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2. Why is the yield so low in India? The straight forward answer is that, nature providing an adequate water supply, paddy which, for a lazy cultivator, is the easiest crop to grow has been cultivated for centuries without adequate return to the land, and the soils are therefore generally in an exhausted condition except for the fresh silt of rivers. 5 Soil Surveys of deltaic tracts have been done in Madras with reference to the manurial content in these soils, and the general inference is somewhat as follows.—

Derived directly or indirectly from gneissic rocks containing orthoclase felspar, the soils are generally well supplied with total and available potash. The amount of organic matter is low and the nitrogen content is in proportion also low. This is largely rectified by the general practice prevailing in Madras of ploughing in green manures, formerly cut from forests and waste lands and now largely grown as leguminous crops in the fields themselves. Let alone the question whether green manures directly supply nitrogen to the plants under swampy conditions of cultivation, there has been a general improvement in crop production as a result of green manuring. Ryots do understand the efficacy of farmyard manure, sheep penning and organic manures like poonacs, but only a small proportion of the lands under cultivation receive anything like manure. Next, the lime-magnesia ratio, as advised by Japanese scientists, seems to be about properly maintained in these soils and there does not seem to be any immediate need for the supply of lime as a manure. With regard to phosphoric acid, the outlook seems despondent; the content of both total and available phosphoric acid is very low, and the continuous depletion of phosphoric acid goes on, as the grain in which most of the phosphoric acid is lodged is sold off the land. The only sources of phosphatic manures available in Madras are bones and Trichinopoly phosphate. The manufacture of super on an extensive scale is apparently a remote and even impossible task, and there is probably no need to use the more costly super in paddy lands, while the cheaper bonemeal and powdered phosphatic nodules seem to be equally good for paddy under the conditions of cultivation carried on in the country. The writer's work on the availability of flour phosphate has confirmed the result that flour phosphate is rendered available to paddy when green manure is ploughed in, especially if a readily available nitrogenous manure is also applied. Field experiments in Madras have given similar results.

3. As a sequel to the work on the availability of flour phosphate, the question of [illegible] suitable manure mixtures for the paddy lands of Madras was taken up, especially of the premier rice growing district of Tanjore which feeds the Cauvery delta.





Phosphoric acid and nitrogen being the two manurial ingredients required for these soils, the investigation required the elucidation of the two following points:—

(i) the comparative merits of the chief organic nitrogenous fertilizers at present available in Madras; and

(ii) the comparative merits of bone meal and flour phosphate as suppliers of phosphoric acid.

*Experiment I.*

20 plots, 5 cents each, were laid out in four different villages in Tanjore District, and 4 organic manures, fish guano, groundnut cake, horn-and-hoof meal and castor cake were applied, some mixed with flour phosphate and some with bone meal the total amount of nitrogen and phosphoric acid being 10 lbs. and 30 lbs., respectively, per acre. The duplicates received 2 lbs. of ammoniacal nitrogen and 4 lbs. of water soluble phosphoric acid, to find out whether these small quantities stimulated the growth of the crop in early stages. The soils varied in nitrogen content from ·049 to ·074 per cent, in total phosphoric acid from ·053 to ·087, and in available phosphoric acid from 0·0035 to ·009. Seedlings of long duration varieties of paddy were planted about the end of September 1923 and harvested in the 1st week of February 1924. The harvest was done under departmental supervision and, while the yields of grain may be taken as accurate, the yields of straw were only approximate owing to the differences in its dry or green state.

The same experiment was carried out in pots in the pot culture house at Coimbatore, with a soil which contained ·067 per cent of nitrogen, ·038 of phosphoric acid and ·009 of available phosphoric acid. Each manured field-plot and each manured pot received same quantities of nitrogen and phosphoric acid per acre, the nitrogen of bone meal and the phosphoric acid content of the organic manures being taken into account. The general opinion that bone meal is superior to flour phosphate is not borne out by these experiments, the flour phosphate series, on the other hand, being slightly superior to the bone meal series. The following summary from the tabulated figures brings out the force of the above statement:—

| Nature of Experiment. | Yield in lbs per acre. Grain. | Straw. |
|---|---|---|
| Check (average of 8) ... ... ... | 2013 | 4379 |
| Flour phosphate series (average of 32) ... ... | 2310 | 5315 |
| Increase due to phosphate ... ... | 297 | 936 |
| Check (average of 8) ... ... ... | 2105 | 4766 |
| Bone meal series (average of 32) ... ... | 2249 | 5029 |
| Increase due to phosphate ... ... | 144 | 263 |

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# The Madras Agricultural Students' Union.

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Farming will never be a success unless the farmer had more voice in the disposal of his produce—P. Merrel.

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## Some Experiments on the Manurial Requirements of Paddy

By Rao Sahib M. R. Ramaswami Sivan, B. A., Dip. Agri.

Paddy occupies the largest area of cultivated crops in Madras and is grown in deltas, along river banks and under tanks. References to the grain in old Indian literature and the ancient irrigation systems bear testimony to its antiquity as the most important staple food crop of the country. Water is the first and deciding limiting factor for the growth of the crop and, barring some localities receiving silt from higher levels, a large proportion of the paddy soils in Madras with which alone the writer is quite familiar, may be said to have reached their minimum cropping value; and this statement is substantiated by Dr. Butler who, in an account of his deputation to the International Rice Congress in Spain in 1914, published in Volume IV of the Agricultural Journal of India, 1914, gives the following figures as the average yields of grain per acre in different countries:—

| | lbs. |
|---|---|
| Spain (Province of Valencia) ... | 5700 |
| Italy ... | 3300 |
| Egypt ... | 3300 |
| Japan ... | 2100 |
| India ... | 890 |

A paper contributed to the Indian Science Congress, 1925.

As suppliers of phosphoric acid, therefore, both bonemeal and flour phosphate may be said to be of equal value and the present experiments show, if any, that flour phosphate is superior to bonemeal. In other words, divested of its nitrogen, the phosphoric acid in bones has equal value with the phosphoric acid of flour phosphate, as it is present in both cases as the insoluble tricalcic phosphate. This is a very important consideration considering the present market price of the two manures. Owing to the demand from Ceylon and other countries, bonemeal is now selling at Rs. 120 per ton, while a manure Firm in Madras to whom a portion of the phosphatic nodule area has been leased out, has stipulated with the Government to supply properly ground mineral phosphate at Rs. 40/- per ton.

As regards the organic manures, all the four manures seem to be of equal value as suppliers of nitrogen. The following summary makes this point clear:—

| Number of experiments. | Nature of Experiment. | Yield in lbs. per acre. Grain | Straw | Excess yield over check in lbs. Grain | Straw |
|---|---|---|---|---|---|
| Average of 8. | Check | 2107 | 4573 | ... | ... |
| ,, 8. | Fish guano series | 2266 | 5072 | 159 | 499 |
| ,, 8. | Groundnut cake series | 2247 | 5044 | 140 | 471 |
| ,, 8. | Horn & hoof meal series | 2201 | 5358 | 194 | 785 |
| ,, 8. | Castor cake series | 2308 | 5214 | 201 | 641 |

The results do not warrant a statement regarding the superiority of any of the four manures as suppliers of nitrogen, although castor cake and horn meal seem to be better. The choice for a manure mixture will, therefore, depend on the quantities which can be procured in a particular locality and the price at which it is available. The current prices are as follows:—

| | | |
|---|---|---|
| Nitrogen in fish guano | Rs. 12 to 13 | per unit. |
| ,, groundnut cake | 15 to 16 | ,, |
| ,, horn meal | 11 to 12 | ,, |
| ,, castor cake | 20 to 21 | ,, |

From the above remarks, it will be seen that fish guano and horn and hoof meal amongst organic nitrogenous fertilisers and flour phosphate amongst the phosphatic manures, may be the bases for manure mixtures. Sulphate of ammonia is available in Madras at Rs. 14 per unit and should also form an ingredient of manure mixtures, especially as ammonium salts are easily fixed in soils and as paddy feeds directly on ammonium salts.





*Experiment II.*

Based on some experiments carried out by the writer in 1918 on the availability of flour phosphate, as a result of composting it with different organic fertilisers in puddle, a manure mixture was evolved by the Deputy Director of Agriculture, and has been in use with fairly satisfactory results for the last 5 years in the Tanjore delta; and, on account of the present higher prices of some of the ingredients of that mixture and on account of the increased grain-yield not covering the cost of the manure in some cases, it was considered desirable to examine the question of manure mixtures more thoroughly.

An experiment was tried with an improvised manure mixture, containing 5.25 per cent of nitrogen and 12.5 per cent of phosphoric acid, in 20 villages in the Tanjore district. Selected plots in these villages were divided into an even number of strips, alternate plots receiving the manure at 2 cwts. per acre. In two cases, the manurial plots yielded less grain than the unmanured. Of the remaining 18 plots, 12 plots gave an increased amount of grain covering the cost of manure which was Rs. 10 per acre.

4. The experiments of 1923-24 having, to a certain extent, elucidated the comparative merits of the organic fertilisers and the phosphatic manures, proposals were ready for the continuation of the experiments in the year 1924-25, both in the field and pot culture house. The dislocation of Railway traffic owing to floods interfered with the transport and application of manures, and the field experiments had to be dropped for the present.

The pot experiments were, however, improved upon in the following manner. As it is very difficult to maintain in pots, the actual paddy soil conditions, throughout the season of growth, Guddapah slab frames, each one yard square, were sunk in the paddy lands of the Central Farm Coimbatore after the usual preparatory cultivation was over; and different proportions of manure mixtures were applied to each frame, the field being carefully bunded for letting in and letting out water, without contaminating other plots. These experiments were modelled after Kellner in Japan.

5. The next point for consideration is the quantity of manure which should be applied. The general principles governing the application of manures are so many and so varied, that it is difficult to give a definite answer. Manure Firms which sell fertilisers for different crops appear to have compounded their mixtures chiefly on the basis

of the quantities of nitrogen, phosphoric acid and potash which will be removed by an average crop annually. In Spain, 800 lbs. of a manure mixture containg 64 lbs. of ammoniacal nitrogen, 70 lbs. of water soluble phosphoric acid and 24 lbs. of potash are applied per acre and this will cost at the present market rate about Rs. 60 in Madras. Kellner recommends an application of 75 kilograms of ammonium sulphate and 125 kilograms of water-soluble phosphoric acid per hectare, which amounts to 65 lbs. of nitrogen and 110 lbs. of phosphoric acid per acre, and this will cost again about Rs. 60. In his calculations, Kellner has taken into consideration not only the quantities of nitrogen, phosphoric acid and potash removed by crops but also the assimilation factor for each manurial ingredient, which worked out to 56 to 62 per cent of *nitrogen* in ammonium sulphate, 50 per cent of *potash* in sulphate of potash and 21 per cent of *phosphoric* acid in superphosphate. Kellner's experiments were carried out over 30 years ago in Japan and the results of his experiments are buried in old Japanese bulletins, but one certainly gets a certain amount of inspiraton from these old records. His final results regarding the manurial requirements of paddy may be summarised in the statement:—

*For every 100 kilograms grain, apply 2.53 kilograms of ammoniacal nitrogen and 1.42 kilogram of water-soluble phosphoric acid and, if there is a deficiency of potash, 1.31 kilogram of potash as a soluble salt.*

The soils of Japan contain from .489 to .799 per cent of nitrogen and .49 per cent of total phosphoric acid, ten times the nitrogen and phosphoric acid content of South Indian soils and, when Kellner recommends an application of a heavy manurial treatment as described above, there is a feeling of despondency about the possibility of our improving Indian soils with such small homoeopathic doses as 10 lbs. of nitrogen and 30 lbs. of insoluble phosphoric acid. Scientific determination of the requirements of paddy for maximum crops is one question, and the recommendation to a cultivator to apply a certain quantity of manure is another ; the latter depends upon his ability to find the cost of the manure, and at present the cultivators of Tanjore are unwilling, rather unable, to spend more than Rs. 10 to Rs. 15 per acre for manures. The scientific aspect, however, is the more important and requires several years, sustained work on a definite policy and, if possible, concerted action between workers in different Provinces.

[The Tabular Statements giving detailed results of experiments have been left over for a future issue—Editor.]



## Insect Pests of South India and their Control.

RAO SAHIB Y. RAMACHANDRA RAO,

*Ag. Government Entomologist, Coimbatore.*

About four years ago an insect pest had the honour of cutting a prominent figure in the Budget discussions of the Madras Legislative Council. In addition to the chronic failure of timely rains that the dry farming ryots of the Bellary Districts are usually afflicted with, the "Aggipurugu" or "Benkihula" of Cholam (*Calocoris*) had appeared that year and caused an almost total loss of grain. "What have the Agricultural Department done to save the ryot from this pest?" demanded the Member for Bellary and naturally much of his wrath decended on the devoted head of the Entomologist. Two or three other pests had bid fair to attain to such distinction, though they did not actually get into similar limelight. One of these is the "Rice Army Worm"—*Spodoptera mauritia*,—known variously as "Karakkotti", "Laddepurugu" and "Arakkan." It is one of those swift scourges of Nature, that seem to descend like the lightning on broad stretches of young paddy and disappear altogether after dealing widespread destruction. In the year 1924, numerous villages in Malabar had been affected and there was a loud wail calling for help from everywhere at one time. Later in the season the same year, there were numerous calls for help against "Bambuchu" or "Chazhi" (the name by which the Rice Bug is known in South Kanara and Malabar respectively) sucking dry the green ears of paddy.

