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Editorial.

The Russell Report. Readers of our journal will remember that in the cold weather of last year two eminent British scientists visited India at the request of His Excellency the Viceroy to inspect and report on the activities of the Imperial Council of Agricultural Research. Their reports have been submitted to the authorities and are now under their scrutiny. We have not seen the full report of Dr. Wright and would therefore confine this note to that of Sir John Russell. Although the terms of reference of this enquiry did not require them to go beyond the schemes subsidized by the Council, the experts, we find, have also scrutinised as well as their limited time permitted, the work carried on in the different sections of some of the provincial departments of Agriculture. If, as we have reason to suspect, anybody had any misgivings regarding the quality of work turned out by these provincial departments, misgivings based perhaps on the illinformed criticisms now and then given vent to in the press and from the platforms by persons who knew not what they said, the report now placed before the public should once and for all give the quietus to all such unnecessary apprehensions. There is a general tone of optimism running through the whole report regarding the lines of work in progress in the different provinces and in the opening chapter while reviewing the activities of the department as a whole from its inception to the present day Sir John observes "*The provincial departments have already achieved valuable results and have fully justified the confidence reposed in them from the outset.*"

The report is written in two parts. The first part deals briefly with the general agricultural practices and crops in India, the methods of improving crop yields, the difficulties in the way and means of confronting them and concludes with suggestions for the reorganization of the work of the Council and the Imperial Institute on lines suited for the carrying out of the recommendations made in the report. Part II deals with the various schemes subsidized by the Council.

The ultimate object of the enquiry being the improvement of the lot of the agriculturist, the report in part I deals fairly exhaustively with the present state of the Indian villages and the lines on which improvements may be effected. In the opinion of the expert "the improvement of village life is probably the greatest need in India today." And with this end in view he recommends that the activities of the Research Council may hereafter lie more in making wider and

fuller use of existing science than in developing new science for which latter purpose the Universities, in his opinion, are in the main the places for work. He feels that "there remains a great gap to be bridged between what can on present knowledge be accomplished and what is actually being done by the cultivators". An enquiry into the present methods of propaganda is recommended the more efficient of them to be finally accepted and widely used. Among the difficulties in the speeding up of Agricultural improvements "perhaps the most serious is the lack of an agricultural aristocracy and an educated agricultural middle class. Many of the great advances in Western agriculture are due to men of this type. In Great Britain an improvement effected in the experimental stations can be at once put into practice. Some large farmer is prepared to try it at his own expense.....Unfortunately India has nothing corresponding with this educated class. It is unfortunate that the colleges have been able to do so little in this direction.....In all my journeys I met only two or three college trained farmers". The other difficulties referred to in the report are too well known to us to need repitition here.

The Imperial Institute and its activities occupy the last chapter of part I. Valuable suggestions regarding the future of this institution "the purpose of which is to carry out investigations of fundamental importance to India in the same kind of way as is done at the Rothamstead Experimental Station or the Agricultural Research Departments at Washington" are offered. Regarding the staff of the Institute it is suggested "that the Director and heads of leading sections should, if possible, be men of international repute who would be respected for their own merits by workers at other institutions. The Director should be a scientist of wide repute.....need not be an agriculturist but should be distinguished in some science basic to agriculture." Sir John is convinced that it is not necessary to go outside of India to find a suitable man. As regards the Council itself the expert is of opinion that "during the short period of its existence the Council has accomplished a remarkable amount of good work and I do not see how its results could well be bettered." To those therefore who have been labouring under the false impression that the Agricultural departments in India are a sort of "White Elephants" the report of Sir John Russell should have come as a surprise—we hope none the less agreeable—and to those who have all along been the targets of uncharitable criticism, as a source of inspiration and encouragement in their future work. To conclude in Sir John's words, "the Indian ryot compares favourably with any of the peasant population I have met in different parts of the world. The change from the ancient to the modern system took some seventy years to accomplish in the West. There is no occasion to despair of its accomplishment in India."

THE PLACE OF BOTANY IN AGRICULTURE.*

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Students of Botany, in fact, students of Natural Science are perhaps more fortunate than students of other branches of science, and especially students of Arts and Law, in that they come into daily contact with nature when they study plants—their flowers and fruits, insects, birds and animals of which Nature is so full. Those who come in contact with Nature constantly, see the great unseen hand that is responsible for the creation of universe and all that therein is. We come into contact with Nature through things created. A close study of either Botany or Zoology discloses to one the power, the glory and the majesty of the Creator. Need you, therefore, hesitate to call yourselves fortunate when your study brings you into close touch with Nature?

What is the connection between Botany and Agriculture? While Botany is a science which deals with all plant life in all its aspects, Agriculture is a science, an art and an industry—all combined, which deals with the culture of plants of economic value to man. A student of agriculture before he becomes a scientific farmer should know all he can about the plant—its inside so to speak—its relation to soil, to its environment, how it lives, what causes its illhealth, just in the same way as a mechanic should know his engine and the doctor the human body. Not only this, science is progressive, and the scientific farmer should constantly concern himself with the improvement of the plants in which he is interested. Do we not hear from day to day the so called "improvements" of the various models of motor cars—the new Minx, or the Ford 22 or the Flying Standard, etc. bringing to the notice of the public small points of difference between the old and the new to catch the fancy of the purchaser. Whereas in those concerned with crop improvement the object should not be and is not to "catch the fancy" of some one but to be of lasting benefit to the cultivator.

As students of botany you must have learnt that plants and animals are so different in their complex forms; yet such a difference ceases to exist in their simple organisation. You have also learnt that plants and animals have been derived from pre-existing forms by gradual modification and that there has been a gradual evolution from lower forms.

Those who have read Charles Darwin's *Origin of Species* would recollect how he points out the great variability that exists in plants, how nature reproduces itself to an extremely extravagant degree. For

* A lecture delivered before the Madras Presidency College Botanical Association.

a simple example take the *Margosa* or any road-side tree, and what constant struggle there is for existence and that in this struggle only those that suit their environment best are those that survive. The plant breeder of today who was the student of botany yesterday therefore takes advantage of some of these facts, e. g. of the great variability, and uses it for his own purposes. He looks into the variable mass of material of any particular crop like paddy, millet or cotton, and decides in his mind what kinds of plants suit him best. In the case of paddy, for example, he might look for plants with longest ear-heads and closely set grain or for those which produce ears earlier than others or for those with fine grains or for plants with many tillers or for those which have an erect habit or for those resistant to disease and so forth. He walks in the field examining individually hundreds of plants and selects a few which reach the ideal he has set before him. This process may go on for a number of days, and eventually when he makes up his mind how many he should have, he harvests them separately and keeps the produce of each plant separately till next year making a record of each, indicating briefly for what quality he has selected them. What he has stored is the produce of one earhead of a single plant. This he sows next year in single rows, and compares the progenies with each other as well as with the bulk seed of the crop from which he originally selected the single plants, the object being to compare one with another and with the original. Those which satisfy him he retains, others he rejects. The former he sows again in comparative plots and this process goes on for several years; eventually he may have only 2 to 3 % of plants whose seed he considers is better in different ways than the mass seed. This method of crop improvement is known as 'pure line selection' and each plant is given a distinguishing number and is called a strain. The produce of these strains he distributes to the cultivators and awaits results. In a large province like Madras with variations in climate and soil, it is impossible to expect any particular strain to do well uniformly. Therefore, he issues a number of strains in the hope of finding at least one or two which do better than others in any one locality. So that while he may have a number of strains doing equally well in a particular locality, some of these might behave entirely differently under another set of conditions. The task of the plant breeder is therefore not so simple or easy. It calls for a good deal of patience, optimism, courage and above all honesty, as the result of his work is to be j dged by a set of practically minded people,--people who know what they are talking about.

