal, Agricultural College and ex-officio president of the Madras Agricultural Students' Union has been decorated with the title of 'Rao Bahadur' in recognition of his valuable services in the field of agricultural research and education; we felicitate him on this well-merited distinction.

The Fluted Scale, *Icerya purchasi* Mask., as a Pest of Wattle in South India, and its control by the Biological Method (Contd.)*

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The Importation of the Predator Beetles As it became evident that a control of the pest by mechanical or chemical means was neither economical nor efficient, it was decided to try the biological method, and entomologists of various countries where the Australian ladybird beetle was known to be existent either naturally or after introduction, viz., Ceylon, Queensland, New South Wales, Victoria, South Australia, Java, South Africa, Kenya, Rhodesia and Egypt were addressed in April—June, 1928, requesting supply of *Vedalia* beetles for fighting the Fluted Scale in this province. In addition, the Director, Imperial Institute of Entomology, London was approached with a request for arranging supply of live predator beetles from France or elsewhere. There was prompt response from many of these countries, but most of them expressed their inability to send an immediate supply owing to the scarcity of the scale and its predator, especially in the case of the countries of the Southern Hemisphere, where winter was then prevailing. It was not till May, 1929 that the first supplies of beetles were received, and after breeding and multiplying the scanty supply received the first batches of beetles could be liberated in infested areas only in August, 1929. Altogether three consignments of *Vedalia* beetles were received from abroad, the first from South Africa, the second from California through the Farnham—Royal Parasite Laboratory (both in May, 1929) and the third from Egypt in January, 1930.

The first consignment On 26th April, 1929, the Chief Entomologist, Union of South Africa, Pretoria cabled information about the despatch of live Vedalia material collected from Port Elizabeth (Cape Colony) and shipped from Durban on the 20th April, on board S. S. *Gujarat* of the Indian and African Line for Madras. The consignment was received at Madras on 9th May by one of the authors (Cherian), but unfortunately, it was found when the parcel was opened that the contents—about 106 beetles—were all in a dead condition. It was surmised that this disaster could have been prevented if more food-material had been provided for the beetles and arrangements made for keeping the parcel in cold storage during the voyage. Further supplies of beetles were cabled for from South Africa, but could not be obtained as winter had already set in by then.

* Continued from Vol. XXXII., Page 102.

The second consignment In response to a letter of enquiry, Dr. G. A K. Marshall, Director, Imperial Institute of Entomology, London wrote in February 1929 to the effect that arrangements had been made with Dr. Paul Marchal for collecting Vedalia material from the south of France in June, but in the mean-while, as a consignment of beetles had been obtained from California, Dr. W. R. Thompson of the Farnham-Royal Parasite Laboratory cabled information as to its despatch on board S. S. *Morwada* sailing from the Royal India Docks, London on the 20th April and due to reach Colombo on the 16th May. The parcel was duly taken charge of at Colombo directly from the vegetable cool room of the steamer, on 16th May by Mr. T. V. Subramaniam, Assistant Entomologist, sent from Coimbatore, and on opening it cut, three live beetles and about half a dozen grubs were found alive, though as many as 84 dead beetles were also seen among the contents. The live ones were fed at once on Icerya scales brought from the Nilgiris, and incidentally, a few grubs of the Vedalia beetle were found in a small parcel of Icerya bugs collected from infested wattle at Newara Eliya through the kind offices of the Director of Agriculture, Ceylon for the purpose of feeding the beetles on arrival. All this live material was brought without delay to Coimbatore on 18th May, and despatched the very next day to the breeding laboratory opened at Keti (6,800 ft.) on the Nilgiris.

Breeding Work at the Laboratory at Keti Out of the various centres of Icerya infestation on the Nilgiris, Keti was selected for locating the breeding laboratory on account of its central situation, its easy accessibility by rail and road and the existence of a post office, besides the availability of ample food material there for feeding the beetles. The laboratory was fitted up in a rented bungalow and was placed in charge of an Assistant.

Although the stock with which work was started was very meagre, consisting as it did on 19th May, 1929 of 3 beetles and a score of grubs, it proved to be sufficient for securing successful results The grubs throve well in cages, pupated normally and emerged as adults, and the beetles paired freely and laid eggs, which hatched in 7 to 9 days into active grubs. By the first week of June, there were about a dozen beetles laying eggs, about 100 grubs and pupae besides scores of eggs. By the end of July, the stock had increased to about 380 beetles, 350 pupae, about 5,000 grubs and probably as many eggs. Encouraged by the multiplication thus effected and taking advantage of a break in the monsoon, a small batch of beetles was liberated at Aravankadu in August 29 and another, a week later, on Mr. Parry's estate at MacIvor's Bund. During September 1929 further releases were effected at Fairlawns, Aravankad and Bandyshola near Coonoor. Observations made periodically at the places of liberation showed that the beetles were breeding in nature, fresh eggs and grubs being noticeable, in spite of rather adverse weather conditions. With the advent of the North-east monsoon in the middle of October, however, conditions were found to have become very unfavourable for the breeding of ladybirds in nature.

In the laboratory also, a setback was noticeable, which almost threatened to bring the breeding work to a standstill. The beetles in cages exhibited low vitality and large numbers of grubs were found dying. This was at first attributed to the evil effects of in-and-in breeding, and to a certain extent it appeared likely that the setback was partly the result of competition for food from the local predators—*Rodolia roseipennis* and the *Stathmopoda* caterpillar—introduced from the field along with the scales. After careful examination, Mr. S. Ramachandran, who was then in charge of the laboratory, came to the conclusion that the fall in the rate of breeding was mostly due to the general lowering of temperature and the rise in humidity associated with the North-east monsoon. By artificially raising the temperature of the breeding room at night by keeping a lighted Petromax lamp, as well as by selecting scales free from other predators for feeding he was able to overcome the set-back, so that by February 1930 the rate of output of beetles was again satisfactory.

The third consignment (Obtained from Egypt in January 1930). In reply to a request for a supply of Vedalia beetles made in September, 1928, Mr. E. Ballard, Chief Plant Pathologist, Cairo (who was formerly Entomologist at Coimbatore) wrote to say that although *Vedalia* had been introduced years ago for controlling *Icerya purchasi* and *I. egyptiaca*, its distribution was very uneven and that it was proposed to breed the beetles in large numbers and redistribute them about the country. Reminded again in April, 1929, Mr. Ballard intimated in November 1929 that he was in a position to send a consignment by air-mail. After further correspondence, the *Vedalia* consignment was, by previous arrangement, despatched by air on 9th January, 1930 from Cairo to Karachi, where by the kind co-operation of the Deputy Director of Agriculture, Sind, it was booked by rail immediately on receipt on the 13th January to Coimbatore, as at that time there was no air-mail service to Madras. The journey by railway took a much longer time than anticipated and the parcel reached Coimbatore only on the 21st January. According to advice received from Cairo, the consignment consisted of 500 larvae, 150 pupae, 150 adults, and when opened out at Keti on the 23rd January, the contents were reported to be about 152 grubs, 196 pupae and 204 beetles, with 73 dead beetles in addition. The box in which the live material was sent had been divided into 3 compartments by partitions so as to restrict knocking about during transit, and plenty of food-material had also been provided. The pre-eminent success of this consignment should be attributed to (1) the comparative quickness of the transit (part of which was by air), (2) the presence of abundant food during voyage, and (3) the prevalence of cold weather conditions during most part of the journey, Cairo to Poona, at least

Release of Predator Beetles on the Nilgiris As already mentioned, the output of beetles was again on a satisfactory basis at the Keti laboratory by the end of January, 1930, and the receipt of the fine consignment from Egypt at this juncture proved to be a very valuable augmentation of the

stock available for breeding and distribution. A periodical release of the Vedalia beetles was, therefore, once again taken up, and between February and October, 1930 nearly 4,000 beetles were on the whole, liberated in various infested areas ranging in numbers from 100 to over 600 every month. The following were the main areas of liberation: (1) The Avalanche Road area: Fairlawns, Nanjanad, Porthi, Hookaradai, Avalanche etc., (2) The Ootacamund area: Bishop's Down, Marlimund, Kandal, Club Road, Tiger Hill, Jackal Hill, Kilkavatti etc, (3) Ketti area: Keti, Aravanged, Wellington, Katteri, Osatti, Hookabetta etc., (4) Coonoor area: Coonoor, Bandishola, Springfield, Jakatala, Banniway, Ottanhatti, Idappalli etc, & (5) Kotagiri area: Kotagiri, Kodanad Road, Convent Orchard, Cockburn Road etc., Usually adults were set free at the places desired to be controlled, but in some cases infested twigs containing eggs and grubs of Vedalia were taken from the cages and tied up on Icerya affected bushes. Places of liberation were periodically inspected and notes were taken as to the condition of the pest and the activities of the predator. In the course of his periodical examination of the various areas on the Nilgiris, Mr. Subbiah noticed the presence of beetles and grubs also in places where release of the beetles had not been made. For instance, in July, 1930 he found beetles and grubs at Golf Links, and Bishop's Down at Ootacamund on new infestations where the predators had not been liberated, and the only inference possible in these cases was that the beetles had migrated to these places by flight from the nearest liberated area, viz: Fairlawns from a distance of 7 miles nearly, helped perhaps by the monsoon winds. Similarly at Hookerodai, beetles had probably come in from the Avalanche area (7 miles off.) In the Coonoor area, it is presumed that Springfield had its contribution from Bandyshola about 2 miles off, while near Kotagiri a migration from a distance of about a mile or two was noticeable. In somewhat similar circumstances, Balachowsky (1929) noted that Rodolia beetles had found their way to Port-Cros (Iles d'Hyeres, France), although it was situated about 10 kilometers from the mainland and about 7 k.m. from the island of Porquerolles, where the beetles had been introduced some years back. He was of opinion that the migration of the beetles had been facilitated by the Mistral, which often blows with violence in these regions. These observations show that the beetles are capable of actively spreading from place to place in the infested areas and bringing the pest under efficient control.

Breeding and liberation of Rodolia beetles in the Upper Palnis Following a report of the appearance of Icerya on wattles on the Upper Palnis in 1941, a laboratory was opened at Kodaikanal on 1st July 1942 under the charge of Mr. M. S. Subbiah, and breeding was commenced with a stock of Rodolia beetles collected on the Nilgiris. In the course of four months, a sufficient stock was built up, to allow of a distribution of beetles in the affected areas being undertaken. Between October, 1942 and October 1943 an aggregate of 5,817 adults had been liberated all over the Upper Palnis and with further liberations the pest will be brought

under control. Here also evidence was obtained as to the ability of the beetle to spread from place to place by migratory flight, as for instance in the case of individuals getting into the Kodaikanal area from Korappur where releases had been made.

Bionomics of Rodolia (Vedalia) cardinalis, Muls (Figs 2 to 6 Plate III.) As this predator has been introduced practically into almost all temperate and tropical regions of the world, its life-history is so well-known that there is no need of dilating on it specially. In view, however, of the importance of the study of its reactions to the environmental conditions met with in South India, observations were made by the staff in charge of the breeding stations on its behaviour under different seasonal conditions, and incidentally, various notes were recorded on the bionomics of the beetle in the course of the breeding work, and it is proposed to summarise some of the more important results of these studies. Most of these observations were made by Mr. M. S. Subbiah, while doing Rodolia breeding work first on the Nilgiris and at present on the Upper Palnis.

Mating When the weather is warm and bright, the beetles begin to pair soon after emergence, whereas in dull cold weather, they are inactive and lethargic and remain for days without pairing. *Egg-laying:* In warm weather pairing is followed quickly by egg-laying. Mature scales are generally selected for laying eggs, which are deposited singly and usually on the egg-sacs, though sometimes eggs may be laid on nymphs and even on bare twigs The *egg* is elongate, torpedo-shaped, $\frac{2}{3}$ mm. long and scarlet red when freshly laid. The colour deepens before hatching takes place. The egg period varies from 6 to 12 days according to the fluctuations of temperature. A few hours after hatching, the young *grub*, which is about $\frac{1}{8}$ mm. long, crawls about in search of young scales, attacking and devouring them greedily. The older grubs feed on bigger nymphs, while the beetles themselves may attack both nymphs and mature scales, the egg-sacs being first attacked in the latter case. The grub moults thrice, before beginning to rest, and the active growing period may last 13 to 24 days, in accordance with the prevailing temperature. A well-developed grub measures about 6 mm. in length, and usually attaches itself to the twig by the anal end, and rests for 3 to 9 days before it moults and turns into a pupa. The *pupa* is naked and is usually 4 mm. long and $2\frac{1}{4}$ mm. broad, and turns into a beetle in the course of 5 to 15 days. As the new generation of beetles may lay eggs within 3 to 10 days of emergence, the duration of one generation — from egg stage to egg laying — may vary from 30 to 70 days, the length of duration varying inversely with the rise in temperature.

Egg-laying capacity Subbiah found that egg-laying commenced a few days after mating and continued throughout the life of the female provided there was frequent mating. Egg-laying was considerably reduced, when access to a male was prevented. The maximum number of eggs laid by a female was 897, and an average of 217 per female was worked out in 51 cases. The maximum number of eggs laid by a female during a day was 33. The pre-oviposition period varied from 3 to 17 days and the longest

post-oviposition period was 32 days. The duration of active oviposition, as observed in 47 cases, varied from 3 to 99 days, and the average was about 49 days. (See Table IV appended.)

Longevity of adults The maximum longevity record for an adult male was 168 days, and for an adult female, 129 days. The duration of life is affected by various conditions. When adults were fed and allowed to mate, the average length of life of a male was 57 days and that of a female 59·7 days. When allowed to mate but not fed, it was 16·5 and 9 days respectively, and when neither mated nor fed, it was 21·3 and 19·75 days, the males apparently being capable of withstanding starvation better.

Number of generations in the year Under laboratory conditions both on the Nilgiris and on the Upper Palnis, eight successive generations of the beetle can be produced during a year. During the hot months of March—April—May, a complete generation — from egg-stage to egg-laying — may be passed in 33 to 35 days, while in the cold months it may take as long as 58 to 61 days. (*Vide* Tables II and III appended.) On the hills of South India, the season is comparatively dry and warm during the period — middle of March to middle of May; the South-west monsoon makes its influence felt from the middle of May to the middle of September, the days being cloudy, colder and more moist; from the middle of September to the first week of October, there is an interval of fairly warm dry weather; during October and November, the North-east monsoon prevails and is characterised by damp and chill weather; and cold weather conditions with comparatively low night temperatures obtain during December, January and February. As the life-history of the beetle in nature is profoundly influenced by these seasonal conditions, the daily maximum and minimum temperatures inside the laboratory were recorded, and from these data, monthly means were worked out for the period — July, 1929 to April, 1931 (Table I appended), with which correlations have been established between the length of the different generations and the corresponding temperature data. The duration of a generation is shortest in March, April and May, when the monthly means are between 68° and 70° F, and longest in December, and January, when they are about 63° F. (*Vide* Table II)

The efficiency of the Rodolia Ladybird in the Control of Icerya

Icerya purchasi is an insect with a high biotic potential. Not only does it have high reproductive capacity, being capable of laying 500 to 1000 eggs, but the vast majority of the progeny are females which are practically all capable of reproducing without sexual union. It has, however, only three generations in the year. On the other hand, the predator beetle, which has a fairly high rate of fecundity (being capable of laying 200 to 500 eggs), has a shorter life-cycle and can pass through 7 to 8 generations in a year, so that it is capable of rapidly outstripping the scale and bringing it under efficient control. Moreover, besides being a voracious feeder, it is specific in its food-habits in that it does not attack any other scale. Hence its well-deserved reputation as a highly efficient check on the Fluted Scale But this circumstance acts adversely on the biotic potential of the predator

for when the host insect becomes scarce or disappears as a result of its activities, want of food would naturally react on the beetle and cause it to suffer local extinction. When in the course of one or two seasons, stray specimens of the scale that had escaped the attentions of the predator, begin to multiply, the beetle would not be present in the initial stages to check its increase, so that there would be a recrudescence of the pest under these conditions. This is probably what had occurred on the Nilgiris, when a serious infestation of the scale was reported in 1942, after it had been under check for over a decade. Experience in Ceylon, South Africa, Rhodesia and in fact in all countries where the beetle has been introduced, however, shows that the beetle never dies down completely, but sooner or later asserts itself in spite of such a recrudescence of the scale and eventually keeps it within bounds. If, however, an early control is desired, the best plan would be to breed the beetle under cage conditions and liberate it in sufficient quantities to bring about early control. As this is what is being done both on the Nilgiris and the Palnis, it is hoped that the scale would before long be brought under control.

In this connection, it may be mentioned that responsibility for the work done up to the end of 1930 rests with the first author and that for work conducted since that time, with the second author.

Acknowledgements Before concluding, the authors wish to place on record their indebtedness to the following authorities for sending consignments of the ladybird for use in controlling the pest:— the Chief Entomologist, Union of South Africa, Pretoria for the prompt despatch of the earliest consignment, Mr. E. Ballard, then chief Plant Pathologist, Cairo, for ample Vedalia material received in excellent condition by air-mail, and last but not least, Dr. Guy A. K. Marshall, the enthusiastic Director of the Imperial Institute of Entomology, that great and eminently useful institution which is an asset to the British Empire, and to Dr. W. R. Thompson, the Superintendent of the famous Parasite Laboratory at Farnham-Royal, for the timely despatch of a most valuable consignment obtained from California. The writers wish to express their gratefulness to the successive Directors of the Madras Agricultural Department and to the Government of Madras (Development Department) for their uniformly kind support in regard to the measures proposed for the control of the scale. They are also thankful to the Director of Agriculture, Ceylon for help rendered at Colombo while taking charge of a Vedalia consignment from abroad and for furnishing local live Icerya material for feeding the beetles. Lastly, they wish to place on record their keen appreciation of the whole-hearted help and co-operation received from the various members of the Entomological Section whose services had been utilised in the course of this highly important work.