There are numerous other pests of importance in South India, which the Entomologist is expected to tackle. There is the "Kumbipuchi" or "Gongalipurugu" dealing destruction in its millions to all young cereals and pulses in most red soil areas of the Presidency. There is next the Rice Grasshopper defoliating the leaves of young paddy and later on cutting the bases of the earheads in the mature crop. There was last year a tale of woe from one of the western taluks of Bellary regarding the depredations of the "Jitti" or the Deccan Grasshopper, which had thus reappeared after an interval of several years' duration. There are a thousand ills to which fruit trees are subject. The Mango-hopper may in certain years cause an entire failure of the crop. The fruit fly, the mango stone weevil, and the stemborer are only a few of the varied hordes of insect enemies of Fruits. Besides these there are numerous other insects destructive to various other crops. Remedies are demanded for all of these : some "medicine" is wanted that would make the pests vanish in a moment and save the crops. You may give the ryot full information

as to what the insect is, how it lives and what it does; you may give him sage advice as to what he should or should not do in future; but this is not what the Indian ryot wants: what he expects of you is something very different. He demands something very spectacular—a prescription that could transform, as with a magic wand, his yearning wishes into solid reality and a stricken crop into a plentiful harvest, all without the least exertion on his part. Spells and incantations—"mantrams"—are what he places more reliance on, and the village magician oftentimes reaps a decent harvest of silver and copper coins whenever pests come into existence.

We are not, however, living in the days of Aladdin and his wonderful lamp: and though indeed greater wonders have been accomplished during the recent developments of science, it has seen, only through patient plodding research and not by the reputed touch of the magic wand. It may be confessed at once that there is, as in medicine, no universal panacea for all kinds of disease. In each case the disease has to be carefully diagnosed; the actual cause traced and the circumstances under which it comes into existence investigated before proper remedies can be suggested. Each different insect has its own peculiar ways of damage. The remedies have necessarily to be adapted to suit the nature of the particular insect. In reporting the occurrence of diseases, a mere statement of symptoms will not, generally speaking, be sufficient. Several entirely different causes give rise to diseases the symptoms of which are identical to the eyes of the layman. For instance, when the leaves of a plant turn pale and wither, it may be due, firstly, to one of the several sucking insects, such as, scale insects, thrips, or plant-lice or even to redspider, or secondly, to any leaf mining caterpillar, grub or maggot or thirdly to a fungus disease, like Mildew; but the treatment depends on a knowledge of the exact cause of the disease. It is therefore absolutely necessary that specimens of the attacked plants together with those of the suspected insects should accompany reports of pests or disease. In many cases the best procedure on the part of a competent entomologist would be to examine the pest on the spot, institute enquiries and study the life history of the insect, so that he could be in a position to suggest remedial measures suited to the particular conditions.

It is perhaps not generally known that insects—low as they are in the scale of creation—have a more complicated life history than the higher animals. Butterflies are not born as butterflies nor are grasshoppers born as such. The parent insects lay eggs, from which in one class of insects—typified by the grasshopper—young insects hatch out which resemble the parents in general appearance but



differ in being smaller and wingless. As they feed, they grow gradually bigger and bigger until they assume wings and become mature. In the other class, typified by the butterfly, the egg hatches into a worm-like form very different from that of the parents. It is unable to fly but crawls about on the food plant and feeds actively on the leaves and grows bigger and bigger until it becomes fullgrown. It then assumes a form known as the chrysalis or the pupa. It is seed-like in shape and is unable either to feed or to move. After a period of about a week or two in this resting condition, the skin of the chrysalis splits and the butterfly crawls out. The wings are not noticeable in the beginning, but soon grow out and expand, so that in a short time the butterfly is able to fly away. Whereas the caterpillar feeds on the leaves the butterfly is not possessed of biting jaws but only of a sucking tube with the aid of which it sucks nectar from flowers. The life-story of the silk worm is perhaps a more familiar illustration. The silk worms hatch from small circular eggs and are at first very small. As they feed on the mulberry leaves, they gradually increase in size, until they become full grown, when they spin oval cocoons of silk and turn into pupae inside. After a week or two the moth emerges from the cocoon piercing a hole at one end.

Again insects differ a great deal in their feeding habits. Some are armed with teeth and are able to bite, cut and chew. They may feed on the leaves or the bark or may tunnel into hardwood. There are other groups of insects which possess a sharp tubular beak instead of jaws and use it for sucking up plant juices.

A study of the habits of insects is very important in relation to a consideration of remedial measures against them. In the case of insects which have jaws and are capable of feeding on plant tissues, such as leaves, the recognised method of treatment is the application of a stomach poison—like the compounds of arsenic—on the plants to be protected, whereby the insect takes in the poison along with the leaf and gets killed. It must, however, be kept in mind that, in the arsenates, we are dealing with chemicals that are deadly to man and the higher animals as well, and also that if a certain proportion is exceeded, the leaves themselves become affected and get burnt. It is therefore essential that the poison should be mixed with water in certain particular proportions—whereby the insects are killed but the leaves are unaffected. It is also important that the mixture thus prepared should not merely be splashed on the leaves but spread over them sparingly but evenly. This is effected with the help of a mechanism known as a spraying machine. It exists in various sizes

and in various patterns. The most convenient size is that known as the Knapsack sprayer—capable of being carried on the back and being operated by one man. It consists of a metallic reservoir to receive the spraying mixture, a force pump, a hose and a nozzle-which produces a fine mist-like spray. A spraying machine is onvaluable in any up-to-date orchard.

The other class of insects—which have a sucking tube in the place if jaws-are not affected by the above treatment. As they do not feed on solid tissues, the use of stomach poisons does not affect them. In fact they need a different sort of treatment—viz., the use of a contact insecticide. Insects possess a respiratory or breathing system composed of branching air tubes which communicate with the outside air by means of spiracles or breathing holes situated along the sides of the body. Preparations, like an emulsion of kerosene and soap, or a decoction of Tobacco and soap, have, when sprayed on the body of such insects, the effect of penetrating the air-tubes through their breathing holes and causing their death. These contact poisons are of great use against soft-bodied insects like the Mango Hopper, the Cabbage Aphis and Scale insects.

There is yet a third class of insects which, though possessing jaws, live a concealed life. They may be borers in stems of plants, or may tunnel into the pulp of fruits or may mine into the tissues of leaves, but in all cases they are beyond the reach of insecticides that may be sprayed on the plants. It is a difficult matter to get at them unless the stem or the fruit they inhabit is cut open. In certain cases, however, as for instance, of the codling moth caterpillar boring into apples, peaches etc., a careful study has shown that the borers are vulnerable at a particular stage. The eggs are laid on young fruits or flowers and the young caterpillars have to bite their way inside from the surface. Experience has shown that if a stomach poison be sprayed on the flowers or fruits at this stage, most of the young caterpillars are killed and the fruits thus protected from borers.

The fruit maggot is another knotty problem. The eggs are laid singly under the skin of the rind, and the maggot tunnels in and feeds on the pulp. Until the maggots bore their way out of the fruit to pupate in the soil, the fruit presents a healthy appearance, so that it is usually not possible to distinguish infested fruits till the last stages. In Italy, spraying of poisoned solutions of sugar or molasses has been tried with some success against the Olive Fruit Fly—an allied insect pest, the flies, especially the females, feeding on the solutions and getting killed. A similar method is under trial against the Mango Fruit-Fly at Kallar. A measure readily suggested



by common-sense, is of course, the destruction of all infested fruit, since each fruit neglected would mean a deliberate encouragement given to the increase of the pest and would lead to the loss of numerous fruits in the succeeding generations of the Fly.

In the case of certain other insects, the perfect or the winged stage comes to light in abundance and contrivances have been devised whereby such insects are trapped at light and destroyed. The light trap is, however, generally an unreliable method, since in moonlit nights it has not much attraction for insects and to a certain extent useful insects are also lured and destroyed. In other instances, moths have been found to be powerfully attracted to mixtures of sugar solution and arrack, and certain pests have been tackled by exploiting such habits. Experience has yet to show if this method will prove useful in South India.

Of recent times, the utilisation of natural checks against the spread of insect pests has caught the popular imagination, especially in America. In Nature, the powers of reproduction among insects are enormous. In certain species each mother insect is known to be capable of laying as many as 3,000 to 5,000 eggs. Each egg may, under favourable conditions reach the adult or egglaying stage in a month or less. If insects were to continue to breed at this rate throughout the year, the numbers which may be produced from one parent insect would reach a frightfully large figure and there would soon be no space on earth for man or for beast. Under natural conditions, however, there are certain automatic checks on the increase of insects—of which the most important are the limitations of climate and the existence of natural enemies. Of these, the former is clearly beyond human control, but the latter may be made use of to a certain extent.

The instances of successful checking of several serious insect pests by the introduction of parasities in America have already become classics in Entomological achievement. The romantic circumstances under which successful results were achieved have served to clothe the method of utilising the natural enemies of insects with a peculiar halo in the popular imagination; with the result that the layman always imagines that success is indisputable, wherever parasites have been discovered. It is however important to recognise that the undeniable success of parasite introduction in America was due to certain peculiar circumstances. In attempts at importing various famous varieties of fruit trees from Europe and the East, the Americans had in the earlier days unwittingly introduced certain serious pests belonging to the Eastern Hemisphere. Though these

insects were not known to be very serious in their native homes they were found, much to the chagrin of the importers to multiply so rapidly and to such an alarming extent in America as to threaten the complete ruin of the fruit-growing industry. On investigation this abnormal increase was found to be due to the absence in their new homes of their natural checks in the shape of insect-enemies. Consequently American investigators scoured through the world in quest of parasites; and the story of the discovery of these parasites and later on of their successful introduction into America is now a matter of history. The position is however quite different in the case of pests indigenous to the country. These have their own parasites which usually keep them within bounds, but at times, owing to a peculiar combination of climatic conditions. the parasites happen to decrease and as a natural sequence the pests increase in numbers till such time as the parasites are able to regain their ascendency. Under such conditions, it is rather difficult to make use of the parasites. The only way would be to give them protection during adverse conditions in winter or midsummer, to give them other hosts in the absence of the particular pest, and to give them an early start, if possible in spring, so as to enable them to obtain an efficient control of the pest before it assumes real magnitude.

During the last three years, some amount of work has been done in South India by way of the control of a pest by means of its parasite enemies. About 5 years ago a serious coconut pest the black-headed caterpillar—*Nephantis serinopa*—had been inadvertently introduced by rail traffic from Travancore and the pest increased in such numbers within a year that coconut palms became badly affected and began to dry up. Owing to the impossibility of spraying trees of such size and height, the cutting and burning of infested fronds was the only measure that could be adopted. Due to a lack of co-operation among the garden-owners, the help of the Pest Act had to be called in by Government for enforcing the remedial measures uniformly. However, in spite of even a thorough clearing, a re-infestation was always noticed since there were always a large number of moths at large to lay fresh eggs. An examination of the pest in the East Coast Districts of South India revealed the fact that the pest was automatically controlled in these places by the combined action of three or four different parasites. Since all but one of these were absent at Mangalore, live cocoons of these parasites were imported from East Coast Districts and set free there. It was pleasing to find that within the period of a year of introduction two of these got established at Mangalore and there was a perceptible betterment of trees in the infested area. Although the pest has of late spread from Mangalore into various parts of South Kanara and



Malabar it is hoped by a systematic introduction of the parasites into these areas that the pest will be kept fairly within safe bounds. The problem of control by parasites is, however, very much complicated by the interference of other factors such as the effect of weather conditions and the presence of hyperparasites so that it is not such an easy matter as it appears to be.

No hard and fast rules can be given as to the application of remedial measures. The right method of treatment even for the same pest will depend on the particular conditions of the particular spot. Given different conditions the treatment may have to be modified very greatly to suit them. It is on the whole a question of mere common sense. For instance, the swarming caterpillar *Spodoptera mauritia*—may occur in wet nurseries or in dry ones. It may be found in young broadcast crops or may occur in "Kole" cultivation. It may even attack hillgrasses on the tops of hills. The measures that may be successful under one set of conditions may not hold good under others. Flooding the fields has been found to be of value where there are facilities for irrigation, but this method is obviously of no use in dry sown crops, or in the case of hill grasses. Hence the only operation that is possible in dry areas is to prevent the caterpillar from marching from attacked to unattacked fields by digging trenches across their path. It may be possible to destroy them either by poison baiting or by dusting, but these methods are still in an experimental stage and no statement can therefore yet be made on their merits. In the "Kole" cultivation in backwater areas it was found this year that, although water was available in the early stages, flooding was impossible on account of the difficulty of baling it back—an operation which is by no means an economic proposition. Remedies can therefore be based only on common sense—quickness of judgment and rapidity of action being more important than elaborately thought-out plans.

In the case of certain major pests, elaborate spraying is an impossibility, especially when the crops concerned are "Poor man's crops" like cholam and the small cereals. What the Entomologist has therefore to do is to study the life habits of the pest in question in great detail and find out weak points in its life history that could be taken advantage of for devising control methods. In the case of the Red Hairy caterpillar, the pest rests in the ground as a pupa for nearly 9 or 10 months. When the monsoon rains are received, the pupa transforms into a moth, which pushes its way up to the surface of the ground and flies about. The female moths are able to lay about 1000 eggs each and these hatch in 3 or 4 days into small hairy caterpillars which feed on the crops and grow. When they are full grown they are very voracious and do immense damage

to dry crops. Ultimately they dig their way into the soil and wait till next year's rains In the instance of this pest, hand-picking the moths—absurd as the proposition may sound—has been found extremely efficacious, for, each moth picked out is really equivalent to the destruction of 1000 prospective caterpillars.