Let us go into a little more detail in regard to the objects the breeder has in crop improvement. Take the question of *yield*. Supposing a particular variety of paddy in a particular locality yields 2000 lb. of grain per acre. By his efforts which may have meant 6 to 7 years in

time, he finds that the strain selected from this variety had given by repeated tests 10 % more yield (i.e.) 2200 lb. as against 2000 lb previously. What benefit does this mean? In the case of an individual ryot, for every acre of the improved seed he grows, he would get an additional value of Rs. 5 per acre if it is reckoned that for a rupee you could purchase 40 lb. of paddy grain. Therefore, if one has 10 acres, he would obtain Rs. 50 more than before. In the Madras Presidency, there are at least 11 million acres of paddy. If such an improvement could be effected in all the varieties of paddy in the Presidency, it would mean that by this one improvement alone the ryots of the Presidency would get Rs. 55,000,000 annually more than they used to obtain before the introduction of the improvement. In fact, the improvement is as much as 30 % sometimes, but as a general rule, we can reckon on a 10 % increase in regard to yield.

Take again the question of *quality*. We have a strain of paddy known as G. E. B. 24 which has a very fine grain. It is a good yielder but is prized more for quality than yield. It is reckoned that it would fetch 4 to 8 annas more per bag than other varieties. If an acre produces 10 bags, the extra profit by growing this improved variety varies from Rs. $2\frac{1}{2}$ to Rs. 5. So far, for profits that one obtains by plant breeding for high quality. Research is also undertaken to find out what factors are responsible for quality and whether the so called quality is desirable or not. Take, for example, the question of polished rice which educated and well-to-do people prefer to consume. Is it desirable to eat it? It has been shown that it is not as nutritious as unpolished rice, the reason being that in polished rice there is the absence of the aleurone layer in which there is an important principle called tryptophane which is necessary for animal diet. Similarly, in *ragi*, there are two varieties according to colour: white and brown. Which should we consume? Research has shown that while white *ragi*, has a higher nutritive value, the brown has a higher biological value.

There is also the aspect of the duration of the crop. Should the plant breeder look for plants which are earlier maturers or late maturers? In other words, should we look for plants whose life time is short? In a tropical country and in crops which mature by means of irrigation, it is desirable to have plants which ripen off early, as late maturing crops require more irrigation and are therefore more costly to produce. There are certain strains which are excellent as far as yields go, but they need a fortnight longer to ripen. This is indeed a defect from the view point of people who have difficulties for irrigation. On the other hand, if there is no such difficulty, a 15% increase in yield cannot be despised.

Take again the case of a very popular variety of Cambodia cotton called Co. 2 which is a high yielder but is a late variety. As a rainfed

crop, it would be advantageous to have one which matures early in tracts of deficient rainfall. Attempts are, therefore, being made to cross-breed it to obtain the desirable result.

I have just referred to the early and late maturing varieties of crops. This leads on one to the question of the minimum requirements of crops for water. Different crops require different quantities of water, e. g. paddy, sugarcane, and cotton. The same crop requires different quantities at different seasons of the year, e. g. dry months and rainy months. Again, the needs of different varieties of the same crop vary, e. g. sugarcane. From the point of view of crop improvement, it is desirable to have varieties which call for the minimum quantity of water without sacrificing the yield. A variety of sugarcane needs in the Vizagapatam District only one irrigation till the time of harvest whereas other varieties require 20 irrigations. This calls for the study of the root system of plants. When these are examined in a field where different varieties are grown, e. g. sugarcane, it is observed that roots of certain varieties go far deeply into the soil while others remain on the top regions. Further, observations of such varieties show that in a period of excessive drought, varieties possessing a deep root system withstand it better than their shallow rooted neighbours. Here, therefore, is the opportunity for one interested in the welfare of the agriculturist to develop varieties which are drought resistant and suggest to him those which he considers more advantageous, especially in tracts of precarious rainfall.

There are other directions in which a knowledge of Botany is so helpful to the scientific agriculturist. You have heard of fertilisation of plants by various agencies like wind, water and insects. To preserve the purity of his strain, the plant breeder takes steps to see that the plants he selects are self-fertilised, e. g. by bagging whenever necessary. On the other hand, he deliberately crosses one plant with another for the purpose of introducing into his strain certain desirable qualities. For example, you have two varieties of paddy—one is a heavy yielder but is susceptible to a particular disease, and the other though not so good in yield resists the disease. He crosses both varieties with a view to introduce into the blood of their progeny a quality of resistance without sacrificing the yield. We have in Tanjore now a disease resistant strain to a very serious disease of paddy called 'Blast' (*Piricularia oryzae.*)

Similarly, you have heard of parasites living on other living plants. *Striga* is a parasite living on the roots of certain cereal plants. Attempts are being made to evolve strains which are resistant to this parasite. By hybridisation or cross fertilisation, you can increase yield, remove weaknesses like lodging and disease, make plants withstand unfavourable conditions like alkalinity in soils, and resist drought, etc. You may have heard of the intergeneric crosses made

by Rao Bahadur T. S Venkataraman between sugarcane and sorghum with a view to reduce the age of cane from 11 months to 8 to 9 months. Similarly, we have, under trial, crosses in castor which have brought down the normal age from $8\frac{1}{2}$ months to 5 months. These are of great economic importance to cultivators. In Europe, horticulturists take advantage of this fact of crossing and produce flowers of great brilliance by combining certain colours. You are aware that potatoes are propagated from tubers. They are either cut or planted whole. Potatoes also form flowers and seed, but the latter is a very rare occurrence here. Careful attempts made in our potato farm at Nanjanad have enabled us to produce seed and we have now quite a number of varieties of potato from which fertile seeds have been obtained. We have quite a large number of seedlings obtained in this manner and from these, hybrid varieties have also been successfully produced which are better yielders and earlier maturers.

You have learnt in Botany that plants need food, air and moisture. There are, as you know, certain essential elements without which the plants will either die or do not thrive properly. This knowledge is very essential to the scientific agriculturist as this is the basis of manuring of crops. It is known that crops should have sufficient quantities of nitrogen, phosphoric acid and potash: a deficiency of any one or more of these will at once tell on the health of the crop or on the yield. Although the actual requirement of the crop for each ingredient can be ascertained by analysis of soil and the plant, experience goes a long way in helping the agriculturist to know what kind and what quantity of each should be applied to obtain a normal out-turn.

The plant breeder has also, however, to face the problem of deterioration and disease—deterioration because in the hands of the illiterate ryot the pure seed gets mixed with his old seed and all the trouble he has taken in crop improvement becomes a waste; the department has therefore to concern itself in seeing that such mixtures are removed and the purity maintained as far as possible. In regard to disease, their number is legion. I shall not trouble you with what these diseases are and what is being done in regard to them, but I would like to illustrate one or two interesting instances from the point of view of students of Botany. There is a serious insect pest called 'stem weevil' in cotton which bores into the stem and makes the plant to fall down and in extreme cases kills it. Certain types of the cotton plant however, stem the onslaught of the insect by exuding a gum to cover over the damaged part and thus arrest the progress of the insect.

It is not my desire to take you into the several ramifications of this entrancing subject. I have, I hope, been able to show you how a knowledge of Botany is not only helpful but also necessary for the

scientific agriculturist and what the department of Agriculture does in the direction of crop improvement for the benefit of the ryot with the knowledge of Botany it has in its possession. If Botany is studied from this point of view, I am sure you will agree with me, that the study will not only be interesting but is worth all the trouble you take in mastering it, because it would help to improve the lot of a class of people who need our help most.

HE STORY OF TEA

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Tea is probably the most popular beverage in the world, the total consumption being some hundreds of million pounds per annum. The cultivation of this plant has enabled thousands of acres of what had been, for many centuries, waste land in many countries to be converted into valuable plantations; and the cultivation of the plant, the manufacture of tea and the commerce in tea have given lucrative employment to thousands of people.

The principal countries consuming large quantities of tea are China, Japan, the United Kingdom, the British Colonies, Russia, the United States of America and the Netherlands. The consumption in some European countries, particularly, Germany, France and Denmark and in the Asiatic countries, principally, India, Tibet, Burma and Persia has been increasing. The principal countries producing tea are China, Japan, India, Ceylon and Java.