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TABLE I Monthly Temperature Data at the Keti Rodolia Breeding Laboratory Nilgiris: July 1929 to April 1931

Month	Daily Maximum		Daily Minimum		Monthly Mean
	Monthly Range	Monthly Average	Monthly Range	Monthly Average	
1929 July	70° – 62°	67·0°	64° – 59°	61·4°	64·2°
August	71° – 64°	67·4°	64° – 60°	61·6°	64·5°
September	73° – 65°	68·7°	64° – 60°	62·3°	65·5°
October	69° – 63°	66·5°	64° – 57°	61·4°	63·9°
November	73° – 65°	68·8°	63° – 53°	59·6°	64·2°
December	71° – 62°	78·4°	62° – 55°	58·4°	63·4°
1930 January	74° – 62°	69·8°	62° – 52°	57·6°	63·7°
February	75° – 66°	71·5°	62° – 52°	58·3°	64·9°
March	77° – 69°	74·4°	64° – 60°	62·1°	68·2°
April	80° – 69°	75·1°	68° – 62°	64·5°	69·8°
May	81° – 65°	75·4°	68° – 60°	65·0°	70·2°
June	79° – 62°	71·8°	66° – 59°	63·4°	67·6°
July	76° – 62°	70·9°	64° – 59°	61·0°	65·9°
August	75° – 66°	70·0°	65° – 59°	61·3°	65·7°
September	74° – 68°	70·6°	64° – 57°	61·6°	66·1°
October	73° – 64°	68·6°	64° – 58°	61·3°	64·9°
November	72° – 64°	68·8°	63° – 57°	60·3°	64·5°
December	73° – 66°	69·6°	63° – 51°	58·0°	63·8°
1931 January	74° – 62°	69·3°	60° – 55°	75·4°	63·4°
February	75° – 72°	73·8°	62° – 58°	59·4°	66·6°
March	76° – 68°	72·9°	62° – 58°	60·2°	66·5°
April	76° – 70°	74·3°	64° – 61°	62·8°	68·5°

TABLE II Duration of the different stages in successive generations of *Rodolia cardinalis* correlated with seasonal variations in temperature Keti breeding laboratory—July 1929 to April 1931

Serial number of Generation	Date of egglaying	Date of hatching and Egg period (in days)	Date of going to rest and Larval period (in days)	Date of pupation and Rest period (in days)	Date of emergence and Pupal period (in days)	Date of egg-laying and Pre-oviposition period (in days)	Total duration of generation (in days)	Monthly mean temperature in degree F.
I	28- 5-29	27- 5-29 7	11- 6-29 15	16- 6-29 5	24- 6-29 8	2- 7-29 8	43	Not observed
II	2- 7-29	12- 7-29 10	31- 7-29 19	9- 8-29 9	19- 8-29 10	24- 8-29 5	53	64·2° to 64·5°.
III	24- 8-29	2- 9-29 9	21- 9-29 19	26- 9-29 5	8-10-29 15	15-10-29 7	55	65·5 Sep. 63·9 Oct.
IV	15-10-29	24-10-29 9	15-11-29 22	21-11-29 6	6-12-29 15	15-12-29 9	61	63·9 Oct. 64·2 Nov. 63·4 Dec.
V	15-12-29	26-12-29 11	19- 1-30 24	22- 1-30 3	1- 2-30 10	11- 2-30 10	58	63·7 Jan. 64·9 Feb.
VI	11- 2-30	21- 2-30 10	11- 3-30 18	15- 3-30 4	20- 3-30 5	23- 3-30 3	40	64·9 Feb. 68·2 Mar.
VII	23- 3-30	31- 3-30 8	14- 4-30 14	18- 4-30 4	23- 4-30 5	27- 4-30 4	35	68·2 Mar. 69·8 Apr.

VIII	27- 4-30	3- 5-30 6	19- 5-30 16	22- 5-30 3	27- 5-30 5	30- 5-30 3	33	69·8 Apr. 70·2 May
IX	30- 5-30	6- 7-30 7	26- 7-30 20	2- 7-30 6	15- 7-30 13	24- 7-30 9	55	67·6 June 65·9 July
X	24- 7-30	1- 8-30 8	19- 8-30 18	24- 8-30 5	4- 9-30 11	8- 9-30 4	46	65·7 Aug. 66·1 Sep.
XI	8- 9-30	15- 9-30 7	28- 9-30 13	2-10-30 4	13-10-30 11	20-10-30 7	42	66·1 Sep. 64·9 Oct.
XII	20-10-30	30-10-30 10	20-11-30 21	30-11-30 10	9-12-30 9	16-12-30 7	57	64·5 Nov. 63·8 Dec.
XIII	16-12-30	26-12-30 10	16- 1-31 21	23- 1-31 7	2- 2-31 10	11- 2-31 9	57	63·8 Dec. 63·4 Jan. 66·6 Feb.
XIV	11- 2-31	19- 2-31	12- 3-31	16- 3-31	2- 3-31	(not followed probably)		66·6 Feb. 65·5 Mar.
		8	21	4	7	4	44	

TABLE III Duration of the different stages in successive generations of *Rodolia cardinalis* observed at Kodaikanal breeding laboratory— July 1942 to October 1943

Serial Number of Generations	Date of Egg-laying	Date of hatching and Egg-period (in days)	Date of going to rest and Larval period (in days)	Date of pupation and Resting period (in days)	Date of emergence and Pupal period (in days)	Date of egg-laying and preovipposition period (in days)	Total duration of Generation (in days)
I	17- 7-42	27- 7-42 10	12- 8-42 16	16- 8-42 4	26- 8-42 10	2- 9-42 7	47
II	5- 9-42	14- 9-42 9	9-10-42 25	12-10-42 3	17-10-42 5	23-10-42 6	48
III	27-10-42	7-11-42 11	29-11-42 22	30-11-42 1	13- 7-42 13	21-12-42 8	55
IV	21-12-42	2- 1-43 12	29- 1-43 27	1- 2-43 5	8- 2-43 7	11- 2-43 3	54
V	11- 2-43	18-11-43 7	10- 3-43 20	11- 3-43 1	20- 3-43 9	26- 3-43 6	43
VI	26- 3-43	3- 4-43 8	23- 4-43 20	27- 4-43 4	6- 5-43 9	11- 5-43 5	46
VII	11- 5-43	20- 5-43 9	9- 6-43 20	11- 6-43 2	20- 6-43 9	29- 6-43 9	49
VIII	29- 6-43	8- 7-43 10	2- 8-43 25	5- 8-43 3	16- 8-43 11	26- 8-43 10	59
IX	27- 8-43	6- 9-43 10	5-10-43 29	5-10-43 3	20-10-43 12		54

TABLE IV Observations on fecundity and longevity of *Rodolia cardinalis* adults at Kodaikanal

Serial number of Pairs	Date of emergence	Age of female at first egglaying in days	Total No. of eggs laid	Daily average during period of fecundity	Maximum number of eggs laid per day	Longevity of adults		Duration of fecund period (days)
						Male (in days)	Female (in days)	
1	13-7-42	5	557	10	29	44	72	58
2	14-7-42	4	447	4·5	33	108	95	90
4	24-7-42	4	406	4·2	19	91	95	90
5	24-7-42	6	517	5·7	19	97	97	89
6	27-7-42	8	369	5·2	20	86	87	71
22	3-2-43	5	563	8·7	30	12	79	63
24	5-2-43	5	897	12·5	31	45	77	73
25	13-2-43	7	389	10·3	25	168	44	38
26	13-2-43	—	Nil	—	—	2	129	Nil
27	25-2-43	5	567	5·6	24	120	101	92
31	3-4-43	—	Nil	—	—	4	97	Nil
34	1-5-43	5	366	3·7	20	86	99	84
36	1-5-43	11	250	2·5	14	81	116	99
39	1-5-43	11	406	4·6	16	123	98	88
42	5-6-43	8	297	3·0	16	122	107	89
46	1-7-43	11	269	4·5	19	151	72	60
48	4-7-43	8	310	3·3	12	41	79	62

Babul Planting in Tank Beds

By E. K. VISWAM

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Timber for agricultural purposes and fuel are in short supply and are getting scarce, while the demand for them is on the increase, consequently the price of timber and fuel is tending to soar high and in some cases beyond the capacity of the poorer people. Transport is at present restricted, no doubt, but that alone is not the only factor contributing to the scarcity. Wood is being used at a faster rate than the forests and the village sites can cope with. It is therefore necessary to think of methods of increasing the supply of wood immediately. The obvious remedy is planting trees. The trees selected should preferably be capable of growing without much of attention and cultivation, in lands that could not be cultivated economically. It is suggested that Babul (*Acacia arabica*) would answer the purpose and be ideal.

Babul is able to stand extreme droughty conditions and is classed as a xerophyte The tree has a deep root system and the leaf and leaflets are small and the amount of water transpired through the leaves is therefore limited and naturally the tree makes only slow growth. The tree is also able to stand water stagnation to a considerable extent as is evidenced by its growth in many tank beds in the southern districts, particularly Ramnad, and this is rather a curious trait. The babul wood is hard and makes excellent agricultural implements and first class fuel. The babul fruits, that is the pods, contain about 16 % of protein on a dry basis and are good cattle feed. Gum exuding from the bark is largely used as a paper paste and in medicine. The bark has a little tannin.

Site suitable for planting Tank beds, tank and canal bunds and water ways may be sown to babul in December-January when water recedes to the low lying portions of the tank near the bund The planting may be commenced on the forshore and extended gradually inward. Planting on the canal and tank bunds may be done just before the rainy season.

Sowing The seeds have a hard coat and require to be abraded before sowing. The seed may be mixed with 30% of its weight of sand, spread over a hard floor and a thin stone slab, like Cuddapah slab, moved over it to lightly abrade the surface The seeds may be further soaked in water for 24 to 36 hours just before sowing as an additional precaution. Small holes may be made in the ground 10 feet apart, 2 to 3 seeds laid there and covered. No preparatory or after oultivation is necessary. When the plants are about 6 months old, the seedlings may be thinned out, leaving a plant in each hole. No irrigation is necessary, though pot watering during the first summer season would be helpful. The plantations should be guarded against goats which nip off the young plants and prevent them from establishing and making growth. The plantations begin to yield pods from the 4th year onward and fuel and timber from the 10th to 15th year. The growth of the plantation depends on the fertility of the soil and its depth. When the growth is vigorous alternate rows of young trees could be removed in the 8th year and space allowed for the spread of the remaining trees. The thinnings would provide a small quantity of fuel. The plantation may be ready for cutting in 15 to 20 years. It is realised that babul is a slow grower and for immediate requirements quick growing trees should be the preference.

Plantations could be easily raised in most of the tank beds which are likely to be dry for a part of the year at least and where during the season the depth of water standing would not be considerable. The cost of raising and maintaining the plantations is negligible and there are vast possibilities waiting to be explored. Such plantations would in course of time be able to meet the large demand for timber for agricultural implements, door frames, fuel etc. A good quantity of valuable pods would also be available during the period of growth. The plantations would not interfere with the storage of water in the tanks. The plantations would afford shade in summer for cattle grazing in the tank beds. The plantations would yield additional revenue, where none existed before.

Most of the tank beds, tank and canal bunds suitable for plantations are Government property and the departments in charge may be entrusted with the task of raising the plantations. Where suitable village panchayats or grama-sangams are functioning, they could take up the planting and maintenance work and the concessions granted for the planting of trees in porombokes may be extended also to the planting of trees in tank beds, tank bunds etc.

A note on some Fodder Grasses of the Chingleput District

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An account of the grass flora of the Chittoor, North Arcot and South Arcot Districts has been already published in this journal. Some of the prominent fodder grasses met with in the Chingleput District are now listed and some lines of improvement of the grass flora are suggested. The present survey was made in Trivellore, Saidapet, Conjeevaram and Chingleput taluks, in December 1943.

Chingleput is a sea cost district with the Bay of Bengal on the east, the Nellore District on the North, the South Arcot District on the south and the North Arcot and Chittoor Districts on the west. It is almost a flat country with a maximum elevation of 300 feet above sea level in its western taluks of Trivellore and Conjeevaram. Here and there are some small hills. The district as a whole is not characterised by anything like a rich flora.

The average rainfall of the district is 46·5 inches, most of it being received during the North-east monsoon. The soils are mostly sandy loam or red loam and gravelly in few places.

The available land in the district is classified as follows:—

	Acres.
Forest	125,308
Not available for cultivation	717,564
Other uncultivated areas excluding current fallow	155,447
Current fallow	213,434
Net area sown	754,144

It is seen that the forest area is not much and the area under cultivation is fairly large. The important cereal crops of the district, with the area under each are listed below:—

	Irrigated (acres).	Unirrigated (acres).
Paddy	5,73,787	5,25,253
Cholam	267	5,811
Cumbu	2,203	10,470
Ragi	59,673	21,559
Korra	...	919
Varagu	...	49,489

The straw of the foregoing cereals are used as fodder. The estimated average acre yields of straw in pounds are noted below:—

	Irrigated crop	Unirrigated crop
Paddy	2,234	1,626
Cholam	4,395	1,725
Cumbu	3,615	1,638
Ragi	5,972	2,860
Korra	...	578
Varagu	...	3,360

Based on the above figures, the total production of fodder in the district is computed to be roughly 3,082 million pounds. For computing the total quantity of fodder required, the cattle population of the district and their requirements are given below:—

	No	Requirement of fodder in lb. per head per day
Cattle over 3 years.	469,659	18
do. 1 to 3 yrs.	85,503	12
do. under 1 year.	67,138	8

On the basis of the foregoing figures, the total fodder required for the year is nearly 3,656 million pounds while 3,080 million pounds are produced. Thus there is an apparent deficit which is made up by grasses in the forest areas and those in the fields growing in fallow periods which are grazed by cattle. All classes of cattle are not fed alike. Work animals, cows and buffaloes in milk are well fed. The rest are rarely stall-fed excepting for a small equantity of straw given in the night. To improve the general standard of cattle in the district, the feeding requires to be improved all round.

Fodder grasses Nearly 100 species of grasses have been recorded as occurring in this district and a large number of these were collected by us while on tour in this district. Some of the more important grasses are listed below:—

Sehima nervosum Stapf This is present in all districts except West coast A good fodder and comes upto 6000 feet above sea level.

Hind.: *Chota shadai Ghans;* Tam: *Kura itti*; Kan.: *Sinna shadai hullu; Nalai hullu.*

Amphilophis pertusa Stapf Comes up in all districts in elevations upto 4000 ft. above sea level. A good fodder and hay.

Urdu: *Basana*; Tel.: *Janu gaddi, Turri gaddi*; Tam.: *Chinna karai pillu.*

Chrysopogon montanus Trin This is also found in all districts except West coast. It comes upto 3000 ft. above sea level. It luxuriates in laterite soil. A good fodder grass.

Var. robustus, Hook f. culms stouter and taller; all parts larger. Kan.: *Chello San Kanni.*

Dichanthium annulatum Stapf .It is found in all the eastern and central districts. It comes up in low elevations and is a good fodder.

Dichanthium caricosum A. Camus. This is found in all districts except West coast. It comes upto 3000 ft. above sea level. A fair quality fodder.

Kan.: *Urukur hullu.*

Heteropogon contortus Beauv. This is found in all districts upto 7500 ft. above sea level. A gregarious grass, the awns of whose fruits attach themselves to the clothing of men and hairs of animals. A good fodder suitable for hay making. When mature, the seeds get detached.

Hind: *Sinkolo*; Tel.: *Eddi gaddi, Kaseri gaddi, Dubbu gasari gaddi, yerragoyi*; Tam.: *Oosipullu, Karunsi pul, Pani pullu*; Kan: *Kari vunugada hullu, Sunkari hullu.*

Themeda triandru Forsk. Seen in all districts upto 7000 ft. above sea level. When young it is eaten by cattle.

Tam: *Erigai Thatta pullu;* Kan.: *Bettanchi hullu, Thodda anji hullu, Gondamanch hullu.*

Iseilema prostratum Anderss, It comes up in low elevations in drier parts. A good fodder.

Iseilema laxum Hack. It comes up in eastern and central districts in elevations up to 2500 ft. above sea level. A good fodder.

Tel: *Erra Chengali gaddi*; Tam: *Tenga nari pillu.*

Apluda aristata Linn. This too is found in all districts up to 7000 ft. above sea level. Often it scrambles over bushes. When young it is readily eaten by cattle.

Hindi: *Guruna;* Tam: *Manda pillu, Mungil Pullu, Sengamann pillu;* Kan: *Sanna Kari Kachi hullu, Akku Hullu.*

Digitaria marginata Link. A good fodder found in all districts up to 7000 ft. above sea level.

Hindi; *Takri takra;* Tam: *Arisi pillu, Akki Pillu;* Kan: *Hennu akkibu hullu.*

Paspalum scrobiculatum Linn. Wild or cultivated it is present in all districts.

Urochloa panicoides Beauv. Seen in all districts except the West Coast up to 3000 ft. above sea level. The grain is eaten by the poor people and it is a good fodder.

Hindi: *Kuri;* Tel: *Salla wudu*; Kan: *Kadu billi, Samai hullu.*

Urochloa reptans Staph. Similar to the above

Tam: *Shani pullu.*

Echinochloa colona Link. Seen in all districts except the West parts up to 6000 ft. above sea level. It is an excellent fodder and the grains are eaten by the poor.

Hindi: *Sawank*; Tel: *Otha gaddi, Kaproda gaddi,* Tam.: *Sawu, Sawise, varsanum Pullu, Karum pul.*

Panicum repens Linn. Seen in all districts in sandy soil or standing water upto 7000 ft. above sea level. Relished by cattle and believed to stimulate milk yield.

Eng: Sugar grass; Urdu: *Redo*; Tel: *Ladda gaddi Kari gaddi,* Tam: *Tinei Pillu, Inji Pillu;* Mal: *Inchi kanu pullu,* Kan: *Sonti hullu.*

Saccolepis interrupta Stapf Seen in all districts in altitude upto 6000 ft. in swampy places. Grazed by cattle.