In fine, under any circumstances, the ultimate aim of the Economic Entomologist is the furtherance of the prosperity of the farmer. Considering the large amount of loss sustained by the agriculturist owing to the incidence of insect pests, the Entomologist will not only have justified his existence but have earned the confidence and the gratitude of the ryot, in case he could show him how to remedy even a portion of such loss. Before advising remedial measures the Entomologist must first satisfy himself that they are really efficient. His next step should be to see if they are practicable and safe in the hands of the practical farmer; and lastly he must see if they are cheap. It is only when his advisory measures emerge triumphant from all these tests, that he can congratulate himself on being a successful Entomologist.



# A Preliminary note on the Root-gall Nematode *Heterodera radicicola* Muller and its Economic Importance in South India.

P. N. Krishna Ayyar, B.A.,

Among animals other than insects capable of causing losses to the agriculturist, the group of Nematodes or Round Worms is of no mean importance. Besides including numerous forms capable of causing diseases in livestock, the group contains several species known to be seriously destructive to plants of economic importance. Few among them can, however, claim that front rank in notoriety which the Root-knot Eelworm—*Heterodera radicicola* Muller justly occupies by reason firstly of the world-wide distribution it enjoys being present in tropic and temperate climes alike, and secondly, of its cosmopolitan tastes in having one of the widest known range of food plants.

*History of the Disease.* Ever since its discovery in the middle of the 19th century this Eel-worm has been recorded from various countries causing damage to numerous crops. Eminent scientists have made a serious study of this worm with a view to find out possibilities of bringing it under control and the results of their labours have been carefully set forth but it is doubtful if those measures will be applicable in the conditions obtaining in this country. With all its notoriety as a destructive organism and its wide range of distribution it is to be regretted that it has not received the attention it deserves at the hands of the economic biologists of our country. Apart from an investigation of an attack of this worm on Tea by Dr. Barber which was published in the form of a Bulletin in 1905, noting worth nothing seems to have been done in Madras either in regard to observations as to its distribution and damage or measures of control. The question of this rootknot worm was brought to serious prominence recently in connection with its suspected complicity in the reported deterioration of Betel-vine cultivation in the neighbourhood of Coimbatore. This led to a thorough examination of the roots of the Betel vine as also of the roots of other plants found growing in and near the garden. Reports received from other parts of the Presidency as to certain obscure diseases

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noticed on various crops on examination proved in some cases to be due to the attacks of this underground pest. The main purpose of this paper is to draw the attention of the workers in this field to the economic aspect of the problem and the writer lays no claim to any complete investigation as to the lifehistory, economic importance, or control measures of this serious pest. But as its title clearly implies, it is an account of certain observations of interest made in the course of examination of infested plants collected in and around Coimbatore and received from other parts of the Presidency.

*Lines of investigation.* The methods of study adopted for a preliminary enquiry are confined to simple observations of different host plants infested at various stages, the microscopic examination of worms at different degrees of growth and a study of the nature and symptoms of attack of the disease. Inoculations were also made in a few cases in plants grown in sterilized soil in pots for studying its life cycle. The work done is confessedly too insufficient to warrant any attempt at giving a complete account of its lifehistory or measures of control.

*Symptoms of attack.* The symptoms of attack are not always sufficiently well defined or clear to enable one to spot out the affected plants. Apparently in many cases of attack by Eelworms the crop does not seem to have suffered very much in consequence nor does the yield appear to be appreciably diminished which might be one of the reasons why the study of this has not been taken up seriously here. But the decrease in yield and the loss as a result of infestation must in some cases, be really great and may work up to a great percentage. The external signs, if any, are limited to a stunted or dwarfed appearance of plants or the wilting of them to a greater or less extent which very often is attributed to drought. Sometimes the leaves turn slightly yellowish and on the whole present an unhealthy appearance as in certain turmeric plants and the crop may completely fail as was reported in the case of *Coleus parviflorus* (Koorkai-Mal) by the Farm Manager, Tenmalai and the disease in this particular instance was reported to go by a local name Mundringa. In some cases plants in an area may dry up showing a patch of diseased plants as was seen in the case of Daincha in Central Farm Coimbatore. But in most cases no marked colour variation is discernible though a trained eye may detect infested plants in that these show a lighter shade of green than others. On the other hand it is the roots when dug up that show surprising structural changes. It is often found to be marked with enlargements or swellings of curious shapes. These can be easily distinguished from the swellings of bacterial tubercles of leguminous plants. These malformations or



abnormal elevations are in many cases rounded but in bad cases may have their surfaces cracked and grooved. The dimensions of these galls may vary very much from less than 1 inch in diameter to 1 or 1½ inches as have been observed in the case of brinjal roots. In extreme and long standing cases of attack some discolouration is noticeable in that these galls may have dirty black patches of rotten portions. These outgrowths are in fact the galls formed by the presence of this root-gall nematode. A short account of the life history of the pest part of which is based on personal observations, is given here, as it would give a clearer idea of the nature of the pest.

*Lifehistory.* When an ordinary swelling or gall mentioned above is cut across and examined with a lens, one may find a number of the characteristic flask-shaped or pear-shaped structures whitish and glistening. Sometimes if the section cuts through one of these bodies in an advanced state of development a number of eggs of small size (in some of which the young worm can be seen coiled) embedded in a gelatinous mass, some of which just hatched out into small worms may be observed. If one of these curiously shaped bodies is removed from the tissue by the point of a needle and teased under microscope numerous fat globules may be found in case the worm is yet young. The external form and other characters of this female cyst are really interesting.

These female cysts may be found in abundance as already mentioned in any portion of the root gall. When isolated on a slide with a drop of distilled water under a binocular microscope the flask shape with a projecting neck can be easily identified. The projecting neck can be recognised as the head end and the small mouth with the characteristic minute spine or "Spear" can be noted. This mouth spine is very characteristic of all Eelworms that are plant parasites and any form devoid of this may be easily told as not injurious to plants. This spine can be worked backwards and forwards to cut through the tissue of the plant. In the enlarged space the female reproductive organs are seen prominently developed. The ova or eggs develop here and when nature are less than 0,0 mm. approximately in seize and are very numerous. The exact number has not been noted (but is said to vary between three to four hundred). These eggs hatch out into small thread-like worms with a comparatively bluntly pointed head end and narrow tail end roughly about a quarter of a mm in length. The exsertile spine is, if carefully examined, visible even at this stage. These larvae are said to make their way outside or into a fresh portion of the root or root-let with

the help of this mouth spine and the irritation thus caused leads to the formation of a gall. After it has effected a lodging in the tissue it is said to enlarge and form a cyst and both the sexes are alike up to this stage. The male, after this stage, is said to moult inside the cyst and after some transformations issues out in the form of an active Eelworm. In the case of the female the cyst continues to enlarge until it assumes the characteristic flask shape.

*Inoculation.* In order to find out the length of the life cycle and verify other factors in the lifehistory, a series of inoculation experiments was started in 1923 and continued this year also. As eelworms were seen attacking betel vine it was thought convenient to conduct these on betel vines grown in pots. With this object in view on 17-11-23 two pots of betel vine grown in sterilized soil in pots were selected for experiments one of which was inoculated with Heterodera specimens taken out from infected betel vine roots obtained from Singanallur and the other was kept as control. On 29-11-23 another set of two pots with vines was selected. One of these was inoculated with worms from *coleus parviflorus* (Kurkai in Mal.) and the other was kept as control. In all these the inoculations were done as follows. A careful search to see if there were any galls on the roots was made at the outset to assure that the plants experimented upon are uninfested. The worms (young ones just hatched out) were separated in watch glass containing a small quantity of distilled water and introduced on the roots of betel vine after carefully removing the soil. The roots of these plants (inoculated and control) were examined periodically for a period of three months and more and no galls or even traces of Eelworms were found. As no galls could be observed it was concluded that inoculations were unsuccessful and a further fresh set of experiments was started. On 15-4-1924 two young betel vines grown in wooden boxes (one side of which was covered with glass) were selected for inoculations. One of these was inoculated with Eelworms taken out from cauliflower and the other was kept as control. The inoculations here were conducted in a slightly different way. The worms were isolated in all stages from cauliflower in a watch glass having a little distilled water. These were carefully introduced onto the roots as also a bit of infested root of cauliflower. These were examined only on 16th June 1924 and showed plenty of nodules of root galls (only the inoculated one) (size 1 mm to 5 mm) especially on tender portions of roots. When teased under microscope plenty of female cyst were found. As the plant was not examined earlier the conclusion as regards length of life cycle is very indefinite. But two things are obvious from these that the lifecycle of thisworm is less than two months (15th March 1924 to 16th June 1924) and that cauliflower worms could be successfully bred on betel vine.



*Distribution and Host plants.* The hordes of insects injurious to vegetation can be easily seen along with the havoc wrought on it, but the tiny microscopic eelworms that inhabit the subterranean portions of plants are difficult to be demonstrated as destructive to valuable crops. It is the vegetable gardens as will be seen from a list of plants affected that suffer most on account of this pest. Broadly speaking its distribution can be said to be world wide. But here from its occurrence in various places in the presidency such as Tenmalai, Travancore, Salem, Coimbatore, Taliparamba (Malabar) Erode etc., it can safely be inferred that the worm is fairly well distributed in the southern part of the presidency. Many are the plants that are susceptible to the attack of this worm and the following are a few that have been noted to be badly infested in S. India.

| *Scientific name.* | *Popular name.* | *Locality.* | *Collector.* |
|---|---|---|---|
| Solanum melongena. | Egg plant (Brinjal) | Coimbatore. | P. N. K. |
| Lycopersicum esculentum. | Tomato. | Coimbatore. | ,, |
| Capsicum annum. | Chillies. | Coimbatore. | C. K. S. |
| Nicotiana Tabacum. | Tobacco. | ... | P. N. K. |
| Canna indica. | Indian shot. | ... | ,, |
| Curcuma longa. | Turmeric. | Salem & Erode. | R. N. |
| Brassica oleracea (var) | Cauliflower. | Coimbatore. | P. N. K. |
| Brassica oleracea | Cabbage. | ... | ,, |
| Brassica oleracea | Knol Kohl. | ... | ,, |
| Apium graveolens | Celery. | ... | ,, |
| Daucus carota. | Carrot. | ... | ,, |
| Beta vulgaris. | Beet. | ... | ,, |
| Piper betle. | Betel vine | ... | Y. R. Rao. |
| Piper nigrum. | Pepper vine. | Taliparamba. (Malabar) | ,, |
| Sesbania grandiflora | Agathi. | Coimbatore. | P. N. K. |
| Sesbania aegyptiaca. | Daincha. | ... | C. S. K. |
| Hibiscus esculentus. | Okra. (Bendai) | Tenmalai. (Travancore.) | F. M. |
| | | Hagari Bellary Dt. | Y.R. Rao. |
| Hibiscus cannabinus. | Gogu. | Madras. | ,, |
| Coleus parviflorus. | Kurkai (Mal) | Tenmalai. | F. M. |
| Dioscorea. | ——— | do. | ,, |
| Cucumis sativus. | Cucumber. | do. | ,, |
| Camellia Thea. | Tea. | Devala. | C. A. Barber. |

*Possible control measures.* It is evident from the endoparasitic nature of the pest that no cut and dried measure for combating the pest can be laid down. The difficulty is felt all the greater since no

control methods have been experimented upon here. But the following measures tried elsewhere may suggest the lines on which its control may be based. In the case of a bad infestation all plants may be dug up and destroyed by burning and the land kept free of all vegetation for one or two years. They may probably reduce the degree of infestation when cultivated next. On a field such an application of chemicals cannot be recommended though many insecticides such as carbon-bi-sulphide, Formalin solutions or Sodium cyanide dissolved in water have been suggested. The ideal procedure as every one would admit is to produce non-susceptible or resistant strains of plants. Rotation of crops and clean cultivation need no special mention as they are but too often over emphasised. If one method above all should be tried on a field scale it is that of growing trap crops (as suggested by the German Scientist Kuehn). The method is to trap the worms by growing by the side of an infested valuable crop or in the infested soil before the crop is grown, some very susceptible plants and destroying them in time before the worms leave the trap crop. If necessary the process of growing trap crops may be repeated so as to ensure satisfaction. For Heterodera it has been noted that cruciferous crops are more susceptible and as such these can be tried as trap crops. For this purpose a correct determination of the length of the life cycle of the worm is quite essential and the catch plants should be pulled out and destroyed before the worms inhabiting the roots show a tendency to leave the roots.

In conclusion it may be stated that further investigation for finding out the exact duration of its life cycle and experiments in regard to its control by means of trap crops are proposed to be conducted side by side with the search for host plants to note the range and extent of its distribution. This opportunity is taken to acknowledge my indebtedness to M. R. Ry., Rao Sahib Y. Ramachandra Rao, M A., F.E.S., Ag., Government Entomologist for the encouragement given in the pursuit of this problem.

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## New Names for Old Plants.

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*(Continued from page 283 of Vol. X. 9. 1922).*

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P. S. JIVANNA RAO.