Tea in China. Tea was known to the Chinese from very early times, even many centuries before Christ. The Chinese names for tea, *Theh* or *Tha* and *Tcha* or *Cha* occur in several ancient literary works. The word *ming* was also used to denote tea. It is said that in the middle of the fourth century A. D. Wang Meng, the father-in-law of the then Emperor, was fond of drinking tea but his friends found it to be too bitter, and that a later Emperor, Wen-ti (589—605 A. D.) was recommended by a Buddhist priest to drink boiled *ming* leaves as a cure for headache. For some centuries tea was probably used only as a medicine. It was only in the 6th or 7th century that it came to be used as a beverage. The use of tea as a beverage should have been so general in China in the 8th century that a duty was imposed on it for purposes of revenue. About the year 850 A. D. an Arab merchant who travelled in China has mentioned in his account of travels that the people of China were accustomed to the use of tea as a beverage and that the leaves were being sold in all towns.

The cultivation of tea began to increase from the 9th century and considering the enormous population and the widespead consumption

of tea among the Chinese, China must be considered as the chief tea-producing country in the world. In fact "China" and "Tea" have been inseparably associated. In China, tea is grown mostly on small farms of even 4 to 5 acres each. It is said that practically every cottager has his own little tea garden to supply the wants of his family and any surplus is sold. Tea estates or plantations, as we understand the terms, are very few. The methods and appliances employed by the Chinese in the manufacture of tea are very simple and practically the whole of the manufacture is carried out by the hand.

For centuries, the Chinese have been making "black tea" and "green tea". It was supposed that these were products of two species, *Thea bohea*, producing the black tea and *Thea viridis*, green tea. It was only in the middle of the last century that it was established that the question of green and black teas, as also the various qualities of these, was a matter of soil, age of leaf used and method of manufacture, and not to there being two botanically different species. In the Russian and North American markets green tea has been in demand and as the green tea prepared by the Chinese lacked the vividness of colour, artificial colouring of green teas was practised. Gypsum and Prussian blue are the most commonly used for this colouring or "facing" as it is called. The colouring is effected by thoroughly mixing the tea with a compound of calcined gypsum and Prussian blue. From 1911, however, the American market was closed to such artificially coloured teas. It is said that the Chinese themselves never use the artificially coloured teas.

Teas for home consumption and for the Chinese community abroad are often scented. Finished tea has the property of absorbing odours and the fragrant flowers of jasmine, orange and roses furnish the perfume. The flowers are moistened and mixed with the tea in varying proportions and the two left in contact for 10 to 14 hours, the heaps being covered with a cloth. The tea rapidly absorbs the perfume. The flowers are removed and the scented tea is then blended with unscented tea, the mixture being perfumed throughout.

For a very long time China was having a good overland trade in tea with Tibet, Siberia and Russia. In the absence of roads tea had to be carried on men's backs and so it was an advantage to have it in as compact a form as possible. Consequently the manufacture of "brick tea" became popular from very early times. Besides the compactness there is also the advantage that the quality and character of the tea are better preserved. For Tibet the brick tea is made from very cheap and coarse teas, including even stalks and twigs, and for Russia, "tablet tea" or small bricks are made using green and black tea dusts. The bulk of the dust used for these is of Chinese origin but during the past few years large quantities of siftings and dust are imported from India, Ceylon and Java.

During the past few decades the export trade of tea from China has been declining owing to the increase in production in other countries, particularly, India, Ceylon and Java and owing to the change in the taste of the people, particularly of the British Isles who prefer Indian and Ceylon teas to the Chinese. In 1864 the proportion of China tea in the world's exports amounted to 97%, while in 1911 it was only 24% and at the present time it is still lower. There is, however, a steady market for China tea in Russia and Tibet.

Tea in Japan. There is an interesting legend about tea. Dharma, a celebrated hermit, held in sanctity in Japan and China, was doing severe penance and had remained seated on the hard ground fourteen years without moving his body. He had also forbidden himself sleep. One night, however, he fell asleep. Indignant with himself for this weakness he cut off his eyelashes and cast them away, "as miserable tempters, sullying the sanctity to which he aspired." It is said that his eyelashes took root in the place where they had fallen and a bush shot forth, bearing leaves which the people of the country picked, and whereof they made an aromatic infusion which chases away sleep.

There is no doubt that tea was introduced into Japan from China in the ninth century. Its cul ivation on an appreciable scale probably took place in the thirteenth century. As in China, tea is grown in small plots by peasants but there are also some large plantations. The Japanese exercise greater skill in cultivation and manufacture of tea than the Chinese. The methods of manufacture are more improved and machines of a simple type are largely used. The tea produced in Japan is the green tea. The principal markets for Japanese tea are Canada and the United States.

There are some peculiarities in the cultural methods adopted in Japan. Tea is frequently grown in continuous hedges, a few feet apart, and not in separate bushes as in other countries. This method is said to result in heavy crops. Instead of pruning the bushes, they are clipped with shears after the main plucking. In the Uji district there is the remarkable practice of growing tea under artificial shade, the effect being the production of a better quality of leaf and of a darker green colour. Bamboo poles are fixed at intervals and arranged to support a suitable frame-work, over which bamboo mats or straw are spread. This provides shade to the growing plants. After the crop has been plucked the matting and straw are removed. The shade grown tea is greatly valued by the Japanese and it is grown practically for home consumption. Tea is often grown interplanted with mulberry, plums and pears. It is said that the area under tea has been declining owing to the greater interest taken in mulberry plantation.

Tea in Formosa. Cultivation of tea was introduced into Formosa early in the nineteenth century by some Chinese immigrants. But it was only in the seventies of the last century that tea planting was

carried on extensively. Like China and Japan, most of the tea gardens in Formosa are small and owned by peasants. The most noticeable feature in the cultivation of tea in Formosa is the practice of layering adopted on a large scale. It is said that nearly three-fourths of the tea grown in Formosa have been raised not from seed but from layers. It is believed that propagation by layering retains unimpaired the specific qualities of the tea and that deterioration sets in if the plants are raised from seed. Formosa produces the famous "Oolong teas" which have a distinctive flavour and possess a great reputation, especially, in the United States.

Introduction of Tea-drinking in Europe. There is no doubt that tea drinking was very common in the 16th century in China and Japan and that China must have had considerable export trade in tea for a very long time. In all probability Russian traders might have been the first to introduce tea in Europe. The first treaty between China and Russia was made in 1590 but no mention is made of tea in it. It is said that the Chinese Embassy took some chests of tea as presents to the Russian Court and that the Czar was so pleased with it that he sent a special messenger every year to the Chinese frontier to obtain a supply.

The use of tea had spread to the East Indies from China and Japan. It was conveyed to Holland by the Dutch East India Company. From Holland it was carried to England about the middle of the seventeenth century. In the *Mercurius Politicus* of September, 1658, there was an advertisement of the "China Drink called by the Chineans *Tcha*, by other nations, *Tay* alias *Tee*" as being sold in London. Thomas Garway was the first tea-dealer in England and in 1659 and 1660 he sold tea at prices varying from 15s. to 50s. per lb. In 1660 tea drinking was so general that an Act of Parliament imposed a tax of 8d. on every gallon of tea, coffee and chocolate made for sale. There is an entry in Samuel Pepys' diary for the 28th September 1660 which reads "I did send for a cup of tea (a Chinese drink) of which I had never drunk before" and "Home, and there find my wife making of tea, a drink which Mr. Pelling the Pothicary tells her is good for her cold and defluxions".

The East India Company began to take interest in tea. In 1664 the Company presented King Charles II with two pounds and two ounces of tea. The first importation by the Company was in 1669 and it consisted of two cannisters containing 150 lbs. In 1677 the Company had taken steps to secure regular supplies, the total quantity imported that year being 4,713 lbs. and it was at that time thought worth their attention as a branch of their trade, as tea was then sold in London at £ 5 to £ 10 per pound. The supplies of tea were got *via* Madras and Surat and not direct from China.