Tel. *Wolam*; Tam: *Tandan Pillu*; Kan: *Hodikai hullu.*

Setaria pallidifusca Stap fet Hubbard Seen in most districts in elevations upto 7000 ft. Fair fodder.

Hindi: *Bandora;* Tel: *Nakka; Kuradakori gaddi. Nakka toka gaddi.*

Cenchrus ciliaris Linn. Comes upto 3000 ft. above sea level. An excellent fodder. Tam.: *Kolukkattai pullu.*

Tragus biflorus Schult. Seen often in sandy localities upto 3000 ft. above sea level.

Perotis indica O. Ktz. Common in all districts on sea shore sand and elsewhere upto 5000 ft. Common in dry soils.

Tel.: *Nakka peechu, Nakka toka*: Tam: *Narival, Kudirai valpullu, Thopparai pullu,* Kan: *Nari misai hullu; Jabburu Korlai hullu.*

Sporobolus diander Beauv: Comes upto 3500 ft. above sea level. Readily eaten by cattle.

Kan.: *Navalu dondi hullu, Thoddu Karai kandaka hullu.*

Eragrostis plumosa Link. Seen in all districts upto 4000 ft. above sea level. It makes good light hay and is much liked by cattle and horses.

Tel.: *Chinna garikai gaddi*; Kan: *Sanna purlai hullu.*

Eragrostis gangetica Stend: Readily eaten by cattle and comes upto 7000 ft. above sea level.

Cynodon Dactylon Pers: It comes up in all districts except West coast, upto 7000 ft. above sea level. Highly nutritious especially to horses and the underground stems are often very long.

Eng: Hariali grass; Hindi: *Dub; Urdus Dubbula Ghanso.* Tel: *Gericha gaddi Gurka harioli*: Tam: *Arugam pullu;* Kan: *Kudi gerikai, Karkeri hullu.*

Chloris barbota Sw: It comes up in all districts except West coast in elevations upto 2000 ft. A good fodder before flowering.

Tam: *kodai pullu, Sevarugu pullu* Kan: *Henu manchada kalu hullu.*

Dinebra retroflexa Panz. In central and eastern districts upto 3000 ft, above sea level. Readily eaten by cattle before flowering.

Tel: *Wadata toka gaddi*: Kan: *Nari balada gandu hullu.*

Twentysix species are listed above as occuring in the district and as important among the fodder grasses. Most of them are growing in waste places, bunds of cultivated fields and in forest areas in patches or in scattered patches here and there. No systematic trial appears to have been made to establish any of them in large areas, and the list therefore does not indicate the predominance of any grass in the district

Conclusion Among the many fodder grasses occurring in the district only a few are of fodder value. No data are available regarding their yields or number of cuttings obtainable each year. Some of the promising species have been raised in Coimbatore under rainfed conditions and the yield obtained are given below:

Name of the grass	No. of cuttings	Yield of grass in lb. per acre
Sehima nervosum Stapf	2	9,680
Amphilophis pertusa Stapf	1	7,520

Dichanthium annulatum Stapf	1	5,920
Cenchrus ciliaris. L	2	20,560
Panicum antidotale Retz	2	14,760
Eremopogon foveolatus Stapf	2	11,520
Iseilema laxum Hack	1	4,540
Pennisetum purpureum Schum	1	5,760
Panicum maximum Jacq	2	20,560
Chionachne semiteres C. Fish	1	15,200
Cenchrus setigerus Vahl	1	11,400
Enteropogon monostachyos Schum	2	12,680

Under favourable conditions greater number of cuttings and higher yields than the above can be expected.

Grasses by themselves or the straw of cereals do not provide all the food nutrients. They require to be supplemented by leguminous forage. It will be an advantage if wild growing perennial legumes, similar to the clover of the European countries, could be selected from the naturally occurring leguminous weeds and established in the pasture The poor types of grasses on the roadsides, waste places and the grazing areas of the forest may be replaced by valuable types like *Sehima nervosum, Cenchrus ciliaris, C. setigerus, Amphtilophis pertusa, Dichanthium annulatum* etc. and their feeding value and production increased. This work may be usefully undertaken by the forest department and local bodies in their respective spheres. Where feasible *Commiphora Berryi* can be planted to prevent cattle trespass until the grasses establish themselves.

A beginning has already been made by the introduction of some of the reputed fodder grasses like *Cenchrus ciliaris, C. setigerus* etc. in the Attani forest area of the Bhavani range thrcugh the kind co-operation of Mr. J. A. Wilson, the District Forest Officer, Coimbatore North and our experience shows that these two grasses are a success in ihe forests and have induced the *ryots* in the neighbourhood to establish these in waste places. Other grasses like *Iseilema* laxum and *I. anthephoroides,* which have so far not been tried in forest areas, may also be tried.

Acknowledgement We are thankful to Sri K. Cherian Jacob and Sri Daniel Sundararaj for identifying the grasses collected by us in Chingleput district and to Sri V. T. Subbiah Mudaliar for furnishing the estimates of yield of the cereal straws.

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Eat More Fruit*

By K. C. NAIK, M. Sc. (Bristol),
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Experience of the human diet in all countries and ages shows that our food consumption is primarily controlled by circumstances. The popular tendency is to consider food merely as a means of supplying the necessary bulk for the body to function normally. Earlier work in nutritional and medical research indicated that the food we consume must supply sufficient energy. The unit of food energy is termed as the calorie. Till recently very great emphasis was laid on the supply of the requisite amount of calories for people of different ages and in different avocations of life. Thus, it was believed that a fairly active man of medium height and weight could maintain his weight by eating food containing 2,500 to 2,600 calories. The rations for the fighting forces were for a long time fixed on the basis of calorie standard, the daily requirements of the army being generally deemed to be over 4,000 calories per man. This notion was subsequently replaced by later discoveries in nutritional science which proved that besides energy, the human body requires protective foods largely made up of dairy products, vegetables and fruits. All these foods provide certain essential health-promoting substances called vitamins, the absence or inadequacy of which results in mal-nutrition, a host of diseases, poor growth and low efficiency of the body.

Japan was the first country to bring about something of a revolution in the domain of nutrition. In a lecture delivered at the XII International Horticultural Congress in Berlin, Dr. Wirz of Munich, who is the Nazi Expert in the Advisory Committee for public health at the headquarters of the Nationalist Socialists Party, showed how Japan succeeded in effecting a very significant quantitative economy in her food consumption. Japan, he said, was able to successfully reduce the calorie intake of an adult from 3,200 to 1,500 that is, to more than half of what is considered according to the widely accepted International standard as the adequate daily requirement of an adult engaged in light work. This achievement was rendered possible by introducing a diet containing a large quantity of protective substances which are contained in fruits and vegetables. A similar extraordinary result was achieved in Nazi Germany in 1938. Here it was found that in districts where ample vegetables and fruits were eaten by the populace the daily consumption of fats was 30 per cent below the Reich average.

Dr. Wirz also referred to the authoritative statement made by military experts to the effect that proper diet containing fruits was responsible primarily for the success of Italy in the last but one Abyssinian War. By

* Summary of a lecture delivered on 31—12—'43 and 1—1—'44 at Trichy during the Tamilnad Fruit Show.

proper diet Italians controlled certain epidemic diseases, which under the climate of Abyssinia could devastate more armies than the Abyssinian armaments. A similar view has been expressed by Lord Woolton, till recently the Minister for Food Supply in Great Britain. After the conclusion of the first National Nutritional Conference for Defence, convened by President Roosevelt in Washington, the Secretary for Agriculture stated that the people of the United States would have to consume twice as much of protective foods in the form of fruits as they did in 1941. The special measures taken in Great Britain to conserve their vitamin supply have the same end in view. All these provide unequivocal proof of the inestimable value of the protective substances contained in fruits for safe-guarding the physical fitness of the civilian population and the fighting forces.

One of the established facts revealed by scientific research is that, even if we supply the body with protein, fat and carbohydrates in abundant measures, the body would nevertheless starve. What matters, are the thousandth, even the millionth parts of gram of mineral salts and vitamins. If these are lacking, disturbances of metabolism, of health, and finally degeneration and sterility arise. It is, therefore, now well-known that by defective diet, we do not simply mean insufficient diet—not enough to eat—but rather incorrectly composed food, in which minerals and vitamins are lacking or are inadequate and which form the characteristics of the food eaten even by some of wealthiest of persons.

Of the several vitamins that fruits are reputed to possess vitamin C is the most important. This vitamin is best known for its ability to prevent and cure the scurvy disease. Bleeding from the gums, haemorrages, black and blue spots on the skin, and painful joints are some of the well-known symptoms of this disease. From a thorough study made of the blood changes which occur following continuous daily administration of vitamin C to tubercular patients at Chicago University, it is reported that very favourable results were obtained in patients. Because of its various beneficial properties, the Nobel prize winner, Professor Szent Gyorgyi who first synthesised vitamin C has predicted that realisation of full health would come only when the medical profession and the public had reached an appreciation of the importance of vitamins, particularly of vitamin C. Fruits are now known to have besides the antiscorbutic value, value against insomnia and certain forms of insanity. It has been proved at the University of Chicago that patients receiving large amounts of vitamin C overcome insomnia without further medication and that insane patients require 3 to 5 times as much as normal persons to obtain restful sleep. This vitamin also strengthens blood vessels and connective tissues, promotes strong cartilage, bone and teeth. The greater need for vitamin C during fevers is also indicated by research. Guavas, Indian gooseberries, cashew fruits, pineapple, papaya, oranges, limes, lemons, grapefruits, mangoes, strawberry, pummelo, carambola (or Kamrak), bilimbi, jack fruits, wood apples and tomatoes are some of the South Indian fruits which are fair to rich sources of vitamin C.

The second important vitamin in fruits is A. Absence or inadequacy of this causes a lack of resistance and consequent susceptibility to infection. This is manifested by a tendency towards development of infections in the head sinuses, nasal passages, tear ducts, tonsils, respiratory tract, skin, bladder and gastrointestinal tract. Vitamin A is essential for maintaining normal skin and mucous membranes which are our first barriers to infection. Animals deprived of vitamin A show degenerative changes in the mucous membrane lining of the nose, throat, kidney and bladder. If maintaining a healthy mucous membrane is protection against colds, then the vitamin A found in fruits is protective in this respect Besides promoting healthy skin and tissues, strengthening mucous membrane, aiding respiratory system and digestion, this vitamin strengthens eyes against diseases and night blindness. Mango, papaya, persimmons and cashew fruits are rich sources of vitamin A, while some bananas, figs, guavas, oranges, tree tomatoes, pummelo, bilimbi and jack fruits are fair to good sources.

Some fruits are also fair to good sources of vitamin B, and some, the only known sources of vitamin P. All these various vitamins are necessary to build healthy nervous tissues, aid digestion and absorption of starches and sugars and, are therefore, essential to normal growth and health. Fruits are not specially rich in B1 vitamin, but bananas, grapefruits, oranges, pears, plums and tomatoes do contain this in fair amounts.

Vitamin P has to do with controlling capillary permeability—the haemorrages associated with scurvy and known as purpura. This vitamin is claimed to help in the curing of high blood pressure and haemorragic nephritis (Bright's Disease). The discoverer of this vitamin further claims that it prolongs life, and prevents loss of weight. Vitamin P is known to be found in lemon juice and peels, and is otherwise known as citrin.

The pectin contained in fruits stimulates intestinal activity without injuring the mucous membrane lining the tract. Spastic and irritable colons which are caused by the overuse of foods known as "roughage" can be avoided by using fruits regularly, as these provide a bland and non-irritating bulky material. An ideal bowel action is, therefore, promoted by regular fruit diet.

That portion of the pectin which is digested gives rise to certain products such as galacturonic acid, which when absorbed and carried to the liver enables that organ to get rid of many poisons. These detoxicating effects of fruit diet are valuable in cases of intestinal disorders including intestinal ulcers.

The cellulose in fruits also adds bulk to foods and thus favours normal intestinal activity without producing any friction or irritation. Dr. Wirz believes that if only the public realise this important aspect of fruit diet, that curse of mankind—the chronic constipation—will have been mitigated to a large extent. There are also instances which indicate strongly the value of the regular fruit diet in the curing of piles.

According to a popular notion, fruits which are tart or acidic may cause acidosis. As a matter of fact fruits counteract acidosis, aid in maintaining alkalinity in the body and are almost at the top in the list of the alkaline reacting foods.

Fruits are among the most splendid appetisers, possessing rich flavour and the ability to increase the flavour of other foods as well. By adding colour and gayness they make an inviting appeal. Crisp and tart fruits stimulate the circulation in gums and freshen the teeth. That unpleasant tooth trouble—pyorrhoea—is said to be cured successfully by the intake of certain fruit juices such as orange juice, at the rate of one pint a day. The value of fruit diet in counteracting dental decay and gingivitis has also been proved by nutritional experts.

Among the reducing foods of special value to fat persons, fruits occupy a high place, being low in calorific value, low in fat, starch and protein, and high in essential acid-neutralising minerals and vitamins that help to act as buffers by soaking up the adipose acid waste from the tissues of the obese. Some fruit juices are also reputed to be an aid to beauty.

The manufacture and maintenance of healthy blood supply, the fortification of the body against the infectious diseases of child-hood, such as diptheria, scarlet fever and rheumatic fever and the counteracting of such diseases as artithritis and diabetes, as well as the promotion of wound healing are yet other claims made by certain medical authorities, in favour of regular fruit diets.

As a medicinal agent possessing prophylactic and therapeutic powers, as most tempting, palatable, and enjoyable foods of the highest health-giving properties, there are, therefore, none other to equal fruits for human well-being. Fruits are admittedly the Nature's best devices for keeping mankind healthy and happy. The fruit industry is, therefore, deemed to be one which is more in step with the biological trend than other agricultural industries, with the possible exception of dairy and vegetable-growing industries. It would therefore be not an exaggeration to say that it is a public service of first rate importance to induce people to grow and eat more fruits.

None can deny that the scope for increasing fruit consumption is very great in our province We have no accurate figures of per capita fruit consumption, but there is no doubt that it must be notoriously deficient and far below the American standard. An estimate of citrus fruit consumption has been recently made by the Agricultural Marketing Adviser with the Government of India. According to this our per capita citrus consumption is only about 6 lb. as compared to 54 lb in U. S. A. Yet the U. S. A. is striving to double its fruit consumption Even Great Britian, a non-citrus producing country, has a per capita consumption of 27 lb We can very well visualise, therefore, the scope for a Eat More Fruit Campaign in this Province.

Even among our higher economic groups, the percentage of regular fruit-eators is negligible. Cost is surely of not much consideration with the

rich in respect of fruit consumption. If the health value of fruits is brought home to them, we should be able to increase sales and extend our production of fruits to a remarkable extent. For the people even in the lowest economic group also, there is a large variety of fruits like the cashew apple, jack, ber, nelli or amla, papaya, custard apple, cheaper mango and citrus, which can be produced in plenty and placed within their reach. These oft-despised fruits of the rich are not merely healthful, but are also a source of no mean profit. In these days one often sees a poor man having a satisfying meal with four to five Mauritius bananas. It is doubtful if a more healthy meal can be had of cereals at the same cost.

Above all, let us not forget, that if health, growth and efficiency mean anything in our scheme of life, the value of fruit diet cannot be measured in terms of their actual cost. Fruits are certainly cheap from the stand-point of health value, and are essential for our well-being, which is Home Defence. The origin of the best food is fruit industry. The source of one of the national wealths is also the same. If we are indifferent to that industry, we only ignore the means of bringing about our economic prosperity and improvement of national health, especially in a province like ours which enjoys the most favourable conditions for fruit production at a cost which will defy competition. "Grow More Fruit" and 'Eat More Fruit' are the two slogans which should, therefore, motivate our actions in various spheres of national life

Breeds of Cattle and Their Staple Fodder Grasses

By K. CHERIAN JACOB, L. Ag., F. L. S.,
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Introduction There are four important breeds of cattle in South India viz., the Amirthamahal and Hallikar in the Mysore State; the Ongole in the Guntur District and the Kangayam in the Coimbatore District. These four breeds are not the outcome of any scientific breeding as it is the case in Western countries, though in maintaining the purity of the breeds, some crude principles might have been observed by the *ryots*. These four breeds differ from one another in their characteristics—the Amirthamahal and Hallikar are known for their nimble foot on the road; the Ongole for its massive body and slowness in speed combined with immense capacity to haul heavy loads; the Kangayam for its medium size and long life especially when put to heavy agricultural work such as mhoting. In Western countries cattle breeders pay great attention not only to pedigree breeding but also to feeding and upbringing of cattle. Stall feeding plays an important role. The advantage in stall feeding is that the best forage can be supplied to the animal in required quantities and the deficiencies made up by suitable concentrates. Unfortunately, in this country scientific feeding is still a neglected problem.

Breeds of cattle and grass species These four breeds mainly depend upon the natural fodders, for their feed, chief of which are the grasses in

waste places, reserve forests and other pastures. A study of the grasses in these tracts reveals the fact that each tract has a characteristic grass species as pointed out below:

Amirthamahal breed The predominating grass found at Hunsur and surrounding places in the Mysore State which is the home of the Amirthamahal breed of cattle is *Sehima nervosum* Stapf (Eng: Rat-tail grass; Tel: *Nendra guddi*; Tam: *Kurai yitti*; Kan: *Nalai hullu*; Mal: *Paal pullu*). By cattle graziers it is considered to be the best forest grass and is the mainstay of this breed of cattle which were famous as draught animals for military purposes at the time of Hyder Ali and Tippu Sultan. It thrives in hilly tracts with fairly good soil and under partial shade. It grows to three feet in height and tillers profusely. The great strength and vicious nature of the animals of this breed is attributed to their grazing on this species of grass.