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Since the note on the above subject was published in the 1922 olume of this Journal part V of the Madras Flora appeared in 1923, art VI in 1924 and part VII soon after the death of the author last ear. It may be estimated that a third of the Flora still remains o be written and the work, we understand, has been entrusted to Mr. C. E. C. Fischer a retired Conservator of Forests of Madras and ometime Principal of the Forest College at Coimbatore who has nade notable contributions to Systematic Botany.

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| Old Name. | New Name. | Natural Order. | Common Name. | Remarks. |
|---|---|---|---|---|
| Vinca rosea | Lochnera rosea | Aprocynaceae | Periwinkle, Sudukattumalli | Ornamental plant. |
| Vinca pusilla | Lochnera pusilla | Do. | | |
| Tabernaemontana coronaria | Ervatamia coronaria | Do. | Milagaipundu<br>Nandiavattai | Weed.<br>Garden shrub. |
| Daemia extensa | Pergularia extensa | Asclepiadaceae | Veliparutti | In bushes, medicinal. |
| Pergularia minor | Telosma minor | Do. | Kodisampangi | Sweet-scented flowers. |
| Boucerosia umbellata | Caralluma umbellata | Do. | | Fleshy xerophyte. |
| Cordia Myxa | Cordia obliqua | Boraginaceae | Vidi | Tree. |
| Ipomaea reniformis | Merremia emarginata | Convolvulaceae | Elikkathukirai | Creeping, rooting herb, weed. |
| Herpestis Monnieria | Moniera cuneifolia | Scrophulariaceae | | Succulent creeping herb in wet situations. |
| Tecoma stans | Stenolobium stands | Bignoniaceae | Trumpet flower | Large shrub, common puja flower. |
| Hygrophila spinosa | Asteracantha longifolia | Acanthaceae | Nirmulli | Weed in paddy fields. |
| Lantana Camara | Lantana aculeata | Verbenaceae | Unni | Pest in special areas (Coorg). |
| Aeruva javanica | Aerva tomentosa | Amarantaceae | | In dry waste lands. |
| Gyrocarpus Jacquini | Gyrocarpus americanus | Hernandiaceae (formerly Combretaceae) | | Winged fruits. |
| Phyllanthus emblica | Emblica officinalis | Euphorbiaceae | Nelli | Tree Indian Myrobolans. |
| Chrozophora plicata | Chrozhophora rottlerii | Do. | | Weed in black-cotton soil and paddy lands. |

## EXTRACTS.

### Lord Irwin and the Royal Agricultural Commission.

[His Excellency Lord Irwin made the following reference to the Royal commission on Agriculture in India in his reply on April 3rd to the address presented by the Bombay Chamber of Commerce on his assumption of the office of Viceroy].

"Gentlemen—Lady Irwin and I thank you warmly for the welcome you have extended to us in the name of the Bombay Chamber of Commerce. I am grateful for your reference to the family connection which I may claim to have with India through my grandfather, and to my own public work in England. I trust that my past association with several departments of the Government at Home and with the different parts of the Empire as Under Secretary of State for the Colonies, may assist me in the duties which I am about to undertake in India.

"*No Royal Road to improvement.*" "You have, gentlemen, in your address, touched upon one matter, in which I, though new to India, take the deepest interest. This is the appointment of a Royal Commission on Agriculture, of which I note, with satisfaction, your approval. By instinct and upbringing, I am a countryman, and, as a former Minister of Agriculture in England, I have been brought into close contact with its administrative problems. I am therefore able to appreciate, at their full worth, the wisdom and statesmanship of Lord Reading at whose instance this commission was set up; for, in a country where agriculture is the principal industry, there can be no higher object than to increase the prosperity of the cultivators who form the overwhelming majority of the population. Experience, however, elsewhere, has taught me that there is no royal road or short cut to agricultural improvement. Nature moves at her own pace, and to deal even with a single crop demands years of patient labour; and the necessary processes of research, experiment, demonstration and seed distribution, cannot be hurried. But agricultural progress is not only a question of plant or stock improvement. It depends upon the solution of a host of allied problems of which education and co-operative credit are only two of the most important.

"*Past Achievements.* In all this vast field, nothing has impressed me more than the results already achieved by your agricultural workers. I have only recently become acquainted with their work; and I find that since the agricultural departments, in the modern sense, were created 20 years ago by Lord Curzon, important results have

been achieved in the case of certain groups such as wheat, sugarcane, and cotton to which you especially refer, and in jute-results which have led to a wide increase in the country's wealth. But where much has been done, much yet remains to do and it will, I persume, be the duty of the Commission to review the existing conditions and to examine how best the discoveries of modern science and modern administrative methods can be harnessed to agricultural needs. They will no doubt consider, among other matters, the most effective organisation of research work, the best means of ensuring a supply of trained workers in the laboratory and the field, and of bringing home to cultivators fully proved results, the maintenance of the purity of the selected seed and its distribution, as well as the vital question of the provision of adequate funds.

*Work before the Royal Commission.* "While advising measures to secure the greatest co-ordination of effort between the Governments in India, it will be their (the Agricultural Commission's) duty to keep steadily in view the preservation of the newly gained independence of the provinces in the branch of public administration. Their task therefore is difficult, but they will be supported by the good-will of all who recognise that if the commission can point the way to a wider application of the modern methods to agriculture, the benefits will not be confined to those who till the soil but must lead to a general increase of national prosperity. Their recommendations will be made during my time in India and I shall count myself fortunate if I can assist in the progressive amelioration of the conditions of the rural population.

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## A Parliament of Agriculture.

### *Its importance to India.*

The Royal Commission on Agriculture in India will find much of interest in the proceedings of the General Assembly of the International Institute of Agriculture recently held in Rome and will, no doubt, examine, the relation of India to that body. The Institute was founded in '05 on the initiative of David Lubin, an American citizen and of the King of Italy. A Convention for its formation was signed by 40 governments, and 71 countries, representing 95 per cent. of the world's population, are now adherent. The Institute is housed in a large office situated in the most beautiful garden in Rome. It is governed by a committee of permanent representatives of all countries which wish to make such appointments but India having made no separate nomination, the British delegate has hitherto acted on her behalf. A general assembly is held at intervals of two years, in which the work of the four departments of the institute is reviewed, and the



policy which is to guide the committee is laid down. These departments deal with (1) financial questions; (2) agricultural statistics; (3) agricultural science; (4) co-operation and other social and economic matters concerning the rural classes; and each of these branches issues, in English and other languages, a periodical review in addition to occasional monographs on subjects of importance. It was also intended to formulate and submit from time to time to the governments of the affiliated countries definite proposals tending to agricultural progress but no steps in this direction have hitherto been taken.

*A World Census.* It has much to gain from the activities of the Institute, though its publications are suited only to the study of educated men, the material thus collected enables them to pass on to the less educated cultivator such information as is appropriate to his business. The principal object of the founders was to defeat speculation and prevent corners in agricultural produce by publishing the figures of available stocks and the forecast of standing crops; this duty is still performed and Indian growers and merchants who examine the figures and notes published in this country can form an opinion as to the probable tendency of world prices. The statistical department is projecting an Agricultural World Census in 1930-1931, for which a list of questions will in most cases be given from records already collected by Government and it will not ordinarily be necessary to subject individuals to detailed inquiries. The principal support for the scheme is found in the United States of America, and the Rockfeller foundation in that country is defraying a large share of the expense caused to the institute by the preliminary work of the census. The hope of exact returns from certain countries is likely to be disappointed, yet a collection of data as to agricultural wealth and production throughout the world will be valuable both to Indian producers and to political students.

*Council of Experts.* The aim of the Institute is to centre in itself or to co-ordinate the activities of all international bodies and conferences dealing with agricultural matters. The recent Assembly consequently approved the creation of an International Scientific Council of experts, which will be convoked, or consulted by correspondence, as occasion arises. The appointments, provisionally made to this Council have yet to be submitted to the approval of the various Governments, but the Assembly undertook that India and other non-European countries should receive due representation. A similar though less technical committee has been set up, consisting of the nominees of national agricultural associations, in order to keep the Institute in touch with non-official agriculturists throughout the world.

India unfortunately has no such association at present extending over all provinces and it will be interesting to observe whether the Royal Commission offers any suggestion for filling the void as the Indian Board of Agriculture is primarily an official institution, and is fully occupied with its existing duties as such.

It can hardly be doubted that if the Institute at Rome had not been in existence before the War, an Agricultural Office corresponding to the International Labour Office, would have been created at Geneva by the League of Nations. The Treaty of Versailles, however specified the Institute as an organisation which the League did not wish to absorb, and close collaboration is now maintained between the Labour Office and the older Roman body.

Technical and scientific questions were also debated in the General Assembly. A demand was made for the institution in every country of a department of Agricultural Meteorology, which will examine the influence of weather conditions (other than the monsoon) on crops and outturn ; also for the carrying out of comparative experiments in the value of these proposals was urged the expense of the staff and apparatus required, while the second involves a comparison of results which, being attained under the dissimilar conditions of remote countries, have little validity outside a limited area. International Conventions for the control of locust hordes and for the suppression of plant diseases were further drafted ; but again, the action suggested would lead to expenditure which the financial position of India would, perhaps, not justify.

*India's Position* :—On behalf of the economic section of the Institute a project was approved for an inquiry into the trade in agricultural products, and another for an inquiry into the economic conditions of the agriculturist. The former scheme has not yet been framed in a clear form, while India has not the machinery for the latter, unless or until the recommendations made by the Economic Inquiry Committee in 1925 are accepted.

The Indian point of view, and the claim for closer attention to the agriculture of tropical and sub-tropical lands, was repeatedly urged by the representatives of India in the General Assembly. It has now been resolved to form a separate "Tropical Deparment" of the Institute for the study of this branch of knowledge, and the Assembly assigned to it such funds as its budget allows. There is reason to hope that better justice will hereafter be done to non-European interests, but no great progress can be made while the funds at the disposal of the organisation remain inadequate.



The crux of the situation lies in finance. The Convention under which the Institute was founded established five classes of subscribers, the number of votes which each country casts being dependent on the amount of its subscription. India, which pays eight times the minimum amount, has four votes in the second class ; the minimum being fixed at 2,500 gold francs, her maximum is 20,300 gold francs or about Rs. 10,800. On this basis the total income of the Institute in 1927 and 1928 will not exceed Rs. 5¾ lakhs at present rates of exchange, as compared with Rs. 7 lakhs before the war the difference being due to the fall in the value of various European currencies. Meanwhile, the cosf of living in Italy has risen sevenfold, and the means of the Institute are, therefore, entirely unequal to its requirements. In particular the staff of translators and technical experts, which under the Convention is to be international.ti.e., recruited from all the affiliated nations, is inevitably becoming Italian, since no resident of another country can afford to live in Rome on the pay now offered. The General Secretary of this great organisation, for instance, should be a man of wide knowledge, standing in the front rank of civil administrators. But his salary is no more than Rs. 550 per mensem ! Every credit is due to the present Secretary and his subordinates for their loyal service in return for a payment which may be described as ludicrous, but it is not possible to rely on securing a succession of such individuals, nor is it just or prudent to underpay competent employees. The income of the Institute must be increased, and the Assembly having recognised this imperative need, the Italian Government is addressing the other adherent powers with a view to amending the Convention and raising to 4,000 gold francs the minimum unit of subscription. The possible income of the Institute will thus be raised to Rs. 9½ lakhs, and the maximum subscription which may be demanded from India will be about Rs. 17,000 as compared with Rs. 10,800. If the proposed amendment is accepted by the Government's signatory of the convention, the funds of this great international organisation will still be markedly lower than its importance justifies and its opportunities demand, but it will at least be in a somewhat stronger position for serving the civilised world in a more efficient manner than at present, closer attention can be given by the new Tropical Department to Indtan and tropical agriculture both by means of research and in its publications, and it may even undertake the task, specified in its constitution, of initiating proposals for the improvement of the position of agriculturists and become a true World Parliament of Agriculture.

*[The Pioneer, 24th June.]*

## The Preservation of Straw for Fodder.

Straw was formerly regarded merely as a subsidiary article of food for animals and was administered to them only in admixture with fodder of high nutritive value. Horses in Europe, for example, were not given pure oats but a mixture of oats and finely cut-up straw. During the war, however, it was found necessary to make exact researches as to the nutritive value of straw, and it was found that it contained very considerable quantities of albumen etc., but that these food substances are assimilated by the animal stomach only to a very small extent, because they lie deeply embedded within the straw cellulose. The greater portion of the nutritive substances, therefore leave the body of the animal in an undigested condition.

It was accordingly proposed to facilitate the work of digestion for the animal stomach by subjecting the straw to a preparatory chemical treatment. The straw was, for example, cooked with soda, caustic soda or other similar chemical substances, then washed and dried. On feeding animals with the straw thus treated it was found that whereas they had formerly assimilated 20 per cent of the nutritive substances in ordinary straw, they now assimilated nearly 80 per cent, that is, more than twice as much. Straw has, therefore, now acquired as important character as fodder, especially as it has the further advantage of being stored for almost indefinite periods of time.

Such methods of chemical treatment as those just referred to are however of hardly any value to India, as they entail extensive apparatus, especially for the process of washing and filtration. The necessary chemicals too would be far too expensive. But there are other methods of dealing with the straw, that are better adapted to the conditions of the country. The raw materials necessary for the purpose are present in the shape of the sugarcontaining fruit juices obtainable from the vast quantities of sweet fruit that would otherwise be wasted.