The annals of the East India Company record that in February 1684 the Directors wrote to Madras in these terms :— "In regard *thea* is grown to be a commodity here, and as we have occasion to make presents thereof to our great friends at Court, we would have you yearly to send us five or six cannisters of the very best and freshest that which colours the water in which it is infused most of a greenish complexion is best esteemed."

The import of tea was a private monopoly of the East India Company. The imports began to increase steadily and in the closing years of the seventeenth century it was said to average about 20,000 lbs. a year. In 1703 the imports were about 100,000 lbs.; in 1721 it attained 1,000,000 lbs. It is said that during the 100 years from 1710 to 1810 the sales of tea by the East India Company amounted in the aggregate to 750,470,016 lbs. valued at about £ 130 millions sterling.

By an Act of Parliament the monopoly of the East India Company was abolished in 1833 and since then owing to unrestricted trade, competition was stimulated and prices fell greatly. At the same time the taxation on tea was also gradually reduced. As a result of all these the consumption of tea increased. In 1836 the consumption was about 40 million lbs. while in 1880 it had increased to 160 million lbs. and at the present time it is about 500 million lbs.

Tea in India. On account of the very profitable nature of the monopoly of the China tea trade enjoyed by the East India Company, the question of growing tea in India did not present itself to the Company for several decades. Difficulties with China induced the British Government to urge strongly on the East India Company the desirability of raising tea in India. In 1780, seed was got from China and planted in Calcutta by Captain Kyd. But no progress was apparently made. In 1788, Sir Joseph Banks made a suggestion to Warren Hastings that tea might be grown in Bihar, Rangapur and Cooch-Bihar but the suggestion was not acted upon for some years. In the meanwhile, between 1821 and 1826 tea plants were discovered by Major Bruce and Mr. Scott in parts of Assam and Manipur. But serious attention was not paid to these discoveries. In 1834, Lord William Bentinck took up the matter and appointed a Committee to report on the most hopeful situations for an experimental cultivation of tea. Mr. Gordon was sent to China to procure seed and plants and to bring to India a few Chinese growers. In the meantime, the wild tea of Assam was re-discovered by Jenkins and Charlton. Gordon was therefore recalled from his voyage to China. A Commission was sent to Assam to report on the indigenous tea. They could not agree as to the plant met with in Assam and they recommended that for the purpose of the experiment "the China plant and not the degraded Assam plant" should be used. Gordon was sent again to China but he resigned without making a report.

A third mission was sent to China under the guidance of the botanist, Mr. R. Fortune, expenses of which were partly borne by the Royal Horticultural Society of England. The mission was successful. The true nature of black and green teas over which there was a controversy for many decades was explained. Mr. Fortune wrote three valuable books which contain full particulars of the Chinese tea industry and also details of the seeds, plants etc. conveyed by him to India. Experimental plantations were laid out in the district of Kumaon, in the Himalayas, and in Assam. The Government gradually ceased to take direct interest and the plantations were made over to private enterprise. The Sibsagar plantations were sold to the Assam Company in 1840 and this is the first tea concern in India.

The first consignment of Assam-made tea was sent to London in 1838 and it consisted of 488 lbs. and it fetched a price of 9 s. 5 d. per lb. This was manufactured under many disadvantages and consequently it did not afford any fair criterion as to what the possibilities of the future would be. The report of London experts was quite satisfactory although the tea had different characterisitics from those of China teas. The *Asiatic Journal* of those days had the following remarks about the British Indian tea.

"The decision of the public, however, has not been unanimous. Ladies particularly those of mature age and judgment, whose jurisdiction in all matters connected with the tea-table ought not to be disputed, were enthusiastic in their praises of the new tea, but many of the lords of creation, especially stout gentlemen, whose previous habits had better qualified them for discussing the merits of port wine and bottled porter, compared it somewhat irreverently to chopped straw, and some pleased to display their facetitiousness by observing that a mixture of gunpowder was wanted to make it go off."

In the fifties of the last century tea cultivation appeared to be so promising and attractive that speculators eagerly rushed into it. In a few years the whole of the upper portion of the province of Assam was under tea. Tea planting extended to Darjeeling, Chittagong and Chota Nagpur. It also began to extend to the Nilgiris, Wynaad and Travancore in South India.

From the seventies tea cultivation has been making good progress. The total production of tea in India is over 500,000,000 lbs. annually. The production in S. India alone is 65,000,000 lbs.

During the past ten years the production of tea in all the tea-growing countries had exceeded the demands and consequently prices fell so much that tea growing appeared to be unprofitable. In order to stabilise the industry there has been, during the past five years, an international agreement to restrict production and to control exports. This has worked so well that the industry has again become a fairly profitable one.

An interesting feature of the tea industry in India is the organised efforts of planters to increase the sales of their tea. For this there is a cess fund. At first this was a voluntary levy on the planters coupled with a contribution from the Government for the purpose of advertising Indian tea. This was done from 1893 to 1903 when a Tea Cess Act was passed making compulsory a small tax on all exported tea. The fund is administered by a representative committee and it is expended on many forms of advertisement both in India and abroad in order to enhance the demand for Indian teas. Considerable success has attended these efforts in the United States and Russia and in some countries of Europe. Consumption of tea in India itself has increased on account of this advertising. In South India alone, the consumption of tea was 4,027,107 lbs. in 1925 and 13,876,268 lbs. in 1936.

Tea in Ceylon. Up to the middle of the last century coffee cultivation was the most important in Ceylon, but, in the sixties, a terrible fungous disease (*Hemileia vastatrix*) ravaged the coffee plantations and in a few years the "leaf disease" had ruined many plantations. The planters turned their attention to other crops such as cinchona, cardamoms, cacao etc. but without much success. Then they turned their attention to tea and this retrieved their position. In fact, the modern tea industry of Ceylon was built upon the ruins of coffee-planting.

Although tea had been planted in Ceylon in 1839 and 1841 the first regular plantation was opened only in 1867. For a few years the increase in acreage was not very marked but from 1877 it began to increase rapidly. In 1877 the acreage was only 2,720; by 1887 it had come to 170,000 and in another decade to 350,000. Now there are 450,000 acres under tea in Ceylon. Some of the plantations are interplanted with rubber.

Tea in Java. Tea was introduced into Java by von Siebold in 1826. In 1828 the Dutch Government assumed control of the industry and established plantations which were let out on contract system whereby the finished tea was sold to the Government at a fixed price. This system did not work satisfactorily as contractors cared more for the securing of large quantities of tea while the quality of tea and the permanent well-being of the plantations were not cared for. The contract system was therefore abolished in 1860.

In 1852-53 Jacobsen imported better seed from China and practically laid the foundation of the modern tea industry in Java. In 1878 the "Assam Indigenous" variety was imported from India and from that date the Chinese tea has been replaced by the Indian tea. The climate and soil conditions are favourable. The average yield is very good but the quality is only medium. In Java modern machinery and methods are adopted for the manufacture of tea. From 1890 the industry has been expanding rapidly. Holland is the chief market for

Java tea but exports are made to Australia, the United Kingdom and Russia.

Tea in other Countries. In Africa, tea is produced in Natal and Nyassaland. It is, however, not of much importance. The bulk of the production is consumed locally. In Russia, tea is grown on a small scale in the Caucausus. Chinese varieties are found to be the best suited to the country. Tea-growing in the United States has been the subject of experiment for nearly a century. There are a few plantations in Carolina and Texas. Tea is grown on a small scale in Jamaica. It has also been grown in several localities in the Malaya. In Malacca and the French colony of Annam tea is grown to some extent. Small quantities are also grown in Mauritius, Fiji and the Andamans.