Hallikar breed The commonest grass found in wet situations especially on rice-land bunds and odd uncultivated corners in rice-lands of the Mysore State is *Dichanthium caricosum* A Camus (Kan: *Baadi hullu, Kanda baatha hullu, Pari hullu, Sanna hullu;* Tel: *Motava gaddi*. Villagers of these places are privileged to take the bull calves and young bulls of this breed along the bunds of the rice fields for grazing, even when the crop is on. It grows to $1\frac{1}{2}$ to 2 ft. in height and is very much relished by cattle and is the mainstay of the Hallikar breed of cattle found in Hassan, Tumkur and Mysore Districts of the State.

Ongole breed The two very important and allied species of grasses found in the Guntur and adjoining districts of the Madras Province are *Iseilema laxum* Hack. and *I. anthephoroides* Hack. They are the mainstay of the Ongole breed of cattle. They thrive in black cotton soil and grow to $1\frac{1}{2}$ to 2 ft. high with decumbent bases.

Kangayam breed The commonest and the most important grass found in the south and south-east Taluks of the Coimbatore District is *Cenchrus ciliaris* L. (Tam: *Kolukattai pullu*). It is the mainstay of the Kangayam breed of cattle. This grass thrives in dry places in red soils. It grows to $2\frac{1}{2}$ to 2 ft. in height, and is relished by cattle. Young shoots arise from the root-stocks immediately after showers. It is a hardy grass with a tendency to form 'legs' in fertile soils which should be cut down to the base before the monsoon sets in.

From the foregoing observations it is seen that these four breeds of cattle have in the natural pastures of their respective tracts four dominating species of grasses. It may be interesting to ascertain whether a similar relationship exists between the other breeds of cattle (about 24 in number) in India and the dominant grass of the locality in which the distinctive breeds flourish. The mineral and protein content of these grasses along with soil and climatic conditions of the places may be responsible for the different types of builds of these breeds of cattle.

SELECTED ARTICLES

Agricultural Developments in the U. S. S. R.*

By SIR JOHN RUSSEL, F. R. S.

Prior to the Revolution three systems of farming were practised in the U. S. S. R.: (1) large estates; (2) small peasant farms; (3) peasant land farmed by the peasants under the *Mir*, the village council or commune of very ancient origin.

Some of the large estates were run on good modern lines, some were put into the hands of managers whose business it was to extract all they could for the owner, others were moderately well managed. The peasant farms were small holdings owned by the individual farmers which had resulted from the various agrarian reforms, the most important of the later ones being those of Stolypin (1905), who had a Danish adviser and was aiming at the Danish model. The peasant land under the commune (*nadiel* land) belonged to the body of peasants but not to any individuals, it was parcelled out into many strips which were periodically distributed by the *Mir* among the peasants in accordance with the size of family, etc. These strips were scattered over the whole area so that each man should have his share of good and of bad soil. In the time of the Revolution it was estimated that about 45 per cent of the cultivated land was in the hands of the peasants.

All three systems were disliked by the Bolsheviks, the first two because they involved private ownership of land, and the third because of its grave inefficiency and the utter impossibility of introducing modern improvements. The Bolsheviks also disliked the peasant mentality, so utterly different from that of the factory worker. The peasant wanted to sell his products at high prices while the factory worker wanted to buy them cheaply. The factory worker was accustomed to work in masses for an employer, and had before the Revolution no sense of proprietorship: the peasant was used to working alone or in small groups and always felt that he owned the land he tilled.

After some experiments, State farms were set up which accorded well with Bolshevik theory. The peasants were employees of the State receiving a weekly wage, living in great blocks of dwellings in a central area developed like a town. The whole organization resembled that of a factory, and it was expected that the peasants would develop the factory workers' outlook and become one with them. But the peasants did not like them and so they never developed; in 1938 only about 10 per cent of the cultivated land was worked as State farms, and they were used for special purposes. A completely different type of farm was set up on the basis of the old *Mir*. The first were communes in which the whole body of workers was responsible for the full maintenance of each individual family; but this did not answer. The *artel* organization was therefore adopted; another old Russian method which has no English equivalent. In this the workers feed and house themselves but the produce belongs to them, and after all outgoings have been met the balance is distributed according to the work done. The workers are paid in actual produce; mostly grain, potatoes and vegetables, these being the main constituents of the peasants' dietary; usually also there is hay for the workers' animals, and a small amount of cash. This method after suitable modification proved much more acceptable, and by

* Substance of a lecture at the Central Council for Health Education Summer School held in London during August 1943.

1939 a very large part of the cultivated land of the U. S. S. R. was farmed in this way.

The farms were called 'Collectives'. All the cultivated land in the village, whatever its previous ownership, was thrown into one big farm; it might be 1,000--4,000 acres or more, but was not usually unmanageable in size. All the peasants of the village could come into the group, but preference was given to the so-called 'poor peasants'. The plan of production was until just before the War sent from headquarters; it had been discussed during its development, but once settled, it could not be further discussed. The workers elected a committee to carry it out and to allocate the tasks to the different people; the chairman, however, was not freely elected as he had to be accepted by the Party and the Government; he often came from outside and did not usually stay long. The Party always insisted on keeping its hold on the farms, and it had its representative, who was quite independent of the committee.

Payment was always by the piece; a certain job of work was called a "labour day" and when a man had done this he was credited with one day's work. Not infrequently about two hundred would be done during the year, but specially good workers would put in many more. The worker could eat his share of the produce or sell it to the farm, the Co-operative or in the peasant market.

The workers' share of the produce varied with the yields and the outgoings. The Government's share has varied For some time prior to 1939 it was a fixed amount per acre of winter grain sown, and of spring grain ordered to be sown, also a fixed quantity of milk and meat per animal kept. A small price was paid, much below the market price. In 1939 more latitude in planning was allowed so long as the stipulated Government share was duly delivered. As this was fixed while yields were variable it is impossible to state any definite percentage, but an average of a number would lie between 15 to 20 per cent. Then the machine tractor station, the Government organization that hired out the tractors, combines and other big tackle and supplied the drivers had to be paid; this might take another 15 per cent. Seed for next season and fodder for winter had to be set aside: this also might amount to about 15 per cent. Insurance, administration, sick and needy people, maintenance, capital development, and other farm overheads had also to be provided for. One way and another, more than half the produce would go and the workers' share might be 40 per cent or less.

A great change in the system, and in the peasants' attitude to it came when the Constitution of 1936 gave the collective farms the use of their land for ever, and also gave each member the use of his cottage and its garden and a holding varying from ½ acre to 2½ acres on which he could keep such animals as he and his family could look after. So popular were these holdings that by 1939 much of the peasants' time was spent on them and a large proportion of the livestock of the U. S. S. R. was their private property. So decrees went forth that they must put in a minimum of a hundred days per annum on the farm; this number has since been raised.

There is little doubt that when peace returns this modified system will be able to provide the U. S. S. R. with the food needed for a rising standard of life. The theoretical objection still remains, the peasants are not employees and do not come under the labour code; they have for example, no trade union and are ineligible for old-age pensions. 'Peasant-mindedness' still continues and they are not one class with the factory workers. But so many theoretical difficulties have been brushed aside in the U. S. S. R. for a realistic solution that we may expect this also will disappear and the system will become wholly acceptable.

(*Nature, November 6, 1943*).

Preserving the Good Earth: Anti-Erosion Measures

By SIR R. GEORGE STAPLEDON, C. B. E., F. R. S., M. A.

During wartime it is easy to forget dangers which, in the long-term scheme of things, are even more pressing than many of the problems now absorbing world-wide attention.

Such a menace is soil erosion, which, in cold fact, is the master-danger that faces posterity. Since, in the last resort soil erosion, even on the grandest scale, has been wholly the fault of man, its continuation will be equally the fault of man. Man's attitude towards this problem is the supreme test of his wisdom and of his real interest in the species he represents.

Remedial measures against the results of soil erosion, where still possible, must be exceedingly slow in their operation, while preventive measures not only demand foresight, but benefits must necessarily be cumulative and spread over generations—nay, centuries.

World-Wide Phenomenon Soil erosion is a world-wide phenomenon: it is not totally absent even in the temperate climate of Britain, where the conversion of forest and scrub into agricultural land has been a gradual process. In Britain however, systems of farming are in the main adequate to take care of the precious humus which is an absolute essential to ensure a properly porous soil and to maintain an adequate plant-covering throughout the rotation.

Even so, wind erosion is not uncommon on Britain's Fenlands, and sheet erosion on steeper hill-slopes. In Britain the dangers are easy to counter, but wartime ploughing-up has served, or should have served, to warn that the land can only be mined and exploited at our peril.

It is, perhaps, ironical that the peoples of the world should have woken up to the supreme importance of nutrition, which demands an abundant supply of the right foods, only when by years of negligence vast areas of the world have been allowed to become incapable of food production as the result of sheer folly and inadvertance.

It is not too late however. Immense strides have been made in perfecting methods to counter erosion, and in practices of farming designed to produce good harvests of wanted crops of a character to obviate the starting of erosion.

The chief point to be realised is that erosion is like a snowball. From very small beginnings the most devastating results can happen in a surprisingly short time. Thus, for example, in Cyprus "the change from fertility to aridity has been due entirely to deforestation", is pointed out in a recent book on the subject. The danger is now realised, and in the island 18 anti-erosion centres have been established.

Too Much Deforestation Speaking quite generally, the beginnings of erosion in most countries have been due primarily to deforestation on too grand a scale and without any thought of establishing systems of farming and practices designed to counter erosion from the moment the plough replaces the firestick or the axe.

Little less serious has been the over-grazing of native and sparsely-covered areas of natural vegetation. The two agents that preserve the soil both from wind storms and from deluges of rain are humus and the plant-covering. The two are mutually interdependent. Apart from the adoption of sensible crop rotations and methods of cultivation—such as strip cultivation and terracing—that are best designed to counter erosion, a major problem of arid countries appears to be the necessity to conduct researches with a view to finding the best possible means of afforestation under extremely difficult conditions.

And here it must be pointed out that the essential need is plant-cover, protection and something equivalent to a forest floor and not primarily a marketable product. Another need is to introduce into the rotation an adequate period in humus-forming vegetation and in a covering that will be impervious to erosion. In short, to endeavour to establish a closely-knit ground covering vegetation of a character as similar as possible to the grass and clover ley that counts for so much in the rotation in temperate regions.

Anti-Erosion Measures In most regions of the British Empire the dangers of erosion are now realised. Thus, Australia set up its Soil Conservation Board in 1941, and Kenya created a Soil Conservation Service in 1938. Anti-erosion measures are being pushed forward in Grenada, West Indies, Barbados, Basutoland, Uganda and Nyasaland, to mention but a few examples.

Taking the world as a whole, it is, however, to be doubted if the extreme perils of soil erosion are anywhere fully appreciated. Man is not yet trained to take more interest in and care of posterity than in his own immediate affairs and difficulties.

Soil erosion is the longest of long-range problems, it must be expected everywhere and countered everywhere. The problem is basic, and is fundamentally one of point of view. It must be realised that soil takes thousands of years to develop and can be squandered and lost in a decade. No system of farming should be tolerated that does not first and foremost take care of the soil. The prime need of taking care of the soil must dictate the crops that are grown and the rotation followed and all the methods of cultivation adopted—not economics.

Soil erosion is a world problem. Man must obey the demands of the soil or perish. International trade and international relationships must needs be such as to cry halt to soil erosion and not as in the past to invite it.

Organisation of Agricultural Research in India

By RAO BAHADUR B. VISWANATH, C.I.E., F.I.C., F.N.I.

I am glad to accept the invitation of the National Institute of Sciences to participate in the symposium on the post-war organisation of research and to contribute my views in respect of agricultural research in India.

Agricultural Research has been in progress in India for forty years. During this period an Indian school of Agricultural research with a large body of workers has gradually grown up. In recent years agricultural research and the organisation for it were under review and readjustment. The Royal Commission on Agriculture reviewed in great detail between the years 1926 to 1928 and Sir John Russell and Norman Wright in the year 1937. In examining again in reference to post-war requirements, it is necessary to consider first the nature of post-war agriculture and its problems that are likely to arise and then the research organisation to meet the requirements.

Research has never been more popular and more in demand than now. There is, therefore, no need to expatiate either on the value of research or on its practical contributions to agricultural development in India. We may assume that as in the past research is one of the agencies that can assist agriculture and proceed straight to the consideration of post-war problems and research.

Post-war Agriculture and its Problems The effect of war is dislocation and change in the existing system in varying degrees. Some crops and commodities have lost their export markets. Food crops have exchanged places with industrial and commercial crops. Ways of life and modes of thought have changed, following the war time changes in the agricultural, industrial, commercial and economic fabric of the country. The restoration to peace is not necessarily and in every case the return to pre-war life. The masses of people require to be fed and clothed and housed better than before. The peasant soldier, will emerge with wings from his khaki casing and will demand occupation and instruction in agricultural, domestic and village matters. Post-war problems will not be the usual crop and live-stock husbandry only but also concern the production of healthy farmers and retaining them on the land. The peasant farmer staying at home has become more self-conscious. He has begun to think in a different manner and he needs more income, more buying power and better standard of living.

There will thus be two sets of problems. One set of problems may be described as 'immediate' and will be those arising directly out of current war conditions such as changes in cropping systems, effects of inadequate nutrition and the return of the demobilised farmer soldier. The other set of problems are those concerned with the larger economic national reconstruction in which agriculture constitutes the key problem. The two sets of problems which are in the main agro-economic and psycho-economic are closely inter-related and require scientific approach and solution.

Comparison with other countries—Agriculture is an enterprise which is still dominated by Nature and environment, and more so in India. There can, therefore, be no complete break with the old and building anew, but it can have any style of super-structure, exotic or indigenous. The important point is that agriculture gives shape to research and research in turn determines the pattern of agriculture. It is, therefore, natural to look to other more advanced countries for inspiration and for imitation of whatever appeals as the most progressive and the most suitable. Such a procedure, besides providing a short cut to progress, holds the country and the system as an ideal to work up to. But idealism should not ignore realism if risks and disappointments are to be avoided.

Countries like Great Britain, America, Australia and Russia and their departments of agriculture and research are held up by some as examples for imitation in India. Apart from differences in climatic conditions, the agricultural history of those countries is very short compared to that of India and has been largely concerned with opening up virgin lands which are agriculturally much younger than those in India. Although the basic science of agriculture is the same everywhere and much of the knowledge of the temparate countries would be expected to be applicable to Indian conditions, it has been discovered from experience that it is by no means the case with all such knowledge. Compared to India, those countries have very much easier tasks. The farming communities of those countries consist of large sections of people who are mainly immigrants either through love of adventure or hopes of making fortunes. They farm large farms the smallest of which is many times larger in size than the largest average holding of this country. The new-comers either did not originally have any or only indifferent knowledge of agriculture. They were, therefore, in need of advice and were anxious to have it. There science and research contributed largely to the shaping of new agricultural ventures and having succeeded with science and scientific advice the cultivator is anxious to have it. In India the position in the long established agricultural areas is otherwise. We may expect similar work and results in India also in utilising uncultivated lands.

The Russian system of collectivisation is sometimes held up as an example for imitation. This is primarily based on the belief arising from the large exports of wheat from U. S. S. R. in 1930—31 after a few years following the introduction of the systems of collective farming as part of the planning system. The

increase was only in the total out-turn and not an increase per acre. It is the result of an increase in the cultivated area from 279 million acres in 1922 to 336 million acres in 1931, an increase of 57 million acres. There has been no increase in yield per acre, as will be seen from the following figures quoted from the Stanford University Reports:—

Crop yields in Russia, in units of 60 lbs. per acre.

	1909-13	1925-29	1928-32	1933-35
All grains	11·0	11·7	11·2	11·6
Winter wheat ...	12·9	12·7	12·7	12·6
Spring wheat ...	9·2	10·5	9·0	10·6
Rye	11·0	12·1	12·1	12·0
Oats	11·8	13·0	12·2	13·2
Barley	12·7	11·8	12·2	12·6

These yields are no better than those for India. Collectivisation alone cannot be expected to result in increasing the yield per acre in India. It should be mentioned here that it is doubtful, if in other countries the net result of modern agricultural practices is increase in gross production. In India soil fertility and productivity is largely the work of Nature and to a small extent the skill of man, while in the temperate countries productivity is largely the work of man and less of Nature. Superimposition of skill over Nature's bounty without careful examination is risky.

In contrast to these countries India is a country situated in the zone of dry tropics and sub-tropics. The size of the average holding is tiny. The agricultural systems are several centuries old and are worked by farmers whose knowledge and practice are inherited from generation to generation. The knowledge and the ability of the average Indian farmer is such that he can get the most out of his land if only he were independent of financial considerations.

It follows from what has been said just now that in India so much practical knowledge has already been discovered through experience of generations that the scope for advance at a rapid pace is less than in the new countries and by methods adopted there. Whatever ills of agriculture there are in those countries they are only ailments of youth and are easier to cure than the diseases of age. In India, it is the disease of age and general debility and what is required is rejuvenation, and enrichment of soils and systems for greater efficiency.

It is not difficult to see that this inherited expert knowledge of the Indian cultivator and the settled Indian agricultural systems are not to be despised as they are capable of quick adaptation. If fresh proof is wanted in support of this it can be found in the recent experience with the 'grow more food' campaign which has brought out prominently to the view the fact that quick adaptability is an inherent feature of the Indian farming systems and of the Indian farmer. Nevertheless, this precious gift is of no use in assimilating quickly the systems and methods borrowed from other countries and superimposed on the existing one. The philosophy of the Indian farmer which is misnamed conservatism stands in the way. Conservatism is not peculiar and special to the Indian farmer. It is a characteristic common to farmers all over the world, but the Indian cultivator is admittedly more conservative. It used to be the fashion to blame the conservatism of the farmer for failure to register more rapid and more spectacular advance in the improvement of Indian agriculture. That is all gone now. Experience has shown that the Indian cultivator is not at all incapable of appreciating or unwilling to take up a new thing if it is a real improvement and is within his means. He is quick to see improvement but he is not accustomed to deduce his practice from theory. He wants definite advice in clear and unambiguous terms. He does not even need and insist on

demonstration. If a new crop is to be tried, he wants clear instructions on the soil conditions required, on the exact time to sow or transplantation, when and what amount of manure to be given, and on the after-care and treatment of the crop. He wants and naturally so, infallible advice. We are still far from being able to give such advice. That is because, unlike in other countries, the Indian cultivator and his agricultural practices have been far ahead of the advent of modern science into Indian agriculture. The science underlying the practices of the cultivator must first be learnt before we can teach him.