If such fruit be treated in vats or water-tight pits with a layer of slaked lime, the calcium oxide of the latter enters into chemical combination with the sugar of the fruit. The clear solution containing this chemical compound is then allowed to be absorbed by the straw and to evaporate slowly. The sugar-lime opens up the straw cellulose in the same manner as soda and has the additioaal advantage of not requiring any cooking process. What is even more important is that the straw does not need to be washed. Its nutritive value is now very considerably enhanced by the sugar contents and it is readily



eaten and easily digested by animals. The straw can, of course be often dried in a solution of sugar-lime, until it is practically saturated with the latter. If it is treated in long, uncut stalks, it is easier to dry and make up into bundles, in which form it is also easier to transport. Such bundles can be stacked in places sheltered from the rain and be stored for years as reserve fodder. In Germany the chemically treated straw is finely cut-up and pressed together into dry cakes. Fodder can be prepared for export in this manner, but machinery is necessary for the purpose.

The utility of the above simple method of procedure consists in the fact that the peasants of even the remotest villages can turn the fruit juices and the straw to good account for the creation of new values, no machinery or apparatus being needed. In the neighbourhood of the cities, where it is essential to maintain considerable stocks of cattle owing to the large consumption of milk and meat the economic importance of the prepared straw is obvious, especially owing to the distance of grazing grounds. As, too, there is a very large consumption of fruit, there is also aconsiderable amount of waste which can be profitably employed for preparing straw for fodder. The enormous value of the reserves of such fooder in flooded areas will also be readily appreciated.

(The Industrial and Trade Review for India. Berlin Feb. 1925).

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## Cotton.

HERBERT J. SPINDEN.

When a famous English novelist wrote a history of the world in two heavy but refreshing tomes, he devoted about 8 pages to the contributions which America before Columbus made to the world after Columbus. In this cramped space he could not explain how modern industrial England owes more to American Indian Cotton than to any other material factor. Nor did he explain that the white harvest of poor London scattered values and utilities among all the nations of the earth,

It is not part of our emotional complex to feel a twinge of gratitude for the plants that feed and clothe us. In keeping with artistic rather than practical judgments on civilization, we find sentiments enough about the climbing rose, which embodies the philosophy of ideal beauty, but where is our poet who can muster the drumming thunder of a thousand mills and sing the song of Cotton?

Cotton as a wild plant was blown round the world, and species are found on desert islands like the Galapagos. Two kinds were domesticated in India, one a tree cotton and one a small herb, alternating with wheat to complete the agricultural year of the Hindus. Both of these cottons had very short fibres, which could not be spun by hand. Mention of cotton in the old world is found as early as 7th century B.C. but the first archaeological examples are from well within Christian times.

In America two, or perhaps three, basic species of cotton were developed into a great many varieties, and were bred to yield fibre three or four times as long as the cotton plants in British India. Cotton fabrics are found in the south-west among remains of the pre-cliff dwellers. Columbus was the son of a weaver and was familiar with the scraggy cotton that the Arabs brought to Spain. His first day ashore in the Bahamas was spent in trading red caps and glass beads for cotton thread in balls.

Thus was begun the commerce of cotton between Europe and America, which reached its peak in 1911 when about 11,000,000 bales of 500 lbs. each crossed the Atlantic from the United States, and half as much stayed at home. Now it is true that the sentimental associations of the Europeans are with Asiaic cotton. Calico is from Calicut, where Vasco de Gama landed in india ; muslin is from Mosul, across the river from the place where Sennacherib cultivated tree wool in his hanging gardens. Neverthless, it is the cotton of the Mexicans. the Peruvians. and the Arawaks that rules the world today.

From the tribute roll of Montezuma, it appears that 234.800 porters" loads of woven cotton and 4,400 bales of raw cotton were delivered yearly by conquered Indians as tribute to the Aztees. This amounts to about 35-000.000 dollars in present values. The first Spanish Governor of Yucatan writes, in 1561, that the Mayas of the northern parts of the Peninsula were then paying in tribute 1,280,000 yards of woven cotton. Indeed, cotton was an imported item of Spanish commerce till disease and slavery had tremendously reduced population in Mexico and Peru.

Cotton weaving in England had small beginnings, the raw material being secured in the eastern Mediterranean islands and in Asia Minor. Then the British East India Company brought in Hindu textiles and created a London vogue. In 1692 John Barkstead called attention to the extraordinarily fine fibre to be secured at the British plantations in the West Indies. When by a series of fine inventions, beginning with John Kaye's thrown shuttle, looms, and spinning



frames were improved and put under mechanical power, it was the longer staple of America that made the venture a success. In 1794 to 1798, when the industrial development in spinning and weaving was in its infancy, England's cotton imports show 45,000 bales from America and 11,000 bales from the old world.

Then followed the introduction of American cottons into India and finally into Egypt. It is very clear that the industrialization of cotton in English factories was the first move in our present mechanical age, and as seen above, it was the old civilisations of America that furnished the necessary product. But it is perhaps worthy of note that the art of weaving had been carried very far in America, the fibres being cotton, henequen, the wool of the ilama, alpaca, vicuna, and other allied animals.

Ancient Peru shows more varieties of weaving than any other place in the world, and they are of a degree of fineness untouched on the more celebrated looms of Asia or Europe. Wool weft on cotton warp, in tapestry technique, has been found with 320 or more picks to a square inch. Various finishing processes were developed, such as the dyeing and hand painting, but for the most part designs were mechanically involved in the weaving itself. Among the beautiful colors of the new world were cochineal, anil, or indigo, fustic, and various other logwood stains.

(The Queensland Agricultural Journal, April, 1926.)

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## Caponizing.

P. RUMBALL, POULTRY INSTRUCTOR,

The question whether caponizing is profitable or otherwise is best left to the individual producer to decide, as the features governing the commercial side of the proposition, that is the cost of feeding and ultimate sale. are of a varying nature.

The capon. however. has advantage over the uncaponized bird in weight, quality of flesh, cost of maintenance, etc. The opinion frequently expressed that capons grow to a greater size than cockerels is wrong. When the reproductive organs are removed cockerels lose any fighting instinct and lead a lazy inactive life, thereby putting on more weight or flesh but not size. It is possible also to retain capons until they are fully developed and to market them as desired. This

is not so with cockerels, as they become troublesome and lose the quality of flesh. The inactive life a capon leads, naturally reduces food consumption, and so they are kept at greatly reduced costs, which materially assist a producer catering for a regular supply of poultry. To the mixed farmer, however capons should appeal most, inasmuch as they can be allowed to range with the farm flock. There is no necessity of segregating sex, and by being sterile the egg product is in no way injured.

*Appearance of a Capon.* The comb and wattles of a capon do not develop and the head remains small and colorless having the appearance of unhealthiness. The pointed feathers of the neck and those in front of the tail and large sickle tail feathers grow profusely, and in countries where capons are recognised in their true value as table-birds these feathers are left on the bird in dressing and serve as a trade-mark.

*Marketing.* At present the caponiser should cater for regular customers but if his supply is greater than demand, the marketing of the surplus should take place when young birds of quality are scarce, which happens annually from March until early cockerels are on the market—say September. Cockerels of any breed may be caponized, but breeds of the light or small varieties, such as Leghorns, are not so suitable as the larger varieties, such as Orpingtons, etc., although in this article, Leghorns have been used for illustration purposes:

The age at which the operation is to be performed naturally varies with development of various breeds but generally speaking the correct period is between 8 and 12 weeks when the chickens are about 2 lbs. in weight. The next point which the caponiser must keep in mind is light. A good light is essential, especially to the inexperienced operator. With practice he can operate under indifferent conditions, but for start the positions of various organs must be thoroughly understood. The third requirement is to refrain from feeding and watering the bird for at least 24 hours—36 would be better. Under such circumstances the intestines become empty and will of their own account fall away from the side where the incision is made and as well as lessening the chance of injury, permit of the reproductive organs being seen much easier.

*The Operation.* In addition to knife, spreader, probe and forceps, a table and two pieces of soft cord with a running nose at one end and two half bricks attached to the other, with a basin containing a weak antiseptic solution are necessary. The table may be an old packing case or barrel or the operator may prefer to make a more



elaborate and possibly convenient bench. The bird is fastened down by means of the cord and bricks, one noose being placed around its legs, and the other around its wings, close to the body, and the bricks allowed to hang down on either side.

The next move is to pluck a few feathers off the seat of operation which is just in front of the hip joint. In a bird of the correct age very few feathers will need removing and those that are lying in the way can easily be held aside by damping them with the antiseptic solution which should always be used to cleanse the position to be operated on. The clear space obtained by doing this is shown in Fig. Having done this the correct position to make the incision must be ascertained. This is best done by placing the thumb on the hip-joint gradually moving the forefinger along the body until the last rib is felt. It is between the two last ribs that the incision has to be made but before doing that draw the skin as far back as possible with the forefinger so that when the operation is completed and the skin goes back to its natural position the wound in the skin and the abdominal cavity are not directly opposite. Having made the cut insert the spreaders, enlarge opening to about 1½ inches and gently spread the ribs. When this is completed a thin membrane will be noticed covering the intestines. This has to be removed which is done by means of the probe, before the testicle can be seen. The testicle is easily noticed if the bird had been properly starved. It is yellowish-white in color, runs parallel with the backbone and in birds of correct age three quarters of an inch long and little thicker than a plump grain of wheat. With the forceps take hold of the testicle, being careful not to grasp the large artery which runs parallel with and close to it. Withdraw the instrument with testicle attached with a twisting motion and after appendages have been twisted up and pulled out, cut them about one and a half to two inches from testicle to make certain that no portion of the organ remains. When the operation is completed on one side turn the bird and repeat the process. Some operate from the one side only, but this method carries more risk and saving in time is doubtful. The operation does not appear to cause the bird much distress. In about a week it is a very difficult matter to find where the incision was made—a few wind puffs are occasionally met with, but they merely need to be pricked.

After the operation of caponizing turn the bird loose. If the operation had been correctly performed the skin covers the wound and no dressing of any description is required. It is as well, however, to keep the capons in clean quarters and away from untreated birds for a few days, but beyond this other treatment is unnecessary.

(From Queensland Agricultural Journal, April, 1926.)

## Recognised "Vitamines."

"Vitamines" are now recognised : (1) Fat soluble A vitamine, which is present in animal and fish oils and green feeding stuffs. It is essential to growth, is heat stable, and appears to be necessary for the growth of all animals, although evidence shows that fowls require a very small amount of this vitamine for normal growth. (2) Water Soluble B vitamine (antineuritic), the absence of which causes a form of neuritis with paralysis. It is present in cereal grains, and birds are particularly sensitive to its absence from a diet. (3) Water soluble C vitamine (antiscorbutic) is easily dsstroyed by heat, and its absence from a diet gives rise to scurvy. Man and the guinea pig are peculiarly susceptible to the absence of this vitamine. whereas birds appear to be able to dispense with vitamine C altogether. (4) Fat Foluble D vitamine (antirachitic) was formerly grouped with Fat soluble A. Its absence from a diet gives rise to rachitic symptoms. By suitable exposure to ultra-violet light, the onset of rickets in an animal fed on a diet deficient in fat soluble D vitamine may be delayed or even prevented. (5) Vitamine E has been described by Evans and Bishop, who showed that absence of this vitamine from a diet led to sterility. This vitamine is heat resistant, and is present in wheat germ oil. It is present in oats, maize. lettuce, lucerne, and in small amounts in animal tissues. In the male, absence of this vitamine from a diet gives rise to degeneration of the testes, and in the female temporary sterility occurs which lasts as long as the diet remains deficient in this vitamine.

(The Journal of the Ministry of Agriculture, Vol. XXXIII, May, 1926.)

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## Rural Developments.

SIR REGINALD H. CRADDOCK, G.C.I.E., K.C.S.I.

In some quarters it is the fashion to write as if the Indian Government had up to the present been entirely oblivious of its responsibilites to the rural population, and that it lay upon Indian Ministers to repair past neglects, and to devise and carry out policies to transform the Indian plains into great granaries, and to convert poverty-stricken and ignorant cultivators, with only a rudimentary knowledge of agriculture into prosperous and scientific farmers. Such a view ignores entirely the labours of several generations of revenue and settlement officers, the remarkable results already achieved by the agricultural departments, the entire machinery of co-operative credit, the activities of the veterinary officers, and the wonderful effects upon India's prosperity of the great irrigation works and railways. There



is indeed little that a Royal Commission can find out that the Government does not know already, or cannot collate from the abundant material available in the settlement and revenue reports and the recommendations of numerous committees and conferences held annually or from time to time. In fact, for years past the Government has been much more active and much better equipped with reference to rural economy than to urban and industrial problems, witness the remarkable success of its efforts in coping with successive famines.

*The ryot is no fool.* Anyone who has been in close contact with Indian agricultural problems for a great many years knows that the progress made has been on sound lines and that if these lines are steadfastly pursued this progress will be accelerated and greatly extended. The Indian ryot is no fool, he has long-inherited experience, and though if left alone he is very conservative yet once let him be convinced that a particular crop or a particular method is within his means, and is going to pay him, he will adopt it. But he has no use for an itinerant lecturer with a science degree who merely lectures and passes on. Long before scientific agriculture was heard of in India particular improvements and more advanced practices came into use. The ryot must know that you know all that he can teach you before he will begin to learn from you. The way to convince the Indian ryot is not by publishing the results obtained on some distant farm, but by demonstration *in situ*.