In Burma and the Shan States a peculiar form of tea is prepared known as the "Letpet" tea which is only consumed locally and not exported. It is used as a vegetable and only rarely used as a material for infusion. The young leaves are thrown into boiling water and allowed to remain for some time to get softened. They are then taken out and rolled by hand and then rammed down tight into the hollow of a bamboo and the top closed with a stopper of leaves. After standing in the shade for a couple of days with the stoppered end down, to drain off any water, the stopper of leaves is removed and the portion above the rammed in leaves is filled in with ashes mixed with a little water. The bamboos are buried underground until the "letpet" has matured. The tea pickled in this way is eaten with a little oil, garlic, fish, etc.

Other Teas and Tea Substitutes. Among the other "teas" the most important is the "Paraguay tea" or "Yerba de Mateē". This is prepared from the leaves of *Ilex paraguariensis* a shrub belonging to the holly family. It is found commonly in Brazil and Paraguay and in these countries it is also cultivated on a large scale, even as regular plantations. It is one of the most important economic products of South America and several million pounds of *mate* are used in the S. American countries and in small quantities even in Europe.

The "black drink" of the North American Indians known as "Youpon" is prepared from *Ilex cassine* found in the eastern and southern shores of the United States, for some distance inland.

The "Bushman tea" of South Africa is prepared from *Cyclopia genistoides*. "Bourbon tea" known also as "Faham tea" is derived from *Angraceum fragrans* which is found growing as an epiphyte on the trees of the forests of Bourbon and Mauritius. The green leaves of this have a persistent vanilla-like odour.

During the Great War many substitutes for tea appeared. It is said that a "*German Tea*" was prepared in 1917 by the consumers themselves and consisted of mixtures of leaves of myrtle, raspberry, strawberry plant, bramble, flowers of the lime, of heather, woodruff and camomile. The fruits of wild rose, apple peelings and dried apples were made use of. A special brand of tea consisted of "a chopped mixture of the flower of lavender and elder, liquorice root, leaves of coltsfoot, of the strawberry plant, of bramble, birch and water mint."

ROLE OF INSECTS IN RURAL RECONSTRUCTION

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Introduction. It is proposed to place before you a few items of work which could find a place in any programme of rural reconstruction, viz., beekeeping, Eri silkworm rearing, control of crop pests and sanitation. These subjects will show the part played by insects in rural reconstruction. They have been specially selected as the Entomological section is doing work in this direction.

Beekeeping. It will be admitted by every one that the lot of the ryots in these days is not an enviable one. The income from agriculture being poor, he has to look to other avenues to enhance his earnings. Beekeeping on scientific lines offers great scope as a cottage industry.

In the limited time at my disposal it is not possible to describe in detail the habits of the honey bees, how the different members of the colony are produced, their varied duties and the perfect organisation of a bee colony. I think, however, a few words should be said about the advantages of beekeeping as a subsidiary industry. In the first place this industry does not require much capital and this is a point in its favour especially in a country like India. A few hives and a honey extractor are the only important appliances needed for starting beekeeping and these require only a small outlay. A teakwood hive costs only Rs. 3 to 3—8—0 and a honey extractor depending on the size and metal used costs from Rs. 2—8—0 to Rs. 9. The small extractor costing Rs. 2—8—0 devised by the section is quite enough for a ryot owning a few hives. A hive is capable of yielding 15 to 20 lbs. of honey under favourable pasturage and weather conditions. Even if the average is taken only as 6—7 lbs. at the present price Rs. 7 to 10 may be got per hive per annum. It will thus be seen that this industry is a profitable concern.

In the second place, in many parts of our Presidency there is no dearth of bees or bee pasturage. The Indian bee can be procured without much difficulty. The bee paturage plants are also available in most of the districts throughout the year.

In the third place, the training required in beekeeping is not of a complicated nature. A working knowledge of the various items in the management of bees such as catching swarms and wild colonies, fighting against bee enemies, care of the colonies during the lean as well as the breeding seasons, extracting and storing honey, etc., can be gained in about a month. It is always safe to begin with a few colonies and increase them later on after gaining more experience.

Apart from giving us honey the bees are good pollinators and this is an additional reason for rearing bees. This aspect of their good work is not realised by many. The fruit grower and the florist have to depend mainly on insects for their pollination and among insects honey bees are the best.

Yet another reason why beekeeping should be practised is that honey is a good food in itself and also of medicinal value. Miss Kennedy Bell, an authority on beekeeping and one who was chosen by the British Broadcasting Corporation to deliver a course of lectures on beekeeping states as follows about honey.—"Honey is not and should not be considered as a luxury. It is a first class food and should be used as daily article of diet by every family ; it has been predigested by the bees and hence its purity and excellence. Cane sugar is actively poisonous to many people if it is taken in any quantity and to all if taken in large quantity ; but honey acts as normal producer of heat and energy. The value of honey cannot be over-estimated for children, invalids and aged, also for the ordinary hardworking man and woman. It is an easily assimilated food and as it is predigested by the bees it is of special benefit to weak digestive organs of elderly people. Every body can eat honey with impunity and digest it when often he cannot touch any other sweet food." Honey is also said to have medicinal properties and some of the publications on *Ayurveda* bear testimony to this fact.

There is yet another product of the honey bees, namely, wax. In scientific beekeeping, however, the wax combs are used over and over again for rearing brood and storing honey. It is not destroyed as in earlier days when honey had to be squeezed out of the combs.

After having stated the advantages of beekeeping, let me very briefly narrate to you the work of the Department under three heads—research, propaganda and training.—At the instance of the Director of Agriculture, Madras, an Apiary was started by the Government Entomologist during 1931 and there are at present about 40 bee colonies in working condition. The more important of the various items of research consist of the study of bee pasturage plants, bee enemies and their control, artificial feeding of bees, trials of range of flight, acclimatising the hill bee on the plains, bee appliances, etc., and very interesting results have been obtained from these lines of investigations. In addition to research, a good deal of propaganda is also being done by the section and the district staff. Demonstrations in hiving bee

colonies, and in the care and management of bees, etc., are being held in different parts of the Presidency. Bee colonies, samples of pure honey as well as the necessary apicultural requisites are being exhibited in most of the exhibitions and fairs and these, as a rule, attract numerous visitors—Attempts are also made to sell as many hives, extractors, etc., as possible to the public. Literature on bee-keeping—scientific as well as popular—is being published. To meet the numerous demands for advice from the public a popular account of the subject was prepared by Mr. S. Ramachandran, Assistant in charge of the apiary and published as bulletin No. 37 of this Department and a revised second edition of the same has already been issued. A Tamil translation of the above bulletin is also being got ready. As these are priced publications a short pamphlet on "Practical hints on beekeeping" has been prepared recently and sent to the press. Special mention should also be made of the "Honey Week" organised by the Section in April last and conducted throughout the Presidency. In addition to research and propaganda, about 25 students are trained every year in the theory and practice of bee culture. Besides these students, 27 departmental officers were trained during last year and it is hoped that these officers will try their best to popularise the industry in their respective sub-circles.

Ericulture. The silkworms are yet another of the useful insects. The two important worms in this Presidency are the Mulberry and Eri silkworms, and as there is a paper on the former by Krishnamurti* a few facts about the latter alone are given here. Ericulture has also some scope as a cottage industry. The worms are fed on castor leaves. The silk produced by them though not as good as mulberry silk is stronger, finer and more durable than cotton. Unlike mulberry silk, the thread is not continuous and as such it should be carded and spun like cotton.

The acreage under castor in this Presidency is about three lakhs. As the crop is grown by many ryots there will not be any dearth of food plants. The climatic conditions are such that the worms can be reared in many places throughout the year except for two or three months during the hot season. The necessary rearing appliances are not costly either as these consist of a few bamboo trays for rearing worms, a few baskets for placing the mature worms for spinning cocoons and a shelf for keeping rearing trays. The worms are fed at regular intervals but feeding them is not a difficult process. One advantage in the rearing of eri worms is that no life is taken and the moths are allowed to come out of the cocoons. This is not so in the case of mulbery worms where the thread produced is a continuous one and as such the pupae will have to be stifled to prevent the thread being broken by the emergence of adult moths.