Outlook and Philosophy of the Agriculturist—With conservatism there is also poverty. As Bernard Shaw has said, the trouble with the poor is their poverty. It may also be said that they are poor because they are illiterate and they are illiterate because they are poor. Conservatism and poverty and the conditions of his profession have combined to develop in the Indian farmer an outlook and philosophy which are different from those of the farmers of the other countries. Occupations and experiences play a large part in moulding character, outlook and philosophy. In the new countries success with science has been largely responsible in shaping their agriculture. The circumventing of the phenomena of Nature (which are much less arbitrary than in India) has developed faith in science and scientific outlook with a materialist philosophy. On the other hand, the Indian farmer has been accustomed to witness season after season and year after year the majestic march of natural phenomena. At one time Nature is so bountiful that he need do little. At other times Nature adopts so arbitrary a mien that all his efforts are set at naught. He has learnt to accept Nature's gift with philosophical resignation.

Unless the mass philosophy of the receptor country is as nearly similar to that of the donor country, successful imitation of exotic systems and methods are attendant with uncertainty and risk.

Agricultural Research vis-a-vis Practice—When agricultural research began in this country forty years ago, there was available the report of Voelker, who at the invitation of the Government of India spent two years examining Indian agriculture and agricultural practices in the light of scientific knowledge. He paid a tribute to the Indian agricultural systems and to the skill of the Indian cultivator and stressed throughout his report the importance of the scientific study of the existing systems and practices. The urge then, as now, being for quick results, it appeared logical to begin with the application of the results found successful in the more advanced countries and also to adopt their lines of research.

Although the application of borrowed knowledge had often the disconcerting habit of failing, collateral research has helped to make substantial contributions to knowledge and materially benefited the cultivator through increased yield per acre and in other ways. The most tangible economic results have arisen from plant breeding which was effectively supplemented by better informed use of manures and fertilisers and irrigation water and control over diseases of livestock. The introduction of sugarcane mills and chaff cutters are excellent examples on the implement side which appealed to the farmer. In other directions it has been largely acquiring new knowledge on soils, crops and of pests and diseases occuring in the country.

While it is true that valuable results in soil, plant and pest sciences have accumulated, more has yet to be learnt before making more tangible contributions to practical agriculture either by way of developing new practices or by modifying old ones. It should be borne in mind that under the dominating influence of new theoretical knowledge and concepts, most of us are apt to forget or ignore the necessity to first apply such knowledge to ascertain the principles underlying or governing existing practices otherwise interpretations and hypo-

theses cause confusion instead of clarification and the results have generally to be described as disappointing.

Collateral laboratory research and field experience have been slowly but steadily clarifying knowledge. The various environmental and scientific factors underlying our agricultural practices are becoming clearer. Each of the concerned sciences is taking its place as important but not as all-important. There is shaping a new outlook born of the realisation that in dealing with our agricultural problems research should concern itself more with the study of the existing practices and methods with a view to further improvement.

Modern Agriculture and its ancillary needs:— I have devoted some attention to the comparative examination of the agricultural histories and the agriculturist philosophies of India and other countries, to show that Indian agriculture constitutes a problem of its own and that improvement should come from within and not from without. Many years of experiment and research are required fully to understand the agricultural systems and practices of the Indian cultivator and to build up new Indian agriculture on the solid foudations of real knowledge.

Agricultural research reduced to simple terms, has to deal all along the line, with problems concerned primarily with growth and competition. In crops there is growth and there is competition arising from many plants growing together; there is growth and competition between insect life and disease-causing life on the one hand and between these and plant life on the other; there is also growth and competition in respect of animal life; and above all, there is growth of human populations and fierce competition in all spheres of activity. Added to this, there is growth and competition in ideas, values and standards and the impact of these on agriculture brings about changes in the economic significance of agriculture itself, and research has had to adjust itself accordingly. Within this generation we have witnessed the oscillation of the emphasis between food and industrial crop production and on the stress on qualities and standards,—all due to growth and competition in ideas.

There is, therefore, need for the systematic and continuous ascertainment of facts and problems in their local and general aspects to provide clearly defined objectives and a base line for research in the shape of reliable statistical and other information worked and classified by agricultural departments. Otherwise, ideas and schemes of research and development in the wake of research cannot emerge from the sphere of supposition and controversy into the sphere of reasonable certainty and constructive effort. It is in published record that about ten years ago the Director of Agriculture and the Rice Specialist of a major province came to the conclusion that the province was producing sufficient rice, if not more, and that endeavour should be made to restrict rice cultivation. We know today that there is actually a high deficit. If accurate statistics were available these authorities would not have come to the conclusion they did. Even today we are in no better position with regard to accurate statistics. Consider the oft-repeated cry which deplores the miserably low yields in India compared to those in other countries. There is no information whether yields from a single crop in a year are compared with the yields of a crop which form part of two or three crops in a year; nor is there accurate information of the extent of areas compared. All that it implies is the urge for increased production per acre. That is right so far as it goes. But for the aid of research there must be accurate information about regions of maximum, medium and minimum productivity.

Another point is that research can only indicate the means of development. The paths for progress must be marked by the economist and laid by the State. Here again lack of accurate statistical information hampers progress. Research must know to what type of agriculture it has to cater (peasant and subsistence

farming, collectivised and power farming by Government or to commercialised and mechanised farming by syndicates). The significance of this observation will be appreciated, when it is realised that knowledge and application in the different branches of agricultural science have not developed and cannot develop at the same rate and to the same degree, although there have been advances in all the branches. Only by providing authoritative and reliable information for initiating research for the application of the results of research and on the results of such application can we hope to derive the maximum benefit from research.

Agricultural research is expensive and takes time. The advances in knowledge and technique and the results of application open out new approaches. It is, therefore, endless and has no finality. The demand for quick results is impracticable. Such demand has often resulted in short cuts with less important and temporary results, and has been responsible for the origin of terms like 'long range' and 'short range', 'fundamental' and basic' researches. These expressions have really no meaning. Research is research, whether applied or pure. We must learn to differentiate between research and experiment. Some of the principles of science can be applied in their general and simpler forms in many problems; several others are not capable of direct and immediate application, but such knowledge is necessary to partly or wholly bridge the gap between ideal and actual conditions and to build up a rational system of agriculture suited to the needs of the country.

Attention should here be drawn to the omission of an important item in our scheme of research thus far, namely, psycho-economic research in agriculture. Research in that direction may throw light on the peasant farmer's mind and explain why co-operation succeeded or failed in some places and among some communities and also find reasons for the different degrees of thrift and outlook in different regions and in different communities and professions in the same locality. This knowledge is valuable directly in the application of the results of research and indirectly in the orientation of research in the light of the knowledge.

The Agency for the Technical Promotion of Agriculture *General consideration* —To the individual farmer agricultural research can at best mean a small improvement. In the aggregate, however, agricultural research means a large increase in the production and wealth of the country. For this reason the necessary enthusiasm and impetus to promote agriculture cannot be expected to come from individuals or groups of individuals. It has to come from the State—the authority responsible for agriculture and rural welfare.

The expression 'technical promotion' includes both research and development in the wake of research. That is to be expected as otherwise research in an applied science has no meaning and will be without purpose. Although the present discussion is confined to technical promotion it should be borne in mind that it is an important part of the larger structure of agriculture, and is profoundly influenced by the economic structure on the one hand and on the other, by the extent and influence of political representation of agricultural interests in the counsels of the Government. Discussions and controversies between agricultural and other economic groups and interests will arise and disputes are bound to occur in agricultural interests themselves.

Whatever may be the shape of post-war agriculture, its success depends on the efficiency of the agency for the technical promotion of agriculture. It is, therefore, of the greatest importance that this agency should function on two important basic considerations: (1) the agency or organisation should not be affected in any manner in the accumulation of knowledge and its technical application, (2) it should be sufficiently elastic to permit changes. Mistakes may have been

at the beginning and experience with time and more mature knowledge may show defects. The constitution and the system of working should be sufficiently flexible as to permit corrections to be made easily and rapidly. In regard to the scientific aspects, it will be advantageous to consider separately organisation *for* research and organisation *of* research.

Organization for research.—The tendency of modern agricultural research is to rely less and less on the classical old methods of selection and breeding of plants and animals, soil analyses and manurial experiments and of pest and disease control, and to place more and more emphasis on genetics, ecology, physiology and technology. Another important development is 'one crop station research' where teams of specialists concentrate attention on improving the economic efficiency of one crop. The organisation for research must be designed to cover the whole range of agricultural activity. We want more research and more and more knowledge. The demand for more research will be followed by the demand for more trained men and the organisation should be such as would provide a steady flow of such men. In addition to the main body of what may be called '*directed*' research workers with definite objectives, we should also have a large number of 'free' research workers to act as pioneers in opening up new fields of thought and research. In the category of 'directed' research workers, there should be a very large body of field workers who form the base of the 'pyramid' of the research organisation This is the body to establish *liaison* between the research worker and the actual cultivator, big or small.

Organisation of research—Organisation of research is as difficult as it is vital in the organisation for research. It is concerned with the human element and the psychology of the workers. Research is creative and creative work is mostly of individual rather than of organisations and groups. Attempts at absolute and rigid control by individuals or committees is liable to lead to disappointment because such a control does not allow any one to grow above the limitations of the controlling individual or committee. As against this there is the fact that some investigators are competent and make their best contributions when working alone and on their initiative while some workers lack originality and initiative and are productive only under guidance. The majority are between the two extremes. And there is the necessity that the activities of the different classes of workers and of workers in different branches of science be kept directed towards the objective of the plan or scheme drawn up. Organisation of research and administrative attention are, therefore, necessary to overcome individualistic view-point, and to develop co-operation, collaboration and co-ordination.

Co-operation and collaboration are entirely personal matters to be accomplished by conferences and discussions and exchange of workers for which there should be adequate and suitable provision. Co-ordination is a difficult matter. It may be considered under two divisions: co-ordination on all-India scale, and co-ordination at research institutes or stations. The points in favour and against co-ordination of all agricultural research on all-India scale are briefly given below:—

In favour of co-ordination—(i) Unnecessary duplication is prevented or reduced, (ii) comprehensive attack on problems is possible, and (iii) disadvantages of artificial political boundaries are eliminated.

Against co-ordination—(i) Tends to suppress individual creative ability and becomes too mechanical, (ii) tends to cumbersome and unwieldy organisation and consequent waste of time and paper in preparing unnecessary reports and travel, and (iii) unless suitable leaders are available, who by their scientific eminence in that particular field can *command* instead of *demanding* respect, to bring about voluntary co-ordination.

Co-ordination either on an all-India scale or on a restricted scale should not fail and has not generally failed when the objective is specified and definite. But when it is sought to apply for research in general, even in a particular branch of science, the disadvantages outweigh the advantages. On the other hand, the conditions inherent in the agricultural research institutes and experiment stations afford scope for internal co-ordination and linking up the different branches of sciences towards a common objective. It is here that co-ordination should begin. The actual plan and programme should not be imposed by administrative fiat from above, but must be settled after discussion by the workers themselves who analyse, and dissect problems and construct such co-operative plan as will involve joining heads and hands. The administrative attention should have both vision and tact and should provide such assistance and encouragement as will co-ordinate rather than subordinate and such as will direct rather than dominate. The amount of wasteful overlapping and duplication, if there are any, are negligible. Even when two or more centres are investigating the same subject, it is usually seen that they have approached the subject from different angles and are likely to help each other. Such a conjunction of enquiries is good and not evil. As Prof. A. V. Hill, F.R.S., M.P., pointed out as recently as June 1942, co-ordination will come naturally with increase of knowledge and contact. It should be carefully tended and not just pushed into a mechanical frame work first planned from outside.

The Existing Research Organisation—The beginnings of organised experiment and improvement in Indian agriculture may be traced to the establishment of the Agri-Horticultural Society of India about the year 1820. This Society encouraged experiments with imported implements and crops, organised meetings and discussions, and published its proceedings and journal. The Dharwar-American and the Punjab-American cottons are the remains of early efforts by importing a party of American cotton growers and cotton seed for developing cotton cultivation in India.

The establishment in 1905 of the Imperial Agricultural Research Institute and of the departments of agriculture in the Provinces mark the beginning of sustained and systematic effort in scientific agriculture and research. A later development was the establishment of separate organisations for the scientific study of the problems of growing tea, coffee, cotton and jute. Following the recommendations of the Royal Commission on Agriculture, there came a further development in the establishment of the Imperial Council of Agricultural Research in 1929, to promote research, to co-ordinate the activities of the various provincial governments, in the field of agriculture and to supplement such activities as and when necessary. The Imperial Council has done much to further research and has brought into being special stations and centres for research on potatoes, sugarcane, tobacco and various fruits, instituted several co-ordinated schemes of research in crop and animal husbandry and encouraged and enlisted the co-operation of universities.

During these forty years an Indian school of agricultural research has steadily grown up, with a numerous body of agricultural scientists working in the central and provincial institutions and departments, universities and other special organisations on crop basis. The central research institutes give post-graduate training in methods of research, and are placed similarly as the universities in that the functions of both are in the main similar. Both are for post-graduate instruction and research. The difference is that in an agricultural research institute there is that direct and living contact with reality, namely crop growing and maintaining of live-stock. In an agricultural institute continuity and collaboration between several sciences are assured or can be insisted upon. Here the problem is the central and fixed point. In a university

continuity and sustained collaboration may or may not be possible, nor can they be insisted upon. There the professor is the central and fixed point. The workers are students who frequently change. There is the other and the more important consideration and that is the distinction between filling the mind and forming the mind. A research station gives the young student several opportunities of contact with day to day agricultural problems enabling him to form his mind. This is a type of training and experience which is far more advanced and special in character than could with any propriety be included in a university curriculum. The young agricultural research worker of today is making his mark because of more than passing acquaintance with the agricultural problems and methods. He cannot forget that, however scientifically sound and economically feasible his work may be, he has not completed his work unless it can be operated in the field.

In the provinces the departments of agriculture impart instruction in their agricultural colleges which are affiliated to their respective universities. The provincial institutions and their research staff are directly linked to the cultivator through the district staff. These organisations constitute what may be called the 'eyes and ears' for research and are in a position to carry out experiments and to provide intelligence from their local experience. There are the central institutions to analyse and synthesise the information with a detached and wider view and to institute further research with specific objectives. There are the universities, which can take a more completely detached view of the available knowledge and advance basic knowledge and technique. There is thus the mechanism which has in it the capacity to run research like a relay race the one group handing knowledge to the other group of workers.

A suitable framework of organisation for research is already there I say advisedly framework, because it is nothing in size compared to the size of the country and its requirements. The framework needs considerable filling up. It should be mentioned here, that if the organisation for research should be efficient the emoluments offered, particularly to young recruits, should be much better than what they are now. Equipping oneself for research is very expensive. The worker has in the first place to go through long and expensive courses of university and post-graduate education and then another expensive course of study in some branch of agricultural science before he can think of employment as an agricultural research worker. The salaries offered to these young men are ridiculously low; there is no security of tenure; the prospects are next to nothing in most cases. An organisation packed with enthusiastic young men, with no or gloomy outlook cannot be expected to produce results much less wonders. The system should be remedied at the earliest opportunity.

There is need for a central organisation with grip not only on research but also on agricultural policy. Research alone is not enough. Agriculture and research policies are mutually related and, therefore, the policies need constant examination and periodical re-orientation. There must be a central organisation whose functions should be (i) to interpret agricultural research in agricultural reconstruction and policy, (ii) to secure for the benefit of agriculture co-operation and collaboration between the different nation-building departments and to secure co-ordination for the even flow of rural life, (iii) to secure accurate statistical and other information on matters concerning agriculture as a whole, and (iv) to interpret larger agricultural and economic trends for the guidance of agricultural research and to provide a general plan for research which is at once comprehensive and sufficiently flexible to admit expansion and adaptation to changing needs, nationally and internationally.

The Imperial Council of Agricultural Research can be suitably altered in its structure, constitution and working system, to enable it to function as the

central organisation mentioned above. In its present form the Council if charged with only responsibility for research and has a structure and system of working which is rather too cumbersome to be of maximum utility. It has in it the capacity for advancing research and it has done admirably well, but curiously, in its success lies its failure. It is not difficult to see the weakness in its elaborate organisation. Although the Council has done a great deal to advance research in many ways it has not altogether succeeded in building up a healthy school of research. The committee system and the system of financing research on the basis of schemes have sometimes led to unhealthy competition which tends to militate against the maintenance of research spirit and research morale. The committee system, however democratic and sound it may be in theory, does not always yield the results that are expected of it.

Outline of the Picture of Future Organisation From a consideration of the foregoing, there emerge the conclusions:—

(i) that the framework of the organisation for research that has gradually grown up is capable to meet the post-war requirements, for the conduct of research when suitably strengthened, that the need is to make up the deficiency in the organisation for the accurate statistical and other information to assist the technical promotion of agriculture, and

(ii) that a central organisation which will co-ordinate agricultural policies and other policies is necessary.

Agreeably to this finding the following outlines of the picture of post-war organisation or the technical promotion of agriculture is suggested.

The existing organisations for the actual conduct of research should continue to be maintained by the respective authorities at their maximum efficiency.

Experiment stations on one crop basis should be established to cover work from growing to technology. The funds of these stations should be found from the cess realised on that crop.