*Practical Demonstration Essential.* The scientific agriculturist must first experiment on a central experimental farm, which is typical of a tract ; he must not be in any hurry to demonstrate until he has satisfied himself over a series of years that the seed and the method tested is really a success. The premature demonstration on the village lands that fails puts back the improvement many years. But if the scientific agriculturist is patient and the demonstration *in situ* succeeds he may be perfectly assured that one after another the neighbours of a demonstration plot will imitate and adopt his methods. It is thus by the establishment of central farms on which experiments can first be proved, and by the subsequent multiplication of demonstration plots, that knowledge can be diffused. But success is only obtained if there are in the agricultural department earnest practical men, who add to their theoretical knowledge experience of the locality and of the mentality of the cultivators. When a man like this wins the confidence of the cultivator he will be looked up to, consulted and his advice followed. It is by these methods that the agricultural department has won success in provinces where they have been adopted.

*Tillers of Soil Must Prosper.* But this is still only half the battle and if it is to be won, there are other obstacles to be overcome before success can be widely diffused. The great desideratum is to keep the actual tiller of the soil prosperous and contented. This is a more baffling problem than the mere instruction to him of more profitable agricultural methods. A man must not only be taught, but he must have the incentive and the means to apply what he learns. To have the incentive, he must enjoy security of tenure, and to have the means he must command cheap credit. The first of these essentials is dependent upon the enactment and enforcement of tenancy laws ; the second upon the organization of co-operative credits. But the first also reacts on the second ; for a man with security of tenure can command better credit than the man who has no security to offer, except that one of uncertain harvest.

*No use helping the Wrong Man.* The Government has done a great deal to protect the cultivator much more in some parts of India than in others, but its intention and its laws are constantly frustrated because the protection reaches the wrong person. In the Zemindari provinces it has secured the landlords, but in many of them the tenant has not got adequate protection, while in the ryotwari provinces the protected ryot has often become a landlord and a middleman and the tenant beneath him—the actual cultivator—is impoverished and rack-rented. In the Punjab cultivated by large bodies of small landowners and in the Central Provinces, Bengal, and Bihar the protection is very partial while in Madras, Bombay and Burma, whereever the ryot has taken to letting his land, instead of cultivating it himself, the protection has shifted from the actual cultivator to the middleman. This is the great problem, and it is the one on which it is probable that the verdict of a Royal Commission might carry weight. On the other problem-that of cheap credit-usury laws can seldom escape successful evasion, and co-operative credit is the one remedy that promises most success. It seems unlikely that a Royal Commission, could suggest a better, but there can, in view of the magnitude of the problem be no objective to their trying to find one.

*Advantage of small holdings.* Great stress is sometimes laid upon the ill effects of minute sub-division of holdings, but this is an evil for which a violent remedy would probably be worse than the disease. The most productive and intensively cultivated areas are those in which population presses on the land ; give a man a large area and a low rental and he becomes prone to sub-letting, or else he cultivates in slothful fashion. Any interference with the age-long joint family system in favour of primogeniture would arouse the most violent opposition. The sub-division of lands corrects itself for the superfluous



members drop out and seek their livelihood elsewhere, or the land passes again, owing to debt into the hands of a single holder. No legislation and no Royal Commission can keep the thriftless, shiftless, unwilling or unindustrious cultivator upon the land, and in spite of trials and vicissitudes, a substantial proportion of Indian cultivators are hard-working, contented and reasonably prosperous. But that fact need not, and should not cause us to relax our efforts to make the proportion larger and the degree of prosperity greater. There is enormous scope for improvement.

*Not many over Assessments.* There are two matters, on which it is only possible to touch briefly : (1) the effect of land-revenue, (2) agricultural education.

Time was, no doubt, when whole tracts of country were over assessed. This with successive settlements and accumulated experience has passed away. The only places which might be over-assessed now are stray villages in which deterioration due to special local causes has escaped notice and relief. Otherwise, over the country at large, the revenue is so light that the revenue payer can always obtain rents so high in proportion to the Government assessments that middlemen are created and rack-rented subtenants come into existence. No commission will now-a-days be able to impeach either the moderation of the land-revenue demand or the consideration with which it is collected.

*Adult Education wanted.* As to agricultural education it is useless to multiply science students with an urban up-bringing. Nor is it within practical politics to make millions of ryots scientific farmers with English education. A nucleus of well-equipped colleges to provide teachers and demonstrators is of course necessary but 90 per cent of the students in agricultural colleges and demonstrators are not prone to practise the profession of farming. Moreover agriculture is a department in which it pays better to instruct adults than children or adolescents ; for whereas the youth will not be able to teach the elders, and will not be an elder himself until he has forgotten his school and college course, any practical instruction that the adult absorbs he will most certainly impart to his children. A shrewd cultivator will learn much more from demonstration plots and farms than he will acquire if he is taken to agricultural college where he learns to prefer urban life to rural, and salaries to farming profits. The training of farm labourers at the farms is also very valuable.

*Co-operation Essential.* The greatest results [illegible] by the co-operation and co-ordination of [illegible]

Social intercourse among the rural people should be promoted. Social intercourse begets friendship and understanding, and understanding begets co-operation. There should be a room in the village school for social purposes. The village school can be used as a health centre. Health work in the villages should be carried on in connection with the village school. A small cabinet containing first aid remedies in the school building would be very handy for cases not needing expert medical treatment.

We are spending much of the government income for the aggrandizement of the city institutions. We are making city conditions very inviting to the rural people. The flow of the rural population to the cities should be curtailed. Improvement of rural conditions and spirit will tend to dam the flow. The improvement of the village school in physical plant, equipment, and personnel should take precedence over all projects of the Government in the rural districts.

The taxes that come from the rural districts should be spent for the improvement of rural conditions. A law so providing would be a blessing to the country. The insular aid to the academic high schools-most of it—should be shifted to the schools in the rural districts. Part of the municipal income for general and school purposes should also be set aside for the improvement of rural conditions.

The expenditure of more money of the government in the rural district will be conducive to symmetrical and well balanced development of the country, educationally, socially, and economically. We need it to stabilize conditions, political and economic. How many times the countries of Europe have been saved from political chaos and economic crisis by the rural class! We must develop a rural class to produce our food and to produce the raw materials for industry and manufacture. The development can be most advantageously made by means of the village school or consolidated school or any kind of school in the rural district. We cannot develop a rural class in the city. The rural atmosphere is not there. The rural problem must be attacked first and foremost in the rural districts.

(From the Philippine Agriculturist, Vol. XIV, No. 10, March, 1926.)

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## A Labour view of agriculture.

Mr. F. Montague. Labour M. P. :—said "to start a socialist state in this country while dependent on a foreign food supply would mean that they would be at the mercy of international financial magnate



and it was desirable that most of the food required in this country should be homegrown. There was nine and a half million acres of land in this country capable of cultivation which were now derelict, and on six and a half million acres wheat could be grown at 40 bushels per acre which would supply all the wheat required for this country.

In 1920 the cost of production of homegrown food was £ 400,000,000, or £ 400 per head of the agricultural population. In 1920 the agricultural worker received somewhere round £ 75 to £ 80 per year, and the farmer got about £ 120 to cover his costs. That amounted for roughly £ 200 and another £ 100 was accounted for by bad business methods among the farmers.

When the representatives of farming said that farming did not pay, they meant that capitalism did not pay.

(Farmer and Stock Breeder of 29th March '26).

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## The Maximum of Encouragement with Minimum of Control

The Minister of Agriculture, Mr. W. Guinness was the principal guest at the annual dinner of the Hunts Chamber of Agriculture at Huntingdon, over which Mr. A. G. Dilley. High Sheriff of Cambe and Hunts presided.

Mr. Guinness responding to the toast of "Success to Agriculture" proposed by Mr. C. K. Murchison, said not much complaint could be made on the technical side of British agriculture. although they had got behind on the economic side and on the measures taken to benefit the home market. The measures which the Government were able to take to help agriculture were designed to give the maximum encouragement with the minimum of Government control. The Government had been severely criticised for not having competed with other political parties in the fundamental principles of land tenure which were now being put before the country. He did not think that would bring any benefit.

The only method by which agriculture could be benefited was by getting it on to an economic basis. He considered they ought to

under conditions not favourable to production of fertile arrows and the benefit of this in breeding work, will unquestionably result in the production of hardy and more resistant varieties of cane.

Mr. Venkataraman a short time ago supplied the sugar world with a most excellent publication on Sugar Cane Breeding in India covering the entire subject from hybridization to testing. This attracted attention in the entire cane producing world and this notation of the control of fertility of the arrows is a further addition to the good work being accomplished by the Government Sugarcane Expert in India.

Another feature of prominence that we note in the report is the breeding of sugarcane for provinces which are unable to germinate their own sugarcane seedlings. This has been accomplished with pronounced success not only in India, but mention is made that as early as 1922 a batch of hardy sugar cane seeds sent from Coimbatore to the Bureau of Plant Industry of the United States Department of Agriculture germinated after the journey. Mention is made that this is perhaps the first instance where cane seed is known to have germinated after travelling such a long distance.

Work was also devoted to the breeding of sugarcane for disease resistance and attention is being paid to this feature of the work through the researches of this institute.

The Coimbatore seedlings which were orginated by this institution have given splendid results in Northern India, The two seedlings most favourable are Co. 210 and Co. 213. These canes have been commented on before and are being rapidly extended through the work and tests made under the supervision of the Secretary of the Sugar Bureau at Pusa, India, notice of which we have had the pleasure of presenting in previous issues of THE PLANTER.

Another seedling is mentioned in this report as proving valuable under a wide range of conditions. This is Co. 205. It has shown a particular value in areas where the soil is water-logged. This seedling has been grown successfully both on unirrigated land and on the heavy water-logged lands on river borders and is reported to give good results under indifferent conditions. It is recommended as a poor man's cane and shows better results in bad years.

The station at Coimbatore has now been placed on a permanent basis after a probatory period of over a dozen years. This is a conclusive proof of the esteem in which it is held by the sugar industry in India. The seedling canes produced by this station have



come to be known in every province of Northern India and have extended from India to various sugar cane producing countries. In Northern Bihar these seedlings, by their superior sugar yield have shown conclusively that good canes of high sugar content can be grown in this section. The results achieved during the short period since the introduction of these canes have unquestionably justified the expenditure on this station. The introduction of these seedling canes has developed and stimulated the sugar manufacturer in India and marks an advancement which can be attributed practically entirely to the good influence from the work of the station.

We note with pleasure the establishment of this station on a permanent basis and look forward to still further betterments through the excellent research and investigations conducted at Coimbatore.

(The Planter and sugar manufacturer Vol. LXXVI No. 8.) Y. R. R.

## A Review on the Tenure of Agricultural Land.

BY ORWIN AND PEEL.

"England has been a landlord's country; the state is entirely divorced from the land except when, as in the case of Crown lands it assumes the function of landlord. The whole rural system has been built up and has hitherto rotated round this central fact. Any incremental values that accrued during the course of centuries, whether the result of improvements or of any change in money value, pass in consequeuce to the landlord and tenant, the relative share between the two being adjusted in the rent. The State received no regular part of such increment though, owing to the rise in administration costs, such taxes as death duties which have in recent years been imposed, do form such a drain on estates, but a drain which is less satisfactory, because irregular in incidence.

The system hes broken down; the landlord is a disappearing element from rural life and tenants are being forced to purchase to retain security though all evidence points to the absence of desire to purchase. Lack of capital for intensive development and lack of marketing facilities characterise the change and it is evident something must be done to rescue British Agriculture from the slough into which it has drifted. The authors propose a system of state purchase as distinct from nationalisation and elaborate the system in some detail with a fair statement of the *pros* and *cons*, though doubts may be entertained as to the advisability or effectiveness of a further host of officials.

2. Describe with diagrams, giving examples, all the forms of dry fruits that you know of.

3. By what striking features would you be helped in recognising the families of :—Cruciferae, Malvaceae, Umbelliferae, Rubiaceae, Asclepiadeae and Amarsllideae ? Give a full account of the characteristics of Scitamineae and mention some plants of this family that are of economic importance.

4. Explain the following terms, quoting examples:—phylloclade, lysigenous, idioblast, phellogen, anthodium, syconium and coleoptile.

B

5. Point out the differences in structure and disposition of tissues between a dicotyledonous root and that of a monocotyledon.

6. Describe the various elements of a vascular bundle and their distribution in the stem of any dicotyledenous plant.

7. What constitutes the food of a green plant ? How do they obtain them ?

8. Give an account of the various functions of a green leaf pointing out the adaptation of structure to function.

*Chemistry* :—Thursday, 8th April 7 to 10 a. m.

(Answer three questions in A and three questions in B. Questions 1 and 6 are compulsory. Write answers to questions in A and B in separate books).

A

1. 1.000 gramme of an organic substance whose vapour density was 45 on combustion, gave 1.466 gramme of carbonic acid and 0.600 gramme of water. Write the constitutional formulae of all possible isomers having the above composition. Name them and explain the nature of isomerism exhibited by them.

2. Explain the significance of the term 'hydrolysis' as applied to the hydrolysis of aualkyl halides, esters, nitriles, and carbohydrates. How can the hydrolysis be brought about in each case? Write equations.

3. Starting with acetic acid, name the different compounds which can be derived from it. Show how each compound is obtained.



4 (a). What are the products of distillation of coal tar? How are they isolated? (b) Compare phenol with ethyl alcohol as regards constitution and chemical reactions.

B

5. Give a brief account of the chemical and physical properties of the proteins. By what means has their constitution been examined?