* *The Madras Agricultural Journal*, 25; 239—244 (1937).

Now a word about the economics of ericulture. An acre of castor yields between 6000 and 8000 lbs. of leaves. About 80 lbs. of leaves will be required to feed sufficient worms to produce 1 lb. of cocoons. Taking 6000 lbs. of leaves per acre we get 75 lbs. of cocoons. One maund (82 lbs.) of pierced cocoons sells at Rs. 55 to 60 in Assam.* It should, however, be stated that one drawback at the present time is that there is no market for cocoons in Madras. The Industries Department when addressed on the subject has stated that in case the silk is spun into cloth they will try to find a market for it. Perhaps the formation of co-operative societies for the purchase of cocoons and spinning cloth will solve the problem.

Control of Crop Pests. Till now we have been dealing with insects which help us in rural reconstruction. It should, however, be remembered that there are many insects which devastate our crops and are thus our enemies. The work of the Entomologist is a continuous struggle against these marauders but thanks to the researches into the life histories and habits of these insects it has been possible to cope with many of them. Especially is this so in the case of kitchen garden crops grown in villages near important towns. In such places there is great scope for growing vegetable crops and flower plants. Pests, such as plant lice on lablab, *Epilachna* on brinjals, *Papilio* caterpillar on curry leaf, the cabbage caterpillar (*Plutella*), cockchafer beetles on roses, the jasmine bug, the chrysanthemum caterpillar, etc., can be dealt with by agricultural, mechanical and insecticidal methods and as such the growing of the crops should prove to be a remunerative concern.

Sanitation. It is a well known fact that insects are very important in connection with disease. Malaria, yellow fever, filariasis, etc., are transmitted by mosquitoes. Sleeping sickness, a terrible disease prevalent in Africa, is transmitted by tsetse flies. Fleas have a great part to play in the spread of plague, and bedbugs are accused as carriers of Kala-azar fever. The house flies are responsible to a great degree for the spread of diseases like typhoid (enteric), dysentery, cholera, tuberculosis and diarrhoea. Howard, the well known entomologist, in one of his publications, states that the house flies should be known as typhoid flies, so as to focuss the attention of the public on these extremely dangerous insects. There is no exaggeration in saying that house flies are the filthiest of insects and their habits the most disgusting. They breed in all sorts of filth, human excreta, decaying vegetable and animal matter, manure heap, etc. They feed on the matter contaminated with germs and then settle on our food and infect it with germs carried on the different parts of their body. It has been found by examination that six million germs have been carried by a house fly. I am sure every one will agree with me that

* Messrs. Haribuksh Lachminarayan, Fancy Bazar, Gauhati will be willing to purchase cocoons at the above rates, Gauhati delivery.

the flies which carry such huge numbers of germs are a danger to public health, and those who kill them should be regarded as good citizens doing service to humanity in general and to themselves in particular. Some work has been done in connection with the control of house flies by the Entomology section. The use of what are known as 'Minnesota' and fly maggot traps has given some measure of success. The former devised by Washburn for trapping adult flies is about 2 ft. long, 1 ft. high and 8" wide. It consists of three portions, a base board with two bait pans, another board which carries two wedge shaped structures having wire gauze sides open at the top and bottom and a wire gauze cover for encapping the adult flies trapped. Baits are placed in the two receptacles and flies attracted by the bait enter through the space between the two boards and feed on it and later, fly up through the slits and are practically imprisoned inside the wire gauze receptacles. Jak fruit, sugarcane, meat, fish, etc., were tried as baits and of these fish, slightly putrified gave the highest catches. In one day as many as 6081 flies were caught in one of these traps. The cost of the trap is Rs. 5 and the cost of meat or fish used as bait will be about 4 to 6 annas per month.

The fly maggot trap as the name implies is for trapping maggots. It consists of a wooden frame work enclosed by wire netting all round and is open above for dumping in manure. This is provided with a zinc drain filled with water. The maggots which breed in the manure heap in the course of their wanderings fall into the drain and are drowned. The trap is to be gradually filled with manure until it is full. Assistant Entomologist, T. V. Subramanya Ayyar has been conducting certain experiments to make the dung more attractive to the flies for egglaying. Of the various substances tried by him such as citronella oil (at a strength of $\frac{1}{4}$ oz. per gallon of water) and gingelly oil cake (3 ozs. per gallon of water soaked overnight) were found to be the most effective. Of the two, gingelly oil cake being easily available and cheaper, should be preferred. A galvanised iron sheet, bent along the length and hung up a little above ground level and filled with manure as in the other case has been found to serve the same purpose. In this case the maggots travel along the length and drop down at the ends and can be trapped in mud chatties below the two ends.

It has to be admitted in this connection that traps such as those mentioned above help the reduction of flies only to a limited extent. The most important thing however is to attend to the breeding places of flies. The proper disposal of night soil, village and town rubbish etc., will to a great extent solve the problem for which the co-operation of the health officers is necessary.

Conclusion. There are other ways as well in which insects affect man but I hope I have placed enough material before you to show the part played by them in rural reconstruction.

NOTES ON SOME IMPORTANT FORAGE AND PASTURE GRASSES

BY T. R. KESAVAN, D. V. M., F. F. Sc.

The value of pastures has long been recognized and studied by investigators in many parts of the world. There has recently been a renewed interest on the subject in India. Such development in nutrition as the necessity for vitamins, the importance of mineral salts and the effects of deficiencies of these food factors furnish a broader basis of study than previously existed. Pasture grasses are particularly good sources of vitamins, minerals and in many cases a high grade of protein.

Inquiry has now been extended into the nutritive value of pastures, the deficiencies that may occur in them, and means of increasing their value by the use of well-selected food supplements on the one hand, and the enrichment of the soil and pasture management on the other.

The nutritive value of many varieties of grasses and legumes, both native and exotic, have been tried in the various stock farms and breeding stations of Japan, Philippines and Java of which some of the most important forage and pasture crops that may show promise in India are the following:—

Pasture Grasses: **Kikuju grass** (*Pennisetum clandestinum*). It is a first class tropical pasture grass for dairy animals that they like and will eat readily. All kinds of poultry also like this when it is young and tender. This grass is light green in colour and is used extensively for lawns, parks and playgrounds in many towns of Japan, Java and Malaya. It thrives best at altitudes of 1,600 feet or more, where there is sufficient moisture throughout the year, where it will form a thick mat-like growth when planted in rich soil. The grass does not seed and must be propagated from roots or cuttings.

Rhodes Grass. (*Chloris gayana*). This grass is considered as a dual purpose grass in Japan and is extensively used there for grazing purposes and also for curing into hay. It should not be grazed during the first year after planting as it roots very shallowly during this time and the cattle may pull it up by the roots. But after the first year the root system is sufficiently developed and it will stand grazing.

Bermuda Grass. (*Cynodon dactylon*). In Philippines this grass stands the dry season better than any other kind of grazing grass. It was imported there from Australia and is found throughout the lowlands in that country. It is very useful for lawns and poultry runs.

Dallis Grass. (*Paspalum dialatatum*). This grass is extensively used as a pasture grass for dairy cattle in Queensland. It grows well

in moist soils and produces dense masses of palatable stems and leaves of dark green colour. Where weeds are eliminated it grows very well and reseeds itself. It may be considered as a valuable pasture grass in localities where the rainfall is more or less frequent throughout the year.

Carpet Grass. (*Paspalum compressum*). This grass is well liked by all kinds of herbivorous animals as well as poultry. The growth is short and eventually forms a mat-like covering of the ground which gives the sensation, when walking on it, of a thick carpet. It is a very promising pasture grass in localities where there is sufficient moisture throughout the year.

Buffaloe Grass. (*Paspalum cojugatum*). It is a common tropical pasture grass. Cattle, buffaloes and sheep eat it readily but horses are not fond of it. It will grow abundantly and often forms pure growths in shady places, especially in low ground.