The Imperial Council of Agricultural Research or the Board of Agriculture (one institution should be enough) should form the 'apex' of the organisation for the technical promotion of agriculture which includes research and development. The functions of this body should be primarily —

(i) to guard the general interests of agriculture by advising the administrative authorities in all questions relating to agriculture ;

(ii) to concern itself with laying down the larger agricultural and research policies and in fostering and watching the progress of such policies ;

(iii) to assist in the formulation and development of agri-industrial policy for the benefit of agriculture and the agriculturist ;

(iv) to secure accurate statistical and other information on matters concerning agriculture and the agriculturist :

(v) to arrange for the carrying out of surveys of resources such as water supplies, erosion and waste land and soil surveys, etc. ;

(vi) to directly aid research : It is best done by awarding research scholarships and fellowships with adequate living allowances so that research talent may be discovered and fostered ;

(vii) to encourage experimental work on the application of results in rural areas : This is best done by utilising the district staffs of the provincial agricultural departments for carrying out widely flung field experiments. The testing is to be done on land offered by the members in a given village or area and this can best be done by reviving agricultural associations. The failure of such an agency in the past should not deter renewed effort. They failed because the cultivators

were told that it was an improvement. The position would be different if they were clearly told that it was only an experiment or trial; and

(viii) to foster activities which would be mostly educational in character in respect of stimulating the interest of the cultivator in scientific side of agriculture and in the matter of putting into practice in the widest area possible those results and that knowledge which have been proved to be reliable and correct in any given locality. (*Proc. Natl. Inst. Sci. India, Vol. 10, No. 1, 1944.*)

Abstracts

Why do Farmers Plough ? (*Better Crops with Plant Food. Vol. XXVII, No. 6; June-July 1943*) Farmers plough the land to improve their crops, both in quality and quantity. No doubt, people in the United States of America have been doing too much ploughing. The North European origin and ancestry, common in the U. S. A. are mainly responsible for this. The tradition of Northern Europe has been literally transplanted root and branch in the U. S. A. In North Europe people would not make a living if the soils of clay and clay texture, with a liberal and regular rainfall were not ploughed to aerate and warm them. As one moves westward towards Central U. S. A., a more continental climate with torrential rains is met with. The southward trek ushers a continental climate with higher and more fluctuating temperatures. Ploughing without understanding its function in relation to soil, fertility and climate has demonstrated that too much ploughing had been done in the silty loams of America. In the U. S. A., the usual frequent ploughings given in the earlier years increased biological activity in the soil, and burned out the reserve organic matter therein; this resulted of course in high crop yields, in the beginning. In course of years, the soils became less responsive to the heavier rainfall, encouraged greater runoff and damaging erosion resulted. Excessive tillage exhausted the soils of fertility that would have otherwise encouraged nature to grow readily a vegetative cover and reduce the erosion hazard.

Ploughing aerates the soil and provides additional oxygen for the respiration and growth of the large number of microbes in the soil. Carbon in the soil is oxidised to carbon-di-oxide, sulphur to sulphur-di-oxide, ammonia to nitrate and so forth and some of these become available for plant growth. But for the ploughing, the consequent aeration and soil microbial activity, the soil matter would stay 'put' and the plants would be starved of the much needed nitrates for their growth. The supply of soluble soil nitrogen increases as the temperature rises and also when the soil is aerated. It may be consumed by plants, or leached out by rainfall or be reduced to the elemental state in the absence of sufficient aeration and ploughing helps to increase the supply of soluble nitrates for plant growth. The cycle of growth, death and decay of both the plants and the microbes go on incessantly.

Studies of nitrate supply in the soil in three adjoining plots, one unploughed, one ploughed and the other ploughed and cultivated, showed clearly that ploughing provided a large supply of nitrates and that further cultivation provided extra nitrogen for the crop. The same result was obtained whether the land was cropped or left fallow. Crop growth and yield follow in the order of the level of these nitrate supplies. The farmer may not know that the large nitrate supplies contribute to greater crop growth and that ploughing is the cause of the formation of large nitrate supplies. He knows definitely, however, that ploughing increases crop growth.

Cropping a soil year after year leads to declining fertility. The stored fertility must feed the microbes inside the soil before they can leave something for the crop above. When crops are removed continuously, without leaving any residue, the nutrients liberated by the microbes get reduced, for they merely rework only what is given them.

The nitrates in the soil are brought down to a low level by the wheat crop at the time of harvest and stay low in unploughed soil. When the stubble is ploughed in early, the soil-stirring starts the nitrate supply upwards. Early ploughing puts under only little organic matter and the microbes are obliged to oxidise the humus in the soil; much of the carbon therein is burnt and nitrogen accumulates in the soil in the form of nitrates and nourishes the next crop. This explains why early ploughed soils give a good harvest. Delay in ploughing lets the weeds grow and reduce the nitrate supply in the soil. The weeds are growing in soil that was made poor by the previous wheat crop. They depend largely on the nutrients in the atmosphere and moisture in the soil and tend to grow woody. The weeds are consequently rich in carbon, but not in nitrogen and the microbes use the soil nitrates to balance their nutritional requirements. The nitrogen is converted into insoluble complex microbial tissues which do not become available for the next crop. There is as it were competition between the crop and the microbes. The ploughing may be blamed for this state of affairs, but it is really the low fertility of the soil that is unable to supply sufficient nitrogen for the weeds.

The effects of ploughing are not limited to the production of a clean field, the aeration of the soil and the consequent processing of the plant nutrients. Other sciences connected with the study of soil can furnish an answer to the question "Why plough?" and support the plough as an important agricultural implement. V. T. S.

The Nut Grass Pest (W. B. du Preez, *Farming in South Africa, Vol. 19 (1944) (11—10)* The common Nut grass (*Cyperus rotundus*) is a grave menace to the farmer and accounts for a reduction in the yield by 25—30 per cent. Negative results were obtained in efforts for the propagation of the pest by means of seed and the major method of propagation of the weed is by means of tubers (nuts). The dormant tuber system of the plant ensures the survival of the pest after the surface system is destroyed and an effective control method must aim at the complete eradication of both systems, more especially the deep system which propagates the weed even after the surface system is destroyed.

Investigations have shown that nut grass tubers exposed to desiccation lose their sprouting capacity when their moisture content is reduced from the normal average of 50 per cent to 15 per cent and the desiccation is complete only when (1) the tubers are completely severed from the root system, (2) when the soil moisture is about 8 per cent when the mortality is very high and (3) when the humidity of the atmospheric and soil air are very low. Although the weed cannot be completely exterminated, deep cultivation with adequate mechanical traction and strong implements to penetrate the desired depth, depending upon the distribution of the tubers, by which the tubers are severed from the root system and subjected to desiccation on the dry ploughed soil, is recommended as a control measure. The desiccation process can be hastened by using after a few weeks a heavy cultivator when the clods would break up and more tubers brought to the surface. The time for cultivation should be mid-winter so that 2 or 3 dry months may follow after cultivation thus ensuring desiccation. Although spraying with a 30 per cent solution of common salt destroys nut grass, the process is too costly to be put into practice over an extensive area.

Experiments with smother crops to suppress nut grass gave negative results as also efforts for the control of the weed by repeated hoeing of the surface growth. R. A.

Studies in Rat Control R. J. Borden, in *Reports 62nd Annual Meeting Hawaiian Sugar Planters' Association, 1942, pp 63-66.* In further studies on rat poisons zinc phoshide has appeared as an outstanding substitute for thallium sulphate, hitherto the most suitable poison for rat control on Hawaiian sugar cane plantations. The zinc phosphide has proved to be as lethal as thallium sulphate, and baits poisoned with it are much more readily taken by the rats. Its action is quicker, causing death of the rat in 6-8 hours, as against 30-40 hours with thallium sulphate. It does not produce secondary poisoning; as is the case with thallium sulphate. The zinc phosphide bait is prepared by mixing the powdered phosphide with rolled oats in the proportion of 1 to 200. The powder is first added to a vegetable, such as corn oil, coconut oil, etc., the oil zinc phosphide mixture is applied to the rolled oats and thoroughly mixed. Application in the field follows the usual procedure of first prebaiting the infested area with unpoisoned grain to attract the rats and then setting out the poisoned bait. Zinc phosphide deteriorates in the presence of moisture. When kept in the open in the laboratory there was no deterioration in four months. In wet weather any phosphide-treated oats left after 3 days' exposure in the field must be discarded. *Sugar, December 1943.*

The Ram-ko method for the determination of fat in milk using an alkaline solution (*Indian Journal of Veterinary Science and Animal Husbandry, Vol. XIII, Part II, June 1943.*) A simple (Ram-Ko) butyrometric method using alkaline solution is described for the determination of fat in milk and milk products. The method ensures the same degree of accuracy in results as that obtained with the Gerber test and has the added advantage that the initial cost of the equipment as well as of testing the samples is very low, since no centrifuge is required.

The alkaline reagent used in this method was prepared as follows:—

Sodium salicylate	...	...	25·0 gm.
Potassium carbonate	...	...	12·5 gm.
Sodium hydroxide	...	...	5·5 gm.
Distilled water	...	...	100·0 ml.

Iso-butyl alcohol was not incorporated in this solution, as it was observed that the alcohol separated out into a layer at the top and shaking the solution before use did not bring about a thorough mixture to ensure the accurate amount of alcohol essential for the test. It has already been indicated how necessary it is that the amount of alcohol added should be accurately measured and it should be exactly 1 ml., as slight variations lead to incorrect readings. Hence the two solutions were kept separate. This also ensured a long life for the solutions.

Adopting the above, the fat estimation in milk can be carried out accurately as follows:—

First, 5·5 ml. of salicylate reagent is placed in the butyrometer. To this is then added accurately by means of a pipette 1 ml of isobutyl alcohol and 9·7 ml. of milk. The butyrometer is then corked and the contents well shaken and thoroughly mixed. The tube is then kept in a water bath at 60°C with the cork end resting on the bottom of the water bath. After the first three minutes, the tube is taken out and shaken vigorously and returned to the bath. After another three minutes, the above process is repeated. The tube is then kept for 10 minutes in the bath, when all the fat should separate out as a clear liquid on the top. The tube is now taken out, gently turned upside down and returned to the bath keeping it in the original position for another three minutes. Then the tube is finally taken out and the column of fat then read in the neck of the butyrometer which is graduated to give the reading in percentages.

By this method, very satisfactory results were obtained with whole milk, skim milk, butter-milk and whey in the investigations carried out. Further work on this problem is still in progress, aimed at standardizing a still simpler type of butyrometer and also substituting iso-butyl alcohol by a cheaper solvent.

Gleanings

Agricultural Prosperity and Anti-inflation The anti-inflationary drive of the Government would, unless hedged in by proper safeguards, prove to be an extreme hardship upon the agricultural population of the country.....The banking statistics which are published from time to time indicate where the extra issues of paper currency have found their lodgement. For instance, on the 1st September, 1939, the total of the demand and liabilities with the scheduled banks totalled Rs. 237 crores; whereas in November, 1943 they were Rs. 637 crores, that is to say, an excess of 400 crores. Similarly, in the case of the Imperial Bank the deposits in September, 1939 were Rs. 88 crores and those in November, 1943, Rs. 207 crores giving an increase of 119 crores. Therefore, the total excess of deposits since the commencement of the war with the Imperial Bank and the Scheduled banks could be taken as Rs. 519 crores as against an excess note-issue during the same period of Rs. 622 crores.

These figures carry a very plain tale. Nearly five-sixths of the total inflation money has been concentrated with people who are capable of depositing them in big banks and these men are certainly not village cultivators. They prove more than anything else how war-earned wealth has got accumulated in the hands of a few and that surplus money could be deemed to lie with them and not with the cultivators." *(Indian Sugar, February 1944).*

Dried Bananas It is reported that a 1-ton trial shipment of dried bananas from Nigeria (British West Africa) is being arranged and that the Ministry of Food are to consider further quantities. The dried bananas, prepared from fully ripe fruit, are said to be very sweet and to have a natural flavour. They have no important vitmins, but their high sugar content—somewhere about 60 per cent—makes them an excellent source of energy. In 1942 the Germans requisitioned at extremely high prices all the dried bananas unloaded at Marseilles from French African territories, and they were sent to feed troops on the Russian front. *(Food Manufacture, January 1944.)*

Solar Method for *Jowar Smut* *Jowar* seed was infected with *Sphacelotheca sorghi* Clint., soaked in water at ordinary temperature for four hours in the morning of a day in June and afterwards spread out in the sun or in the shade until it was thoroughly dry. The results are summarized as follows:

Treatment	Per cent smutted ears
Seed soaked and exposed to sunshine for 6 hours	19·35
Do 4 ,,	19·86
Seed soaked and dried in shade	0·73
Control — no treatment	26·14

Soaking the seed and drying it in shade has almost eliminated the disease.

The treatment operates in a simple manner. The spores of *jowar* grain smut are seed-borne. When the seed is soaked and dried in the shade, the spores are induced to germinate, and almost all of them are rendered harmless. In the case of seed exposed to sunshine for six and for four hours, the treatment failed because in the sun the soaked seed dries up quickly and most of the spores do not germinate for want of moisture. They survive and germinate and cause the disease later when the seed is sown in the field. *(Indian Farming, October 1943)*

Vitamin C Value of Milk The vitamin C content of the milk and colostrum of Sindhi cows was found to be higher than that of the Gir, crossbred and Ayreshire cows. Murrah buffaloes produced milk and colostrum of a higher vitamin C content than the cows of most of the breeds experimented with.

The destruction of vitamin C content of milk was greater in the 'holding' than in the 'flash method' of pasteurisation.

When the first boil attained, the milk lost about 25 per cent of its vitamin C content, and after 10 minutes of boiling over 65 per cent and after 20 minutes of boiling almost the whole of it. Milk kept at room temperature lost nearly 24 per cent of its vitamin C content at the end of 11 hours, while that kept in the cold store (45°F) lost only 26 per cent only at the end of four days. Vitamin C was completely destroyed when milk was exposed to direct midday sunlight (June) for 45 minutes, about 17 per cent when it was exposed to diffused light and only 5 per cent when it was kept in the dark for the same length of time. The destruction of vitamin C was lowest when the milk was heated in the vessel made of nickel, slightly higher in tinned copper and highest in naked copper. In the last case the destruction was over 78 per cent in the 'flash method' of pasteurisation. Milk handled and processed in a commercial dairy and delivered to customers in half-pound bottles lost over 50 per cent of its vitamin C before it was delivered at the customer's door. (*Indian Farming, Vol. IV, No. 10, Oct. 43*).

The Induction of Lactation During the last two years experiments on the use of stilboestrol as a means of inducing lactation in barren heifers and cows have been carried out under the co-ordination of the Agricultural Research Council. The method consists in placing (implanting) a number of tablets of stilboestrol under the skin and their removal at a later date. The results of these experiments indicate that about 50 per cent of the treated barren heifers have produced an economic quantity of milk. The other treated animals either failed entirely to respond to the treatment or produced only small quantities of milk. About half the treated animals were later successfully bred from.

It would appear that this treatment may have a useful, though limited, practical application in bringing into milk valuable dairy heifers which have failed to get in calf, and which for this reason, may be fattened and slaughtered. Following a lactation induced in this way, a proportion of such heifers may be got into calf, and so saved for the dairy herd. (*Food Manufacture, January 1944*).

Twenty Calves per year No, the heading above is not a misprint! The answer to the question is found in the experimental work carried on by the Aviation Cadet Raymond Umbaugh,—a scientific discovery that possibly will change the history of animal husbandry.

'The technique which has been developed will permit dairymen to produce 10 to 20 calves per year from a single high-producing cow instead of the usual one. For example, if a dairyman has a thousand-dollar cow and access to a thousand-dollar sire, he will be able to produce 10 to 20 calves from this mating. This is done by transferring the developed ova (eggs) from the high producing cow to scrub cows and mating the scrub cows to the thousand-dollar sire. During the heat period a cow produces one egg which can with little difficulty be removed and transferred to another cow. In three weeks she will produce another egg, and she will continue to produce an egg every three weeks until she is mated and becomes pregnant. By the use of hormones, we may be able to force a cow to produce as high as 25 or 30 eggs per year instead of the usual 17; all of which would be transferable. The genetical make-up of a calf depends upon the sperm and the egg and to no extent upon the uterus in which, it has developed: that is to say the blood of the scrub which develops the egg of the high-price cow will have no effect upon the heredity of the offspring. By the use of egg transfers, dairymen could in a few years replace all their scrub stock with registered high-producing cattle. Egg transfers are possible, and this technique will probably be extended to all species of livestock and other animals as well.—(Condensed from the *Farmers' Digest, Canada. The Australian Dairy Review, January 1943*).

New Rubber-making Method. A new mass production method designed to speed the making of rubber from the cryptostegia vine has begun in Haiti. One of the obstacles confronting those attempting to use the vine for rubber was the problem of tapping for latex. Partly with the aid of milk bottles, the tapping problem has been solved. The development of the method, which is part of a programme to replace the natural rubber supply of the Malay Peninsula and Dutch East Indies cut off by the war, was announced by the Office of the U. S. Co-ordinator of Inter-American Affairs, after the official visit to the U. S. of President Elie Lescot, of Haiti. Natural rubber of the type produced from cryptostegia, hevea or castilla trees is needed to mix with the synthetic rubber being produced in the U. S. Hevea requires five or six years before it will produce; when it does come into production the Haitian plantations will produce 1,000 lb. per acre from it, in contrast with the 300 lb. per acre from cryptostegia. (*Food Manufacture, January 1944*).

Tree that thrives on animal flesh On the island of Madagascar grows the most horror inspiring cannibal tree in the world.

Try to imagine a pineapple eight feet high and thick in proportion, resting on its base and denuded of leaves. The trunk is dark, dingy brown and as hard as iron. From the apex of this truncated cone rise eight leaves which, curving over, hang sheer to the ground, like doors swinging back on their hinges. These leaves are twelve feet long and sword shaped.