6. By what agencies is organic matter decomposed in the soil and what are the ultimate products formed? Describe briefly the chemical changes involved.

7. What salts injurious to crops are likely to occur in soils ? What factors lead to their accumulation and what steps can you suggest for their removal ?

8. What are the chief factors determining the water holding capacity of a soil ? By what methods may the properties of a soil be improved in this respect.

*Zoology*. Thursday, 8th April, 1 to 4 P.M.

(Answer three questions in A and three questions in B. Questions 4 and 5 are compulsory. Write answers to questions A and B in separate books.)

A

1. Describe the general characteristics of the different kinds of individuals met with in a hive of honey-bees and explain clearly the part played by each in the general economy of the colony.

2. What are the animals closely allied to insects ? Point out the chief structural similarities and differences between these animals and insects and give a short account of the economic importance, if any, of these animals to the farmer.

3. Name half a dozen of the more important insect pests which a kitchen gardener in South India has to fight against. State, with regard to each the family it belongs to, the damage caused to the plant, the names of the plants attacked, and the control measures you would suggest.

4. Write briefly what you know of the followiug :—(a) Fumigation, (b) Tropisms, (c) Pebrine, (d) Tapeworms, (e) Bot-flies and (f) Mimicry.

B

5. What are the chief insect enemies of the coconut-palm in South India ? State briefly what you know of their life-history and what measures you would suggest to keep them under control.

6. How are insects important to disease ? Give three definite instances that you know of. to illustrate how insects function as disease carriers.

7. How do insects help in the pollination of flowers ? Which are the chief groups of insects that visit flowers ? Show, by reference to two familiar instances based on your observation how they are specially modified to visit flowers.

8. Give a short account of the life-history and habits of the rice-bug. What measures do you suggest to bring it under control ? How would you distinguish damage done to paddy by the rice-bug from that caused by other insect pests ?

*Agriculture* I. Friday, 9th April, 7 to 10 A.M.

(Only 5 questions are to be answered.)

1. *Either.* Why is the study of meteorology essential to a scientific worker? Mention the instruments that would be necessary in this study, and describe how they can be used in the interpretation of his results. *Or*, Write short notes on:—(a) Palaeontology, (b) Lithosphere, (c) Cainozoic, (d) Epigene, (e) Stalagmite, (f) Gabro (g) Basalt, (h) Fault, (i) Stratification, and (j) Schist.

2. *Either.* What are the fundamental problems of dry farming? How are they solved by Indian ryot? Or Comment on the statement that according to dry farming conditions, the fertility of the soil is maintained by cropping without manuring. Support your remarks with actual examples.

3. (a) A red-loamy field bore a crop of karunganni cotton during the season 1925—26. It has to be brought under Tenai and Redgram in the following season. Mention the various operatiosn



that you would adopt to bring into tilth for sowing. (b) If you have 10 acres to sow and have only a three-tyned drill and guntaka, describe the steps you would take to sow three rows of Tenai and one row of redgram; and estimate the labour required for sowing, and the time required to finish the operation.

4. Describe the following by means of sketches and state to what uses you would put them:—(a) Junior hoe, (b) Stone roller, (c) Triangular harrow, (d) Buckscraper, (e) Sabul plough, (f) Swan-neck hoe. (g) Chain harrow, and (h) Pick-axe.

5. What is meant by the "duty of water"? What are the factors which modify it? How does it vary for Sadaisamba and Chitrai Cholam?

*Agriculture.* II. (Animal Hygiene) Friday, 9 April 1to 4 P.M.

(Answer three questions in A and three in B. Questions 1 and 5 are compulsory, write answers to questions in A and B in separate answer books.)

A

1. What are the diagnostic symptoms of Rinderpest, Foot and Mouth disease, Black quarter, Malignant sore throat, Tuberculosis, and Johne's disease ?

2. Describe the causes of Garget in a cow. State what your treatment would be for such a case.

3. Give the actions, uses and doses of the following drugs;—Epsom salts, Sodii Bicarbonas, Alum. Asafoetida, Ginger, Castor oil Camphor and Sulphur.

4. What are the hygienic principles to be observed in constructing a cattle shed and a lambing pen.

B

5. Describe briefly the principles of disinfection, with reference to the common contagious diseases of animals of the farm.

6. What are the excretory channels in the ox and how are they necessary for the proper maintenance of health ?

7. Write short notes on Red water, Coccidiosis and White scour.

8. Describe the signs and course of normal parturition in cow.

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10th April 1926] *Zoology Practical* [Whole day.

1. (a) Dissect the specimen provided so as to show the various parts of the alimentary canal, naming the different parts (Earthworm).

(b) Mount the mouth parts of the insect specimen provided (The banded blisterbeetle).

2. (a) From among the numbered specimens in the box, note down the numbers of ten insects which you consider to be of some economic importance.

(b) Identify specimens 1to 10.

3. (a) Inspection of the collection of insects made by candidates and questions thereon.

(b) Oral Examination.

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12th April 1926] *Engineering Practical* [Whole day.

*Chain Surveying* :—Throwing out and doing up the chain between 2 points; offsets; writing field book; making a hand-sketch of given bungalow for chain survey; calculating area of a figure, allowing for incorrect length of the chain.

2. *Levelling* :—Taking fly levels from the College to Students' Pavilion, touching on given bench marks: writing field book; reducing levels.

3. *Workshop* :—Carpentry; Preparing a teakwood couple as per design.

4. *Building works* :—Measurement of an existing building and calculation of quantities and cost for brickwork and plastering.



5. *Machinery* :—Start the oil Engine in Farmyard well, run for some minutes and stop the Engine.

6. Oral Examination.

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15th April] *Animal Hygiene Practical.* [Whole day.

1. Identification of the internal organs of the cow.

2. Uses of these internal organs in the animal economy.

3. Identification of common drugs and instruments and appliances and their uses.

4. Taking pulse and temperature of cattle.

5. Drenching of cattle.

6. Handling of cattle.

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16th April, 1926] *Agriculture Practical.* [6-30 A.M to 3 P.M.

1. Assemble and adjust Monsoon plough from parts provided.

2. Yoke bullocks and take plough to field No. 37.

3. Plough according to directions.

4. Oral Examination.

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17th April 1926.] *Botany Practical.* [1 P. M. to 4 P. M.

1. Describe fully the specimen A and refer it to the Family mentioning other plants of economic importance of this family in the Presidency.

2. Write full morphological notes on B, C, D, E, F, and G.

3. Identify the slides H, I and J.

4. Make preparations of the specimen K. and indentify it.

5. Oral Examination.

19th April 1925.] *Chemistry Practical.* [Time 6 Hours.

1. Shake 100 grammes of given soil with 200 c. c. of given solution of phosphate for 15 minutes. Estimate the amount of phosphoric acid in suitable aliquots of the original solution and the filtrate. What inference would you draw about the retentive power of the soil?

2. Examine substance in the test tube qualitatively for not more than 2 bases and 2 acids.

3. Identify the organic substance in weighing bottle.

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## EDITORIAL NOTES.

### M. A. S. U. Leads.

On a former occasion, we referred to the advent of the Royal Commission on agriculture in October next and put in a few suggestions on the basis of which readers of this Journal might collect and forward their views on this—the burning question of the hour. Now we feel dismayed at the apathy shown by responsible persons and the general public alike, in this matter. No action seems to have been taken except that the Viceroy called a conference of Ministers and Directors of Agriculture from several provinces. They met at Simla on the 4th June and discussed problems which from an official point of view ought to engage the attention of the Commission. This meeting has certainly cleared much obscurity in outstanding agricultural questions between the Central and Provincial Governments. Local agricultural committees have been constituted to co-ordinate proposals for placing the case of each province before the Commission. So far so good. But we are sure that both his Majesty's Commissioners and the Government of India would like and certainly expect and welcome people directly interested in the land and having considerable stake in it to come forward and express their views on land questions that have been agitating the minds of the public and the Government for a pretty long time. There is no denying the fact that Agriculture has been forced to the front in all countries especially after the war and India cannot stand alone with folded hands, looking at other nations to steal a march over her in developing natural resources.

The International Institute at Rome is making arrangements for an agricultural world census in 1930-31. Being in a position of vantage at present, enjoying the monopoly in jute and oil seeds, India



will have none to blame but herself if, at the hour of reckoning, she finds herself at the bottom of the scale in *per capita* production and consumption. No one can predict what bewildering developments may not take place in the next few years in other parts of the world —for example, in Africa to which the enterprising nations of the West have now turned their attention. We would therefore urge on all to ponder well over the long neglected, yet intricate problem of agriculture and try to improve on suitable and well organised lines.

We are gratified to state that the Madras Agricultural Students' Union Committee have been alert and, taking time by the forelock, framed a tentative questionnare (published elsewhere in this issue) which should compel the thoughtful attention of responsible men, furnishing as it does, hints to look at agricultural problems from the ryot's points of view. We are sure no one will cavil at the idea of the Union starting a questionnare in anticipation of the points that may suggest themselves to the Commission. The object remaining the same viz., the improvement of agriculture, the Union's questionnare must and in our opinion does travel over a large part of ground which the Commission cannot but traverse. We would therefore request our members to send in their replies so that a memorandum may be got ready and submitted in time. It is believed that the Commission will visit Madras in the middle of November and all memoranda may be required to be submitted by the end of October, though their questionnaire may not be published before the 20th of that month. It would be well if replies are received by the Union Committee before the 10th of October, so that they may be enabled to do their duty by the Union and the mass of agriculturists whose conditions they wish to advance according to their lights.

Let the terms of reference to the Royal Commission, be what they may. People concerned will, we feel, be failing in their duty if they do not voluntarily furnish correct information on intelligible lines so as to make the work of the Commission complete, easy and yet satisfactory.

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### The Estate Board Schools.

On the 11th June the residents of the College Estate had the unique pleasure of witnessing the award of prizes to pupils of the Board schools by that silent and practical reformer Mr. R. V. Subramanya Ayyar who was formerly on the staff of the college. It was fitting that the function should be presided over by Mr. Ayyar who

6. How does the ryot spend his income? If feasible, family budgets may also be furnished.

7. What obstacles, if any, do exist in the way of ameliorating his present condition?

8. How far has agricultural improvement spread in rural parts?

9. How far has the cultivator responded? How much is he responsive? If not, what do you think are the reasons?

10. In what directions do you think action is necessary to further the spread of improved methods.

11. Are the existing methods of agricultural education, demonstration and propaganda (1) sufficient (2) popular? Do they in your opinion need modification? If so, in what directions?

12. Do you think any legislation on the lines of the State Aid to Industries Act will bring about any improvement?

13. To what extent in your opinion do the co-operative and agricultural departments co-operate with each other in pushing on agricultural improvement?

14. Do you think any readjustment is necessary or desirable in their individual work or will their amalgamation do any good especially on the non-credit side of co-operation in starting, maintaining and increasing the number of societies for production, purchase and disposal of all kinds of articles the ryot is directly interested in?

15. Will the retransference of the control of the Pumping and Boring section to the Director of Agriculture hasten agricultural progress?

16. To what extent have the Agricultural Loans Act and the Land improvements Loans Act been availed of by the ryot? What suggestions if any would you offer for their further popularisation?

17. Can the food crops now being grown be given up in favour of or be successfully replaced by other food crops so as to increase food supply and keep the population above want as is reported to have happened when potato was introduced and largely replaced wheat in arable lands in Ireland.



18. How far is the system of growing irrigated dry crops in lands under irrigation projects, both existing and to be undertaken, in tracts of which you have experience, conducive to the wellbeing of the cultivator?

19. To what degree can the recommendation made by Mr. A. Galletti, to grow dry crops, fodder and pasture as in Italy be given effect to, in respect of wet lands in your division?

20. Do facilities exist for satisfactory drainage in the wetland tracts you know of? If not, can you suggest any remedies?

21. What damage if any, occurs among crops generally in your tract? What steps do the ryots take to avert it? How far have measures advocated by the Mycologist and the Entomologist succeeded in reducing such damage? Do you advise educational or propaganda methods as desirable or penal enactments as necessary in checking the ravages of pests and diseases in the present state of illiteracy of the rural population?

22. How far has, in your opinion, the research work done by crop specialists influenced progress and their advice taken up by ryots?

23. Has the ryot taken up new canes, new seeds evolved at Coimbatore and other allied stations to any appreciable extent? Can this work be pushed very much further or are there any limitations or impediments? If so, what are these and how can they be overcome?

24. Is Livestock in your division sufficient for all agricultural purposes and milk production?

25. Is there any 'overstocking'? If so, how can it be corrected?

26. Are cows and shebuffaloes in your district sufficient to meet local demands? Is the milk problem only confined to towns or has it spread to villages also?

27. Are there any recognised breeds? Are they improving or deteriorating? What causes are at work in this direction?

28. What ailments do cattle in villages suffer from or succumb to? When do they appear? Do the villagers know of any local remedies or do they call a cattle doctor for help?

after a long break of over 12 years, was again in our midst with all his family and cultured children to renew his acquaintance with the estate, its residents, its children.

Principal R. C. Broadfoot in very graceful terms introduced Mr. Ayyar to the audience. Mr. Ayyar in his humorous way gave sound advice to the pupils and exhorted them not to neglect manual work and handicrafts, Mr. Broadfoot in his concluding speech made some general observations and refered to the present condition of the Board schools which, he expected, would improve in as much as the general financial condition of the Government had become normal.