Para Grass. (*Panicum Barbinode* Trin) It is also a tropical grass and is liked by cattle and buffaloes and, when tender, by horses and other stock. It is a very nutritious one but coarse and growing horizontally, producing roots readily and growing best in moist soils.

Natal Grass (*Tricholaena rosea*) It is a variety of Red top ox-herd's grass, of which there are a number of varieties belonging to the same family. It was imported into the Philippines from Australia planted in various stock farms in that country and it is considered as a dual purpose grass there. All classes of herbivorus animals eat it readily. It is also used for making a low grade hay and fed to cattle mixed with other kind of hay in the Phillippines.

Molasses Grass ; Varagua, Gordura and Braziliam Stink grass. (*Melinis minutiflora*) This grass is a native of Brazil, where it is propagated in large areas for fattening beef cattle for the market. It was imported into Japan and seen growing well in some stock farms at Tokyo. Cattle are very fond of this grass when it is young, but after it flowers which is usually in November, in Japan stock will not eat it readily, particularly so if the animals are not accustomed to eating it when it is young. The grass emits an odour, especially before it flowers, which resembles somewhat the odour of molasses.

Bungalon. (*Homalocenchus hexandra*) It is seen growing around Manila city. Cattle, sheep and goats readily eat it.

Barit. (*Leersia hexandra*) This is cultivated abundantly in many towns in Java and Philippines and sold in small bundles to 'Tonga Wallas' there as a cut feed for horses. It is reproduced by cuttings. It roots readily at the nodes if there is plenty of moisture in the soil. Cattle are fond of this grass and will readily eat it.

Silage Crops. Milo maize (*Holcus sp.*). All classes of farm animals, including swine and poultry, will eat the seeds readily and they are considered to have 50% of the feeding value of corn. Generally it is raised as a silage crop. It thrives under the same condition as for corn and is cut and fed when the grain is in the dough stage. It is best fed when put through a feed cutter, stalks, grain and all.

Sudan grass (*Holcus sudanensis*). Sudan grass is a member of the grain sorghum family, as is milo maize. It is best not to plant both of them on the same farm or, if this is done, they should be planted far about in order to prevent them from hybridizing; as the hybrid plant, particularly the seeds, are somewhat dangerous to stock that eat them. This grass may be fed as a silage or, if conditions are favourable, cut when the seeds are in the dough stage and sun-dried into hay. It is a valuable dairy-animal feed and it may also be fed to horses either as a silage or as hay. It is a heavy yielder and may be cut three or four times during one cropping season.

Japanese Cane; Uba Cane (*Saccharum Japonicum*). It is cultivated in many stock farms in Japan as a succulent hog feed during the dry season; the leaves and tops fed to cattle, sheep and goats and the stalks cut into short pieces and fed to hogs. They will chew them for the juice and spit-out the fibrous portion. Hogs are very fond of the juice and it is believed to be the best green feed that can be raised for them, without irrigation, as a dry-season feed.

Napier Grass. (*Pennisetum purpureum*). This grass resembles Uba Cane in appearance and is a heavy yielder and may be cut repeatedly without being transplanted for a number of years. It is believed that it is more palatable and a better feed for horses than guinea grass, and they will do fairly well on it if they are fed with supplements of suitable concentrates with it.

Guinea Grass. (*Panicum maximum*). Guinea grass requires more care than Napier grass and should be transplanted, from the roots, at least every three or four years to prevent the bunches from becoming root-bound. All animals are very fond of the grass and also can be fed as a silage feed for riding ponies.

Japanese Millet. (*Panicum frumentaceum*). It is the best dairy cow's feed in Japan. The animals are very fond of it and would eat it in preference to any other kind of green feed offered to them. It is believed that it increases the milk production of dairy cows and goats when fed with it. It may be fed as a silage and if properly cured makes also a very good hay for dairy animals.

Teosinte. (*Euchlaena Mexicana*). Teosinte has about the same feeding value as has a good quality of green corn fodder for dairy cows. It is extensively cultivated in many stock farms in Japan and Philippines and fed as a silage for cattle there.

Legumes: Cowpea. (*Vigna unguiculata*). Cowpea is a very good feed for dairy cattle, fed as silage or as a hay mixed with some other kinds of hay in order to prevent cattle bowel disturbances. Poultry are very fond of the peas, as well as milo maize and adlay seeds. These three make a very good combination and variety of poultry feed when planted in their runs or yards.

Soy Beans (*Glycine hispida*). Soy beans are planted and used as a silage for riding ponies and dairy cattle in many stock farms. It is very rich in vegetable protein and also can be used as a hay.

Velvet beans (*Stizolobium deeringianum*). The dried beans have about the same nutritional value as wheat bran and the beans may be ground and mixed with other concentrates and fed to swine and cattle. They can be planted in rice stubbles immediately after the plants have headed and can be grazed by cattle when they are in the flowering stage. After the rice is headed and the long stubble retained they will serve as support for the climbing plants to keep them off the ground. In this way, they serve a dual purpose; as a good feed for the animal and as a fertilizer.

Tapilan Beans. (*Phaseolus calcaratus*). They have been also planted in many stock farms and used for the same purposes as for soy beans. Dried leaves of Tapilan beans may be ground fine and used also as a poultry feed.

Dry Roughage: Rice Hay:— It is believed to be reasonably satisfactory as a feed for horses and cattle when cut at the proper stage and cured without being wet.

The most important problem is its storage, should be prevented from getting wet, otherwise its mineral content may be lost. It is advisable to bale it when dry so it would occupy less space. When feeding, if possible chop hay into pieces, 2 or 3 inches long to decrease wastage.

Corn Fodder and Corn Stover. Like rice straw, corn fodder and corn stover are merely a maintenance roughage and should be cut in the proper stage and stocked until the ears harden. These should then be husked and the fodder put through a corn chopper, and the cut pieces (stover) may be fed to cattle. The chief difficulty in feeding corn fodder is similar to that in curing hay, i. e., moulding when it is a little on the green side, or when it gets wet.

Conclusion. Forage production is regarded as a very important phase of Agriculture in any country, and the need for better forage and pasture grasses for different classes of animals has been an important problem in the development of the livestock industry, and in tropical countries it may be considered doubly so and a real problem. Certainly if we could grow more nutritious feed we could raise much better livestock.

SELECTED ARTICLE

SCIENCE AND THE CONSERVATION OF FOOD

Agencies Affecting Foods. There are many agencies, biological, chemical and physical, which may affect foodstuffs, either by spoiling their appearance or rendering them unfit for consumption. Bacteria are most important among the biological factors, but yeasts and moulds, which may either aid or hinder preservation, have also to be considered; and then there are such animal pests as sugar and cheese mites, moths, rats and beetles, all of which may damage the raw material used in food manufacture, or attack the finished products.

Food products have also to be protected from heat, dampness, the oxygen of the air and sometimes from light as well. These last two factors, acting in association, produce the bleaching or discoloration which is sometimes seen in bottled fruit, when pieces of the fruit project beyond the syrup into the space at the top of the bottle. Then again, canned food must be protected from the action of acids and salts which might corrode the tin.

There are also substances contained in the food-stuffs themselves which may have a destructive action, namely, the enzymes. These are present in both vegetable and animal cells but they can exist independently of them. One enzyme having an important bearing on food preservation in connexion with jam-making is pectase, which, if it is allowed to do so, will destroy the pectin which is responsible for the "setting" property of jam. Jam, in fact, presents a number of problems to the manufacturer, and the way he has been helped to solve these is a good example of the assistance which science has rendered to industry.

Jams. Substances of importance for the keeping quality of jam are held in solution in the water it contains, for example, sugar, acids and salts. The osmotic pressure of these substances, the sugar in particular, can be responsible for protecting the jam from the growth of moulds, because, for germination, a mould spore must first absorb water. If the osmotic pressure of the jam is equal to or greater than that of any spore which falls upon it, either no water will pass from the jam to the spore or the spore will lose water and so dry up and eventually die, and in both these cases its further development will be arrested. The British Food Manufacturers' Research Association has actually determined the minimum percentage of solids necessary to bring about this condition.