On the apex of the cone is a round white concave figure, like a smaller plate within a bigger one. Underneath this plate is a series of long, hairy green tentacles seven feet long, stretching in every direction.

This atrocious cannibal tree comes suddenly to life directly anything living comes into contact with its upper plate, which acts as a snare.

The slender, delicate palpi, with the fury of starved serpents, quiver a moment and then fasten upon the unfortunate victim. Round and round the tendrils close with brutal energy and infernal rapidity, ever tightening. And now the great leaves rise slowly and stiffly, like the arms of derrick, erect into the air, approach one another and close about the victim with the silent force of a hydraulic press.

The Mkodos, one of the island tribes, used this tree for their human sacrifices and remains of human, as well as animal and bird bones, have been found at the feet of more than one of these land octopuses. (*Punjab Agric. Coll. Mag. Jan. 1944*).

Correspondence

Medicinal Properties of the Bitter Gourd *

To

The Editor, Madras Agricultural Journal.

Sir,

I have known a number of cases of diabetics being cured of their dreadful and widespread malady by the use of the leaves of the bitter gourd (*Momordica charantia*). The juice of the bitter gourd leaves is extracted and half an ounce of it mixed with about 2 ounces of cow's milk is taken in an empty stomach, in the morning for a fortnight. There is no restriction about the diet, excepting that it should not be taken for at least half an hour after taking the gourd juice.

* Newspapers, please copy.

It may be necessary to regulate the quantity of juice taken. The juice should just produce a light laxative effect, but not purging. Some people are not able to retain the juice in the stomach. They may however start with a few drops of the juice and increase the quantity gradually depending upon their tolerance. The quantity of sugar in the urine disappears gradually and along with it the frequency of urination and the incessant thirst.

The cure effected seems to be more or less permanent. An old gentleman of 63 had 7½ per cent sugar in the urine before the treatment. It is now about an year since he had the treatment and he has been perfectly fit since then; in fact so fit that he is personally supervising labour working in his rubber plantations in the hills, for 6 to 8 hours a day without feeling fatigued.

Lawley Road Post,
Coimbatore, 29th May '44. } V. T. Subbiah Mudaliar.

College and Estate News

Students Corner—Students' Club At the General body meeting held on 26th June 1944 the following members of the executive committee were elected :—

Club Secretary	...	K. S. Habibullah
Games Secretary	...	M. Ramanathan
Cricket Captain	...	K. S. Alwa
Tennis ,,	...	K. Appa Rao
Hockey ,,	...	V. Narasimhaswamy
Foot ball ,,	...	A. M. Kallankulam
Representative Class III	...	D. Ranga Rao
,, Class II	...	Sankar Rao

The class I representative, C. R. Ramakrishnan was elected on 11th July 1944.

Games Cricket The college team played 4 matches (1) Merchants' XI, (2) Royal Navy XI (3) Coimbatore Cricket Club XI and Officers' XI with the following results.

(1) College XI–150 for 7 (Albuquerque 55, K. S. Alwa 28, A. S. Krishnan 22; Srinivasan 4 for 35, Lokanathan 2 for 39.)

Merchants' XI–135 for 3 (Nagarajan 46, S. Ramanathan 33 not out.)

(2) College XI–90 (A. S. Krishnan 39, Mcgregor 4 for 29, Peacock 3 for 50.)

Royal Navy 120 for 5 (Elsworth 32, Peacock 38 not out, Srinivasan 2 for 13 and Rangaswami 2 for 22.)

(3) College XI–222 all out. (C. Ramaswami 132 retired, B. S. Murthi 29, Subbaraman 4 for 27.)

Coimbatore Cricket Club XI–105 all out. (Subbaraman 34, S. Madhava Rao 5 for 25, A. S. Krishnan 3 for 30 and Albuquerque 2 for 19.)

(4) College XI–126 for 3. (A. S. Krishnan 55 not out, S. Madhava Rao 52.)

Officers' XI–164 for 5. (C. Ramaswami 75 not out, B. S. Murthi 49, K. S. Alwa 3 for 35, S. Madhava Rao 2 for 40.)

Foot ball. Four matches were played, one each against Srinivasapuram XI, R. S. Puram High School, R. S. Puram XI and Govt. Arts College team. We lost against the first (0 : 1), won over the second (6 : 0) and drew with the 3rd (2:2) and 4th (1 : 1) teams.

Hockey We played 7 matches in all, 3 against Officers' teams, 2 against Sporting Union team, one against Royal Navy XI and one with the Govt. Arts College team. We lost one match against the officers (1 : 4) but drew in two (0 : 0, 2 : 2). In the matches with the Sporting Union we lost one (1 : 2) but won the other (3 : 1). Royal Navy and the Arts College teams were defeated by 3 and 2 goals to nil, respectively.

Departmental Notifications

Gazetted Service—Appointments and Postings

Sri V. T. Subbiah Mudaliar, Junior Lecturer in Agriculture and Assistant Superintendent, Central Farm, Coimbatore will hold full additional charge of the post of the Senior Lecturer in Agriculture and the Superintendent, Central Farm, Coimbatore *Vice* Sri C. Ramaswami Nayudu on leave.

Sri M. Sanyasi Raju, Asst. in Bacteriology to Officiate as Agricultural Bacteriologist *Vice* Sri Paul D. Karunakar on leave.

Sri M. S. Kylasam Ayyar, Asst. in Entomology is reappointed to officiate as Asst. Entomologist *Vice* Sri T. V. Subrahmania Ayyar on leave.

Sri M. Narasimham, Offg. Asst. Marketing Officer, Bezwada, to act temporarily as Gazetted Assistant of the D. A. O. Bezwada.

Sri M. Satyanarayana, Upper Subordinate to act temporarily as Gazetted Asst. to the D. A. O. Cocanada, for the purchase of manures and seeds.

Sri K. Cherian Jacob, Asst., in Botany to act as Lecturer in Botany Vice Sri S. N. Chandrasekhara Ayyar granted leave.

Sri K. Krishna Menon, Asst. in Mycology to act temporarily as Asst. Mycologist.

Sri P. Govinda Rao, Asst. in Mycology to act as Asst. Mycologist, Ergot Scheme, *Vice* Sri T. S. Ramakrishna Ayyar, posted as Gazetted Asst. in Mycology.

Sri K. P. Anantanarayana Ayyar, Asst. in Entomology to act as Gazetted Asst. in Entomology.

Sri G. Sitarama Sastry, Upper Subordinate to act as D. A. O. Guntur *Vice* Sri S. Venkataramu Ayyar granted leave.

Sri S. Sundaram, Upper Subordinate, to act as Asst. Cotton Specialist, Siruguppa.

Sri Sitarama Patrudu, D. A. O. to act as Deputy Director of Agriculture, Guntur *Vice* Sri Y. G. Krishna Rao Nayudu granted leave.

Sri C. M. John on return from leave is reposted as Oil Seeds Specialist.

Sri G. Venkatanarayana, on relief is reposted as Superintendent, A. R. S. Nileshwar.

Sri S. M. Kalyanarama Ayyar, Asst. Cotton Specialist, A. R. S. Siruguppa to be Asst. Cotton Specialist, Coimbatore.

Sri K. Varadacharya, Asst. Marketing Officer, Kurnool, to be Asst. Marketing Officer, Madras under the Special Officer for Marketing Manures, Seeds, etc.

Sri Cherian Jacob, Asst. in Botany, to act as Gazetted Asst. in Botany.

Sri M. R. Balakrishna Ayyar, Asst. in Chemistry, to act as Gazetted Asst. in Chemistry.

Sri V. Suryanarayana, Agrl. Demonstrator to act as Gazetted Asst. in Agriculture.

Janab Mirza Ansar Baig is selected as D. A. O. and posted for training to Central Farm,

Subordinate Service—Promotions

The following promotions of Upper Subordinates are ordered without prejudice to their officiating appointments in the case of officers promoted to the M. A. S. :—

Sri S. N. Venkataramana Ayyar I grade (new) to III grade (old), Sri. G. Venkatanarayana, Dr. N. Parthasarathy, and Sri R. Balasubramania Ayyar, from IV grade to I grade (new) and Sri A. Kunhikoran Nambiar from V grade to IV grade with effect from 19–5–42. Sri C. Jaganatha Rao from IV grade to I grade (new) and Sri T. V. Rangaswami from V grade to IV grade with effect from 9–9–43.

Sri K. Govindan Nair, Sri T. S. Ramakrishna Ayyar, Sri P. Vishnusomayajulu, Sri M. P. Gourisankara Ayyar, Sri T. G. Muthuswami Ayyar, Sri M. Subramania Pillai and Sri A. Venkatarangam from II grade to I grade (old), Sri T. K. Balaji Rao, Sri S. Ramachandran, and Sri K. Krishna Menon from III to I grade (old) and Sri K. L. Ramakrishna Rao, Sri V. Achutharamayya, Sri N. Subramania Ayyar and Sri A. N. Muthiah Nattar from III to II grade (old). with effect from 13—10 43.

Sri C. S. Gopalaswami Rao from III to II grade from 13—10—43 and II to I grade (old) from 7—11—43. Sri C. V. Sundaram Ayyar from III to II grade from 13—10—43 and II to I grade (old) from 1—3—44. Sri B. S. Narasimha Ayyar from III to II grade (old) from 7—11—43.

V to IV grade Sri T. Krishna Reddi from 13—9—41, Sri P. L. Narasimham from 9—5—43 and Sri T. Nataraj from 30—8—43.

The following Lower Subordinates are promoted as Upper Subordinates with effect from 1—4—44.

Sri K. Achuthan Nambiar to II grade (new) and Sri M. L. Narayana Reddi to III grade.

The following fieldmen are promoted as Upper subordinates, III grade (new) Sri J. Subramanian, Assistant in Paddy; Sri T. V. Venkateswara Rao (Recorder,) Marketing Asst. Sri A. P. Ananthan, Assistant, A. R. S. Kasaragod, Sri V. Mahadevan, Assistant in Entomology.

Sri Ramanarayana Menon, Marketing Assistant, Madras, Sri P. S. Anantachari, A. D., Trichinopoly, Sri A. K. Nagaratnam, Assistant in Entomology (Icerya Scheme), Sri K. Karuppiah, A. D. Aruppukottai, and Sri R. V. Subba Rao, A. D. Krishna Dist. without prejudice to his temporary appointment in the Central Agricultural Marketing Department.

Appointments and Postings.

Sri K. C. Vengala Rao is appointed to officiate as Upper Subordinate III grade (new) and is posted to Vizagapatam.

Sri C. V. Ramamurthi is appointed to officiate as Upper Subordinate III grade (new) and is posted as Marketing Assistant (Rice Milling) Madras.

Sri N. Anantakrishnan, is appointed to officiate as Upper Subordinate III grade (new) and is posted to Shembaganur (Kodaikanal) as Assistant in Entomology, Icerya Scheme.

Sri R. Subramanian is apppointed to officiate as Upper Subordinate III grade (new) and is posted to Chingleput dist.

Sri V. D. Kamath is appointed to officiate as Upper Subordinate III grade and is posted to A. R. S. Siruguppa as Farm Manager.

The following candidates are appointed to officiate as Upper Subordinates grade III (new) and posted under the Special District Agricultural Officer, Vizagapatam:— Messrs. P. Ammiraju, G. Narasimha Rao and V. L. Narasimha Sastri to Anantagiri.

The following candidates are appointed to officiate as Upper Subordinates III grade (new) with effect from 9—6—44:— Sri V. Ramalingam, Asst. in Mycology, Coimbatore; Sri U. V. Thyagaram; I. L. Narasimha Rao, Marketing Asst., Bezwada, Sri Y. Jaganatha Rao, Marketing Asst., Dwarapudi; Sri S. Krishnamurthi and Sri M. Pitcheswara Rao, A. D. S., Bellary Dt.

Sri S. V. Hariharan is appointed to officiate as Upper Subordinate III grade and is posted to Trichinopoly district.

Sri B. Rangayya Pillai, Fieldman, Entomology Section is appointed as Temporary Asst. in Entomology for a period of 2 months with effect from the date of employment.

The College The College reopened on the 15th June after the summer vacation for the II and III year students. Selection of students for the first year class was made at Samalkot on 19th & 20th, at Madras on 21st and 22nd and at Coimbatore on 23rd and 24th June. On the 3rd July the selected students of the first year B. Sc. (Ag.) course joined the College. In all 95 have joined till now and one more student from Orissa is expected.

Honey Week Celebration The seventh annual Honey Week and Bee-keeping Exhibition was inaugurated by Rao Bahadur Dr. B. Viswanath, C. I. E., D. Sc. F. I. C., Director of Agriculture on Friday, the 5th May 1944 at the Y. M. C. A., in the presence of a large and distinguished gathering. In welcoming the Director and others, Mr. M. C. Cherian, the Government Entomologist said that a scheme for intensifying honey production for the benefit of the army was under consideration. He also traced the development of the industry in the Presidency for the past seven years and said that 10,267 hives were working in the presidency, the increase over the previous year being 1,518 hives. Declaring the exhibition open Dr. B. Viswanath said that honey week was an emblem of unrestricted and uncontrolled activity. Honey is particularly important at a time when severe restrictions are being placed on the production, distribution and the consumption of sugar and jaggery. Continuing the speaker said that the Entomology Section of the Agricultural Research Institute had given a practical stimulus for the Bee-keeping Industry. He was glad that seven years of useful work had achieved good progress. Concluding the Director hoped that the exhibition would be of great benefit to the public. Mr. M. Anandan, Deputy Director of Agriculture, delivered a lecture on Bee-keeping in the Districts. A small Tamil farce on Bee-keeping propaganda was staged by Sri C. S. Rajarathnam of the Mycology section and the staff of the Entomology section. With a vote of thanks proposed by the Assistant Entomologist Mr. T. V. Subramania Ayyar the function came to a close. The Exhibition was kept open till Sunday next and attracted large number of visitors every day.

Visitors Rao Bahadur B. Viswanath, Director of Agriculture, paid a short visit to Coimbatore early in May, 1944. He was particularly interested in the new schemes that have been taken up and had discussions with the respective heads of sections. He met the district work officers of Coimbatore, Salem, Malabar, South Canara and Nilgiri districts and stressed the need for increasing the food production in the country. He had a joint conference with the editorial boards of the *Madras Agricultural Journal*, and the Tamil and Telugu agricultural journals, which the department has started. He was particularly anxious that these journals should carry a mass appeal and gave many useful suggestions.

The Director of Agriculture along with the Deputy Director at headquarters, visited the Estate from 26 to 29 June 1944 They visited the several research sections and discussed with the heads of the respective sections their work past and present.

Board of Examiners The board of examiners of the faculty of agriculture met on the 11th May at Coimbatore and passed on to the University the list of successful candidates who sat for the B. Sc. Ag. examinations in April last.

Upper Subordinate Association The annual general body meeting of the Association of the Upper Subordinate officers of the Agricultural Department was held on the 4th May with Mr. S. Ramachandran, the President, in the chair. After the adoption of the annual report the following office-bearers were elected for the year 1944—45:—

President	...	Sri S. Ramachandran
Secretary	...	,, M. S. Kylasam
Committee	...	,, M. R. Balakrishnan, S. V. Duraiswamy, and C. Balasubramanian.

The Association was 'At Home' to Rao Bahadur Dr. B. Viswanath, C. I. E., D. Sc., F. I. C., Director of Agriculture, the same evening. In welcoming the Director, the Secretary made reference to the immediate prospect of running grades for Upper Subordinate officers being sanctioned by Government and assured the Director of the unswerving loyalty and devotion to duty of the members of the Association. The Director of Agriculture replied suitably.

Madras University

B. Sc. Ag. Degree Examinations, 1943

List of successful candidates

First Year Abdul Wahid; Akkayya, N., Alwa, K. S., Antony Mathew, K., Appa Rao, P., Belliappa, P. U., Chiranjivi, V., Dharmaraju, E., Jaya Bhima Rao, K., Job Servai, J., Kameswara Rao, V., Koteswara Rao, M., Krishnayya, V. V., Kulasekharan, C. R., Lakshmipati Rao, V., Mahanandi Reddi, C., Manamohanan, V. G., Mohamed Haneefa; Mohana Rao, K. R., Morachan, Y. B., Muhammad Maqboolur Rahman, Nageswara Rao, T., Nanjappa Maniagar, V., Narasimhalu Nayudu, T. R., Narasimhaswami, V., Pandiperumal, S., Radhakrishna Rao, K., Raghunadha Rao, N., Ramdas, P., Rama Sarma, K., Rangaswami, G., Sankara Rao, P., Santhanam, V., Srinivasagopalan, D., Srinivasa Rao, S., Srinivas Vishnu Pandit, Subbaraya Sastri, K., Subrahmanyan, T. R., Suryachandra Rao, K., Suryanarayanamurti, A., Vengu, C., Virabhadra Rao, V., Warris Ahmed, Subba Rao, K., Viraraghavan, S. N.

Second Examination Anjaneyulu, C. V., Audinarayana Reddi, G., Balasubrahmanyan, R., Bettai Gowder, R., Bhaskara Rao, K., Gulam Muhammad Sheriff, John Chinnayya, E., Kanaka Rao, G., Khaja Sha Habibulla, Krishnan, A. S., Madhava Rao, V. N., Nageswara Rao, P., Narasimhalu, K., Narayan Patnaik, Padmanabhan Nambiyar, K. P., Raghavan, K., Raghavendra Rao, W., Rajappa Ayyar, P. V., Ramakrishna Rao, P., Ramamohana Rao, S., Raman, K. R., Ramanathan, M., Ranganathan, R., Samuel Sundararaj, J., Satagopan, R., Shanmugham, T. S., Sundaram Pillai, K., Thomas Reddi, A., Venkatachalam, K., Venkatanadhachari, G., Venkataswami, B., Rama Somayajulu, M. V., Janardhana Rao, K., Muthukumarappa, S., Raja Rao, N. V., Ramachandran, T. K., Syed Ahamedulla.