The success of the function was due to the industry of the teacher Mr. Veepappa Gounder and the excellent way in which the Headmistress—Boramma and her assistant had trained the pupils in drill and singing. The assortment of prizes for girls showed care, method, originality and evoked praise from the audience.

We hope that the Local Board will raise the schools to the Lower Secondary grade as a good number of boys from the neighbouring villages and a large number of boys and girls from the Estate which is growing are compelled to attend the schools in the town which is 3 miles off for want of English teaching in the estate schools which, owing to this cause, are in a state of stagnation.

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## Madras Cane Work.

Our American contemporary—the Planter and Sugar Manufacturer—has attracted the attention of the Indians by its handsome reference to and generous praise of the work which is being done at the Coimbatore Cane—Breeding Station under the control of Rao Sahib, Mr. T. S. Venkataraman. (Vide page ).

Coimbatore canes have, we note, spread in all provinces in this country and have crossed the much dreaded black water even to distant America.

The good work to the credit of the agricultural department so far certainly compels one to admit that when facilities are given and enthsiasm is stirred, the ardent band of workers in the nation-building departments will under intelligent and sympathetic guidance give a good account of themselves equally with their countrymen who have already proved their capacity in other departments of life as administration, law, justice, fine arts and letters.



## B. Sc. Ag. Degree Examination.

RESULTS.

(ARRANGED ACCORDING TO RANK).

PART I.

| | |
|---|---|
| Achyutha Wariar, U. | Bapayya, D. |
| Ramanathan, K. | Sundaresan, M. |
| Gopalan Nayar, T. | Sivasankara Menon, K. |
| Ramaswami, K. | Ramamohan Rao, A. |
| Ramachandran, S. V. | Vaidiswaran, K. B. |
| Ramachandran, S. | Sankaranarayana Ayyar, C. S. |
| Kunnikoran Nambiyar, A. | Krishna Rao, V. |
| Parameswara Menon, P. K. | Raman Nayar, M. |
| Mayandi, S. | Rajam Ayyangar, R. |
| Subramanyam, P. | |

PART II. (*Second Class*).

| | |
|---|---|
| Narayanan, T. R. | Mahadevan, S. |
| Varadachari, K. | Karunakaran Nayar, V. |
| Balakrishnan Nayar, A. P. | Annaswami N. |
| Rajagopalan, N. S. | |

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## Royal Agricultural Commission.

*Tentative Questionnaire*

BY THE M. A. S. UNION.

1. Is the land producing as much as it could. N. B. Refer separately to (a) Rainfed lands (b) Lands under wells (c) Lands under tanks (d) Lands under river channels.

2. Is it possible to increase production?

3. In what directions can South India or the portion of it of which you have experience, change her crops and methods of cropping?

4. How far can she rely upon her present supply of (a) manure (b) water and (c) cattle.

5. In what ways can she sell her agricultural products to the best advantage.

29. Do the ryots to any extent adopt the system of growing fodders for their cattle ?

30. Do they use straw as the sole, main or subsidiary food of cattle ? If as the latter, what other foods serve as supplementary, when and at what cost ?

31. Is the system of giving grain and concentrates to cattle as in Europe, prevalent or coming into practice in your tract ?

32. How many days in a year and during which season do the crops grown in typical villages in your jurisdiction engage the labour of all local adult workmen and workwomen ?

33. Are there any village industries which keep them employed during other days? Is it possible in your opinion for them to devote more time to agricultural operations so as to secure better returns ? or is the period of idleness inevitable ? and if so, what is its duration ?

34. Is human labour increasing in numbers and advancing in quality in your division or is it deteriorating ? In what manner has this influenced cropping for good or for bad ? Are any remedies possible? Do you suggest any if harm has resulted owing to deterioration ?

35. Is there sufficiency of fuel and timber supply in villages ? If not how does the ryot fare in regard to his needs ? How can they be met ?

36. Is the local manure supply adequate ? If not, how would you improve it ?

37. Is the ryot keen on preserving his cattlemanure ? Does he use it for any other purpose ? Why does he do so ? Can this be improved ?

38. Are there any possibilities in increasing the supply of irrigation water in your division, through digging wells, or constructing reservoirs or undertaking projects ? Can they be productive or should they be treated only as protective?

39. Have you any practical proposals to interest big landowners, trustees of temple and mutt lands, and zemindars in agricultural improvement and to get them to actively co-operate in advancing in definite lines of farming in the tracts in which they own lands ?



40. Any other points not covered by the above but in your opinion necessary to make your answers full and complete for elucidating agricultural problems both of an immediate and pressing and of an enduring character.

N.B. It is particularly requested that answers as far as possible, be based on facts and figures available in published records, which, if necessary, may be referred to or on actual personal experience which should be distinctly stated.

## Departmental Notifications May, 1926.

*Appointments and Transfers* :—

Mr. G. V. Ramachandra Rao to be a Temporary Assistant on Rs. 85 under the Cotton Specialist.

Mr. V. V. S. Varadarajan, Assistant Manager, transferred to 2nd Circle.

Mr. P. Kannan Nambiyar, Assistant Manager, Palur, transferred to 7th Circle,

Mr. T, S. Venkatarama Ayyar, Demonstrator, transferred to 3rd Circle on the expiry of his leave.

Mr. T. Seshachalam Nayadu, Assistant Demonstrator, Live Stock Section from Madras to Chintaldevi and Mr. S. P. Fernando, Assistant Manager from Chintaldevi to Madras.

*Leave etc., Second Circle* :—

Mr. S. Sithapathi Rao. Assistant Demonstrator, leave on average pay for 21 days from 13th May.

M. V. Ratnaji Rao, Demonstrator, extension of leave on medical certificate for three months.

*Third Circle* :—

Mr. K. L. Ramakrishna Rao, Scientific Assistant, Hagari leave on average pay for 4 weeks from 2nd May.

Mr. K. Jagannatha Rao, Demonstrator, leave on average pay for 15 days from 23rd April.

Mr. L. Narasimhachari, Demonstrator, leave on average pay for 20 days from 10th May.

Mr. R. Swami Rao, Demonstrator, Cuddapah, leave on average pay for one month from or after 12th May.

Mr. A. Venkobachar, Assistant Demonstrator. Markapur, leave on average pay for one month from or after 20th May.

Mr. B. Venkataramana, Assistant Manager, extension of leave on medical certificate for 15 days.

Mr. M. V. Raghavalu Nayadu, Farm Manager, leave on average pay on medical certificate for 6 months from or after 1st June.

Mr. W. Raghava Acharya, Farm Manager. leave on average pay on medical certificate for 4 months from 25th May.

*Fourth Circle* :—

Mr. P. Kannan Nambiyar, Assistant Manager, leave on average pay for one month from 20th May.

*Fifth Circle* :—

Mr. K. Srinivasa Acharya, Demonstrator, leave on average pay for 10 days from 10th May.

*Sixth Circle* :—

Mr. S. Bhima Raju, Assistant Demonstrator, leave on average pay for three months from or after 15th June.

Mr. A. M. Muthayya Nattan, Demonstrator, extension of leave on average pay for 2 months and 15 days, on medical certificate.

Mr. B. Dasappa Malli, Assistant Manager on foreign service, leave on average pay for one month from 23rd April.

*G. E's Section* :—

Mr. C. J. George, Assistant, leave on half average pay for 17 months and leave without allowances for 8 months from date of relief.

Mr. C. V. Sundaram Ayyar, Assistant, leave on average pay for one month from or after 9th May.

*Live Stock Section* :—

Mr. V. Suryanarayana, Farm Manger, extension of leave on loss of pay for ten days.

Mr. M, Krishnaswami Ayyangar, Assistant Manager, leave on half average pay on medical certificate for 6 months from 21st April.

*Curator's Section* :—

Mr. T. D. Iswara Ayyar, Assistant Manager, leave on average pay for three months from or after 1st June.

*G. L. B's. Section* :—

Mr. K. Cheriyan Jacob, Assistant. leave on average pay for one month from 3rd May.

Mr. T. R. Naganatha Ayyar, Sub-assistant, leave on average pay for two months from 23rd April.

*Paddy Specialist's Section* :—

Mr. A. Chidambaram Pillai, Farm Manager, leave on average pay for three weeks from 24th May.



*G. M's. Section* :—

Mr. D. Marudarajan, Assistant, leave on average pay for 8 days and leave on average pay on medical certificate for 21 days in continuation,

*G. E's. section.*

Mr. P. N. Krishna Ayyar, Assistant leave on average pay for one month from or after 17th May.

*G. A. C's. Section* :—

Mr. B. S. Narasimha Ayyar, Assistant, leave on average pay for 11 days from 27th May,

*G. L. C's. Section* :—

Mr. M. Rajagopala Ayyar, Assistant, leave on average pay for 22 days from 20—5—26 and leave on half average pay for 4 days in continuation

## JUNE.

APPOINTMENTS, CONFIRMATIONS, TRANSFERS ETC:—

*Chemistry Section*: —

Mr. M. Suryanarayana, to be Upper subordinate, Vth grade permanent, from 1st April.

Mr. M. R. Balakrishnan, to be Upper subordinate Vth grade on probation from 1st April.

Messrs. T. Rajagopalan, and T. P. Govinda Pisharoti tob[e] Upper subordinates Vth grade on probation. And Mr. T. Varahalu to officiate as Upper subordinate Vth grade.

*Other Section*

The following provisionally substantive promotions are made with effect from 1st June 1926—Mr K. Venkatarama Ayyar, from IV to III grade; Mr. S. Dharmalinga Mudaliar, from V to IV grade and Mr. R. Balasubramanya Ayyar, on probation in the Vth grade.

Mr. C. Venkatasaravayya, Farm Manager V grade to be Assistant to the Paddy Specialist, V grade on probation,

Mr. K. B. Viswanatham. Farm Manager transferred as Farm Manager, Paddy Breeding Station Maruteru

Mr. K. M. Jacob, Farm Manager on return from leave posted to Central Farm.

Mr. T. A. Rangaswami Ayyangar, Assistant Demonstrator, Salem-transferred to Attur, to relieve Mr. C. S. Seshagiri Ayyar, who will report to the head office 8th Circle, Coimbatore.

*Leave etc., Second Circle*:—

Mr. K. Ramanatha Ayyar, Agricultural Demonstrator, extension of leave for three months on average pay on Medical certificate

*Third Circle* :—

Mr. S. M. Kalyanarama Ayyar, Assistant on cotton work, leave on average pay for one month and 10 days from or after 2nd June.

Mr. K. L. Ramakrishna Rao Cotton assistant, Hagari extension, of leave on average pay for 3 days and leave on half average pay for 22 days.

*Fourth Circle* :—

Mr S. Rama Rao, Assistant Demonstrator, leave on average pay for 2½ months from or after 15th June.

*Sixth Circle* :—

Mr. T. S. Venkatarama Ayyar, Agricultural Demonstrator extension of leave for 5 weeks.

Mr. P. R. Subramania Ayya, Aassistant Demonstrator, Dindigul, leave on average pay for 22 days from 4th June.

*Seventh Circle* :—

Mr. G. Sakharam Rao, Demonstrator. Puthur, extension of leave for 5 days on average pay.

Mr. E. Achyutan Nayar, Assistant Manager, Nileshwar. leave on average pay for 15 days from 31-5-26, extended by 10 days.

*Live Stock* :—

Mr. M. Raman, Farm Manager, Chintaldevi, leave on average pay for 4 months from date of relief.

*G. L. C's Section* :—

Mr. M. Rajagopala Ayyar, Assistant leave on half average pay for 7 days from the 11th June.

*G M's Section* :—

Mr. D. Marudaraja Pillai, Assistant, extension of leave on average pay for two weeks.

*G. E's Section* :—

Mr. C. V. Sundaram, Assistant, extension of leave for one month on medical certificate.

*P S's Section* :—

S. Dharmalinga Mudaliyar, Asisstant, leave on average pay from 27th May to 23rd June 1926.

Mr. Jobitha Raj, Assistant, leave on average pay for 15 days from 18-6-26.

Mr. N. Subramanya Ayyar, Farm Manager, Aduthorai, leave on average pay for one month from 2nd May.

Mr. Dasappa Malli, Assistant Manager under foreign service, extension of leave for one month.

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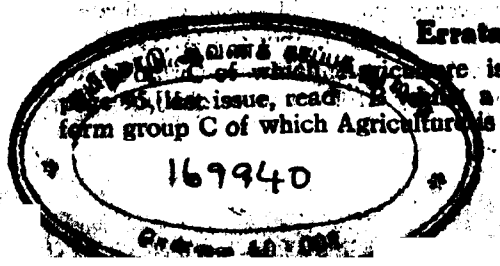
**Errata.**

[illegible] of which Agriculture is one" in line 5 from bottom, page 95, (last issue, read "[illegible] a number of technical subjects form group C of which Agriculture is one."



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" " P. H. Rama Reddi, Bellary.
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" " A. V. Tirumuruganatham Pillai, Madura.
" " K. Raghavachari. Bellary.
" " K. Unnikrishna Menon, Tellicherry.
" " G. Rajagopala Nayudu, Periapalayam via Ponneri

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The resident Vice-President and the ten resident members with ıe following student members form the Working Committee.

**dent-Members (3)** K. C. Kumaraswami Chetty, B.Sc. I
U. Achyutha Wariyar, B. Sc. II,
K. Varadachary, B. Sc. III.

**al Board** (7),—as indicated above.

:—K. Krishnamurti Rao,
T. S. Ramasubrahmanyam.

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