Reference Students Kanakachala Rao, K., Ramachandrachari, C., Ramamohana Rao, A., Ramanathan, K., and Ranga Rao, D. —*Animal Hygiene.* Narayana Reddi. K. V. and Viswanadham, Y.—*Agricultural Engineering.*

Final Year Examination Janardhana Rao, K., Raja Rao, N. V., Ramachandran, T. K., Syed Ahamedulla, Ammi Raju, P., Appalanarasayya, K., Chellam Vincent, E. R., Chocklingam, C. D., Dasaradhi, T. B., Francis Gurubatham., Ibrahim Ali, S. A., Krishnamurti, P. A., Narasimha Doss, T., Narasimhan, R., Narasimha Rao, G., Narasimha Sastri, V. L., Narayanaswami, K. R., Nargunam, W. R., Navaneethakrishnan, T. V., Padmanabha Pillai, D., Priyavratha Rao, S. B., Raghavan, N., Rajagopalan, K., Ramanjaneyulu, S., Rami Reddi, D., Sankara Reddi, G. H., Somayajulu, P. L. N., Srinivasa Ayyar, P. A., Thyagarajan, N., Venkatarama Reddi, T., Venkataswami, T., Venkataraya Pai, T., Subba Rao, K.

The following Candidates are appointed to officiate as Upper Subordinates III grade (new) from 31—5—44:—

Agricultural Section Sri T. B. Dasaradhi, Guntur District, Sri D. Rami Reddi, Kurnool Dt.; Sri T. Venkatarami Reddi, Kurnool Dt.; Sri N. Thyagarajan, F. M. A. R. S. Hagari; Sri T. Venkataraya Pai, Bellary Dt., Sri G. H. Sankara Reddi, Anantapur Dt., Sri T. K. Ramachandran, North Arcot Dt., Sri R. Narasimhan, Salem Dt., Sri P. A. Krishnamurthi, Tanjore Dt. Sri K. R. Narayanaswami, F. M. A. R. S. Audutrai, Sri T. V. Navaneethakrishnan, Tanjore Dt., Sri. E. R. Chellam Vincent, Madras Dt., Sri C. D. Chockalingam, Madura Dt., Janab S. A. Ibrahim Ali, Ramnad Dt., Sri U. R. Nargunam, Ramnad Dt., Sri Francis Gurupatham, F. M. Cantral Farm Coimbatore, Sri P. A. Srinivasa Ayyar, Vegetable Scheme, Coimbatore., Sri D. Padmanabha Pillai, Govt. Botanic Gardens, Ootacamund and Sri N. Raghavan, Nilgiri Dt.

Science Section Sri T. Venkataswami, and Sri K. Rajagopalan, Asst. in Paddy A. R. S. Maruteru and Pattambi and Sri S. B. Priyavratha Rao, Asst. in Millets, Coimbatore.

The following eight candidates are appointed to Officiate as Upper Subordinates III grade (new) and are posted as Food Inspectors for work under the Grain Purchasing Officer, Bezwada:—

Sri K. Janardhana Rao, Sri N. V. Raja Rao, Sri K. Appalanarasayya, Mr. Syed Ahmedulla, Sri T. Narasimha Doss. Sri S. Ramanjaneyalu, Sri P. L. N. Somayajulu and Sri K. Subba Rao with effect from 31—5—44.

Transfers

Name of officer	From	To
Sri C. S. Krishna Ayyar	A servant of the I. C. C. C.	Temporary Asst. in Cocanadas Cotton Scheme Gurzala (Guntur)
,, A. Raghavan	Asst. Cocanada Scheme	Asst. in Cotton, Coimbatore
,, B. Srinivasa Rao	A. D. Karkal	A. R. S. Tindivanam
,, M. V. Bhaskara Rao	Food Inspector (on leave)	A. D. Kaikalur
,, K. R. Nagarajan	A. R. S. Tindivanam	A. D. in Mycology and Entomology, Vegetable Scheme, Coimbatore
,, D. Radhakrishna Rao	A. D. under training. Kaikalur	A. D. under training, Vuyyur
,, G. Prabhakara Reddi	A. D. under training, Anantapur	Asst. in Oil Seeds, Coimbatore
,, B. N. Padmanabha Ayyar	Asst. in Paddy A. R. S. Pattambi	A. D. Attur
,, K. N. Duraiswami	Asst. in Entomology, Icerya Scheme	A. D. Co. 3 Cotton seed multiplication Scheme, Rasipuram
,, R. Seshavatharam	A. D. under training. Vizagapatam	A. D. under training, Narasannapeta
,, K. Rama Mohana Rao	A. D. under training, Yellamanchilli	A. D. under training, Chicacole
,, T. V. Krishnaswami Rao	A. D. Chicacole	Marketing Asst. Vizagapatam
,, G. Venkaratnam	Marketing Asst., Vizagapatam	A. D. Chicacole
,, T. N. Balasubrahmanya Ayyar	A. D. Kumbakonam	A. D. Lalgudi

Sri N. C. Thirumalachari	A. D. Lalgudi	A. D. Kumbakonam
„ P. L. Narasimham	Marketing Asst. Bezwada	A. D. Krishna Dt.
„ K. Purushotham	A. D. H. I Scheme Guntakal	F. M. Hagari
„ M. Kelukutti Menon	Asst. in Oil Seeds Coimbatore	Asst. in Paddy, Coimbatore
„ D. Shanmuga-sundaram	A. D. Koilpatti	Asst in the D. A.'s office in connection with the publication of monthly journal in Tamil
„ M. Gopala Chetti	F. M. Guntur	F. M. Koilpatti
„ S. V. Kuppuswami	Asst. in Chemistry (on leave)	Asst. Soil Physicist Coimbatore
Janab Mirza Ansar Baig	A. D Bellary	A. D. Hospet
„ Sheik Hussain	A. D. Cuddapah	Marketing Asst. Nagpur
Sri G. Satyanarayana	Special A. D. Anantagiri	A. D. Chipurapalli
„ M. L. Narayana Reddi	A. D, Chipurapalli	Special A. D. Anantagiri
„ V. S. Rangacharlu	Special A. D. Saidapet	A. D. Anantagiri
„ N. Sobhanadri	Food inspector, Bezwada	Marketing Asst. Bezwada
„ T. Venketeswara Rao	Marketing Asst. Bezwada	Food Inspector, Bezwada
„ P. Ramachandra Rao	A. D. Bezwada	A. D. for loan work at Bezwada
„ C. T. Ittyachan	Asst. in Oil Seeds from Foregin service	Asst. in Oil Seeds A. R. S. Tindivanam
„ B. Srinivasa Rao	Asst. in Oil Seeds A. R. S. Tindivanam	A. D. Hospet
„ K. R. Narayanaswami	A. D. Under training Arantangi	F. M. A. R. S. Aduturai
„ D. Narasimhamurthi	A. D. Tadepallegudem	A. D. Anantagiri
„ T. D. Muthuswami	A. D. Sriguppa (on leave)	Marketing Asst. Tanjore Dt.
„ P. Sudarsanam Nayudu	Compost Scheme Anantapur	A. D. Kurnool
„ A. K. Ramasubba Ayyar	„	A. D. Palladam
„ G. Duraiswami	A. D. (on leave)	A. D. Koilpatti
„ M. Alagiriswami	A. D. Tiruvannamalai	A. D. Nemalur and Santhavelur Scheme in the Chingleput Dt.
„ G. K. Subramania Iyer	A. D. Cheyyur	A. D. Chingleput Dt.
„ B. P. Masilamani	A. D. Saidapet	A. D. Peravurni
„ P. Gopalakrishnan	A. D. Mannargudi	A. D. Tinnevelly Dt.
„ U. S. Ayyaswami Iyer	A. D. (on leave)	A. D. Tiruvarur
„ K. M. Venkatachalem Pillai	A. D. Tiruvarur	A. D. Peravurni
„ P. Krishnamurthi	A. D. in the sugar Excise Scheme Bobbili	A. D. Bobbili
„ P. L. Narasimham	A. D. Bezwada	Marketing Asst. under D. A O. Guntur
„ I. L. Narasimha Rao	Marketing Asst. Guntur	A. D. Vizagapatam
„ S. Muthuswami	A. D. Mathurantakam	A. D. in charge Seruseeri, Sendivakkam and Karanaipudugberi Scheme, Chingleput

Sri P. S. Venkata-subrahmanyan	A. D. Gingee	A. D, in charge of the Nemalur and Santhavelur Scheme in the Chingleput Dt.
„ M. V. Narasimha Sastri	A. D. Chodavaram	A D. in charge of the Allur Chenneraopalem Malkapuram Scheme in the Kistna Dt.
„ K. G. Sankappa Bhandari	A. D. Coondapur	A. D Bellary
„ K. Mahabala Shetti	A. D. in the Sugar excise Scheme Hospet	F. M Siruguppa
„ K. Dinker Rao	F. M. Siruguppa	A. D. Coondapur
„ N. Muthuswami Naidu	Asst. in Entomology Coimbatore	Ento-Mycology Demonstrator, Poonamalle (Chingleput Dt.)
„ K. V. Chelapathi Rao	A. D. (Special duty), Vizagapatam	Food Inspector, Cocanada
„ K. Kuppamuthu	A. D. Shiyali	A. D. Coimbatore Dt.
„ K. Kannian	F. M. Central Farm, Coimbatore	Land Reclamation Scheme work uader the Special D. A. O., Pattukottai Taluk
„ T. Navaneetha-krishnan	A. D. under training, Peravurni	F. M. Central Farm, Coimbatore
„ D. Bapayya	F. M. Guntur	A. D. H. I. Cotton Scheme, Bellary
„ I. Sambasiva Rao	A. D. Vuyyur	A. D. Bezwada
„ P. Ramanadharao	A. D. Bezwada	A. D. Masulipatam
„ V. Gopalakrishna Gokhale	A. D. Masulipatam	A. D. Challapalli
„ D. Satyanarayana	A. D. Challapalli	A. D. Vuyyur
„ B. Shiva Rao	A. D. Tuni	A. D. Cocanada
„ M. Ramalingam	A. D. under training, Bellary	A. D. Siruguppa
„ V. Ramunni Kidavu	A. D. (on leave)	A D. Krishnagiri
„ P. S. Anantachari	A. D. Ariyalur	To work under the Special D. A. O., Land Reclamation work. Pattukottai
„ T. Arunachalam	A. D. Srivaikuntam	do.
„ C. A. S. Ramalingam Pillai	A. D. Koilpatti	do.
„ T. K. Sankara-subramanyam	A. D. Sivaganga	do.
Mr. J. Moses	A. D. Melur	do.
Sri N. H. V. Krishna-murthi	Asst. in Paddy, Maruter	Food Inspector under Tadepallegudem
„ A. Ramadoss	A. D. Arantangi	A. D. Mayavaram
„ M. K. Swaminathan	A. D. Orathanad	A. D. Koilpatti
„ G. J. Balaraj	A. F. M. Pattukottai	A. D. Orathanad
„ P. Gopalakrishnan	A. D. Mannargudi (on leave)	A. D, Arantangi
„ S. Venkataramanappa	A. D. Pulivendla	F. M. Bhagavadi Farm.
„ P. N. Seetharaman	A. D. under training, Salem	A. D, Co. 3 Scheme, Trinchengode.

Sri J. S. C. Antony	A. D. Dindigul	A. D. Srivaikuntam
Mr. Mohamad Ali	A. D. Salem Dt.	A. D. Salem Taluk
Sri Bhagiradhi Padhi	A. D. Palakonda	A. D. Chicacole
,, P. Y. Chintamani	A. D. Anakapalli	A. D. Yellamanchilli
,, T. Devasikhamani	A. D. Jammalamadugu	A. D. Cuddapah
,, M. Ratnavelu	A. D. Bhavani	A. D. Andiyur for the land colonisation Scheme, Coimbatore
,, A. Rama Mohan Rao	A. D. Yellavaram	A. D. H. 1 Cotton Scheme
,, R. Subramania Ayyar	A. D. Arantangi	A. D. in charge of Karuvakurichi and Tallickottai Colonisation Scheme, Tanjore
,, K. S. Krishnamurthi Iyer	A. D. in charge of Karuvakurchi and Tellikottai Scheme, Tanjore	A. D. Tanjore
,, I. Achutharama Raju	Asst. in Entomology, Coimbatore	Asst. in Entomology, Samalkota
,, K. Ramakrishna Sastri	Food Inspector, Cocanada	A. D. Kanigiri
,, A. Subramaniam	A. D. Etikoppaka (Special duty)	A. D. Peddapuram

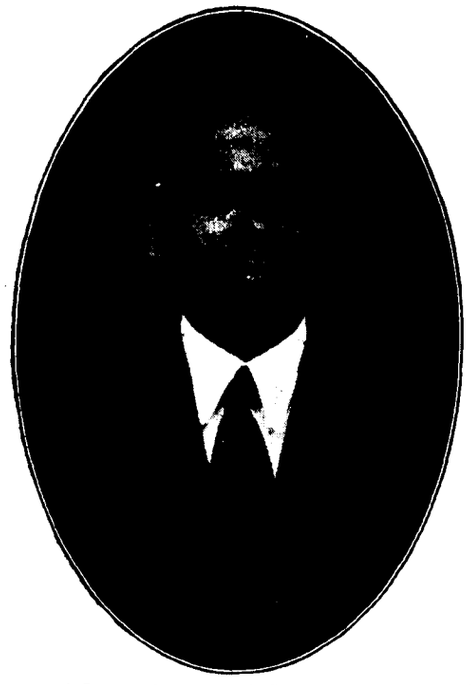
OBITUARY

We regret the untimely death of Mr. V. Viswanatha Iyer, Assistant Agricultural Demonstrator, on 14th May 1944, at Namakkal, due to heart failure. He was a versatile talent, 'jack of all trades' and extremely practical. His simplicity and pleasant manners endeared him to all people he came across. His death is a personal loss to the very wide circle of his friends and acquaintances. We send our hearty condolences to the members of his bereaved family. May his soul rest in peace!

APPRECIATION

P. H. RAMA REDDI, Esq., C I.E, I.A.S, was born on 15th February 1888 in Cuddapah District. He comes from a family of typical agriculturists. it was with great difficulty that he was able to persuade his parents to send him for English education. When once he joined a school he showed extreme enthusiasm and brilliance in his studies, and his parents had to send him to Madras for higher studies. He graduated in the Madras University and proceeded to England for higher studies. During a stay of four years in Edinburgh University, he not only took his Degree in Agriculture but he also secured a Degree in Forestry in one year. This is, indeed, a unique achievement

After he returned to Madras, he entered service in the Madras Agricultural Department as Deputy Director of Agriculture on 17th January 1919.



He was the first Indian to enter the Madras Agricultural Department as an officer of the Imperial Agricultural Service. After a period of training at Coimbatore and St. Thomas Mount, he was posted to Bellary as Deputy Director of Agriculture, where he was confirmed as Deputy Director of Agriculture on 17th January 1922. As Deputy Director of Agriculture, Bellary he was taking keen interest in the improvement of cotton grown in the Ceded Districts and he was responsible for evolving a strain in Hingari cotton, which is still being grown in the Hingari tracts of the Ceded Districts.

On 18th June 1923, he was transferred to the Agricultural College, Coimbatore, as Professor of Agriculture and Superintendent, Central Farm. After a stay of three months, he was again transferred to Bellary as Deputy Director of Agriculture, III Circle. He worked as Deputy Director of Agriculture, III Circle for five years and on 1st June 1928, he was again posted to the Agricultural College, Coimbatore, as Vice-Principal of the College. On 1st September 1929, he was made the Principal of the College. During his stay in the College he became very popular with his colleagues as well as the students, due to his amiable and pleasing manners. He was extremely conscientious

and systematic in his work. He was regular and simple in his habits. He was very polite and kind to everybody which endeared him to one and all.

His services were lent to the Government of India from 1st November 1930 and he was posted as Deputy Secretary to the Indian Central Cotton Committee, Bombay. He made his presence felt there and due to th extremely good work done for the Committee he was later on made the Secretary, Indian Central Cotton Committee.

On 16th September 1937, he was appointed as the Director of Ac culture, Madras. In the early days of his career as the Director of Agricu ture, things were not looking very bright everywhere and in every branc of the Department, there was retrenchment; reduction of pay and closing down of Research Stations and curtailing the scope of the activities of th Department. It was only through his able guidance and his ability to adjus himself to the spirit of the times that he was able to push on the work of the Department creditably. In the year 1939, the War broke out and things looked extremely gloomy. The fall of Burmah and the difficulty of getting imports to India brought about the necessity of growing more food in the country. It was during this critical period that the Agricultural Department came into prominence and exerted to its utmost to produce more food crops The Government, the people and everybody felt that the Agricultural Department was doing yeoman service to the country and the scope and activities of the Department have increased beyond recognition, since then.

Apart from these, Mr. Rama Reddi was mainly responsible for starting the Government Malt Factory at Coimbatore for the production of malt food and malt extract from *cholam*, providing godowns for storing groundnuts in various parts of the Presidency where groundnuts are grown on a large scale, and for establishing regulated markets for the control of trade and securing good prices for the growers at important trading centres lik Tirupur, Cuddalore, Guntur, Nandyal and Adoni.

Government recognised the merit of his work and extended the period of his service by just more than a year till 15th April 1944. In addition, His Majesty the King Emperor conferred the title of C. I. E., as a mark of recognition of the invaluable services rendered by Mr. Rama Reddi.

Mr. Rama Reddi was a very interested member of the Madras Agricultural Students' Union and was always solicitous of the welfare of the Union. We hope that his personal interest in the Union will remain as keen as ever.

Even though Mr. Rama Reddi retired from service as the Director of Agriculture, Madras, he is still hale and healthy and due to his active habits, good health and mental alertness, the Government have made use of his services as Deputy Regional Controller of Food Supplies.

We wish him a very long and happy life.

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