There is, however, still a risk of moulds developing in a jam if the relative humidity of the atmosphere to which it is exposed is above 82 per cent. Then the jam will absorb moisture and so its osmotic pressure becomes lower than that of the mould spores.

Another defect frequently arising in jams is crystallization or granulation of the sugar. In the jam-making process, sucrose is inverted by the boiling acid, and it is necessary that just the right degree of inversion should take place if no crystallization is to occur. Thus if the sugar is under-inverted too much sucrose is left and this crystallizes out. If, on the other hand, it is over-inverted, too much dextrose is formed and this crystallizes out. As fruits vary very much in the amount of acid they contain, the manufacturer must be able to discover the degree of inversion taking place, and modify his process accordingly.

The setting property of jam has already been mentioned, and it is important to remember that unless jam is properly set it cannot be transported and handled. It is therefore necessary to make use of the pectin naturally occurring in fruit cells. Pectin is a complex of different substances and therefore its properties vary from one fruit to another; for this reason the setting properties of some

fruit juices are superior to those of others, for example, goose-berry is poor. Now, pectin must be protected from the naturally occurring enzyme, pectase, which destroys it. So long as the cell structure remains intact, the pectase does not attack the pectin, but in fruit which has become damaged by bruising, the pectase appears to get out of control, and in the case of raspberries all the pectin may disappear in twelve hours. In this fact lies the justification for manufacturers using "added fruit juice" or "pectin" in the making of jam.

Pectin may also lose its jellifying powers by the action of prolonged heat. It is therefore necessary to eliminate any over-heating in the manufacturing process, and this is not always easy when large quantities of liquid have to be dealt with.

Meat Products. The processes of jam-making are more familiar to the public than those of meat preservation. An important difference to bear in mind is that meat has no natural acid to assist the preservation process. Meat, if it is to be kept must be protected from putrefactive bacteria, which though harmless in themselves feed upon animal and vegetable debris, gradually converting them into ammonia and carbon dioxide etc.

Refrigeration deprives the bacteria of water which is necessary for their growth, the water in the meat tissues being converted into ice. The bacteria are not necessarily killed, but their development is inhibited. Some of the bacteria can grow at temperatures around freezing point, and for this reason chilled meat cannot be kept so long as meat which is frozen at temperatures well below freezing point. The growth of bacteria can also be restrained by certain concentrations of carbon dioxide in the air.

Although the spores of some bacteria are highly resistant to heat it has been possible to use heat sterilization as a method for meat preservation. It is of course necessary for the manufacturer to know the combinations of time and temperature at which all spores likely to be present will be destroyed. Allowance must be made, when the product is packed in a tin, for the penetration of heat to the deepest part of the package; and the rate of penetration will vary considerably with the density of the contents, being much slower for meat than for a tin of fluid.

Food Poisoning. A product canned by correct processes is one of the safest articles of diet it is possible to have, and many complaints made to manufacturers that their products have caused illness, have shown on investigation to have no justification. According to Prof. Tanner of Illinois (speaking at the Congress of Microbiology, 1936), in the past canners and distributors have tried to avoid publicity by settling their claimes out of court. Medical practitioners are often unfamiliar with the procedures necessary to establish definitely the causative factors in food poisoning. There is also much prejudice on the part of the public as well as ignorance of the great care generally taken in the manufacture of these products. It has been shown in Great Britain and the United States that by far the largest number of cases of food poisoning are caused by foods which have been prepared in the home or by products sold in a pre-cooked condition but not sterilized.

Tinplate Containers. A difficulty, still not completely solved, is that of producing in commercial quantities the perfect tinplate for the construction of a can, or tin stopper for a glass jar. Then also, the machinery necessary in making the can may break the tin coating and expose the base metal, iron. The iron thus exposed may be attacked by the salt present in meat and vegetable products. An attempt has been made to produce a lacquer which when applied to the tinplate would prevent this action. Several difficulties have so far prevented the realization of this ideal.

Preservation of Meat. The preservation of meat by means of salts has long been practised, but only recently have its scientific principles been studied. The production of colour as well as preservation from putrefaction is brought about by the use of saltpetre. Bacterial action converts the nitrate of the saltpetre into nitrite, which combines with haemoglobin, and when the meat is boiled the latter is converted into nitrohaemochromogen, which has the bright red colour characteristic of properly cured silverside. The micrococci responsible for this action can grow in media containing as much as 20 per cent. of salt, in which concentrations the putrefactive bacteria cannot exist. Nor can their spores develop in media containing as much as 10 per cent. of salt.

Chocolate and Confectionery. Changes in atmospheric temperature and humidity are liable to produce changes in chocolate and confectionery. The British Food Manufacturers' Research Association has given manufacturers a great deal of help in determining the conditions necessary for the production and storage of satisfactory chocolate. In the factory, it is generally possible to secure these conditions, but in retail premises it is not so easy. If the manufacturer were able to deliver his goods direct from his warehouse to consumer, defective products would not be so commonly seen as they are at the present time.

(*Nature*, July 31, 1937.)

Research Notes.

The Moringa Hairy Caterpillar.

Eupterote mollifera, Wlk., commonly known as the moringa hairy caterpillar is a pest of *Moringa pterygosperma* in South India. Though Lefroy, Fletcher and Ramakrishna Ayyar have made mention of this insect in their publications, no detailed account of it has been given by any of them. Hence the studies on the pest.

The moths are about 50 to 60 mm. and yellow in color. Pale yellow eggs are laid in clusters on the stalks of the moringa leaves and measure 1 mm. in diameter. The egg period varies from 14—18 days. The newly hatched caterpillars are 2 mm. long and 0 5 mm. broad with reddish head and yellowish pink body on which are seen numerous warts with black and brown hairs. The caterpillars are gregarious in habit and feed at night on the leaves of the food plant and rest during day time on the tree trunks. They undergo five moults. The mature caterpillars are 30—40 mm. long and 4 to 5 mm. broad. When the caterpillars are full grown they leave the food plant, enter the soil and pupate in cocoons made of silk covered with hairs on the body and particles of soil. The larval period is about 41 to 46 days. The pupae which are brown in color are 15—20 mm. long and 7 mm. broad. In about 27--30 days adult moths emerge from the pupae. The total life cycle of the pest ranges from 82 to 94 days.

The pest is known to do serious damage to moringa in some cases by defoliating the trees. In addition to moringa it has been noted recently on portia (*Thespesia populnea*) planted as avenue trees in Korukkai (Tanjore Dt.). It has also been recorded from Ceylon on *Erythrina*. An egg parasite has been collected at Coimbatore but is not found in sufficient numbers to check the pest. As the caterpillars have got the habit of resting on tree trunks in groups in large numbers they can be destroyed by burning them with a lighted torch or by spraying *Lotal* at a strength of 5 ozs. in 1 gallon of water. Care should be taken to see that the caterpillars are not handled as they have irritating and poisonous hairs. The pupae may also be destroyed by raking the soil round about the food plants as the caterpillars go to the soil for pupation. Detailed studies regarding other remedies are in progress.

Agricultural Research Institute, Coimbatore. 15th October '37.

M. C. Cherian.
M. Basheer.

ABSTRACTS

The Effect of Processing on Vitamins in Fruits and Vegetables—A Review, C. R. Fellers. (*Massachusetts Agricultural Experiment Station, Bul. No. 338*, December 1936). The effects of storage, freezing, drying, and thermal treatments on the several vitamins are discussed at the end of the respective chapters. A bibliography of 235 references to the literature is appended.

Generally speaking, ordinary storage and to a lesser extent cold storage in air have no serious effect on vitamins D, E and G; have a slight to moderate destructive action on vitamins A and B; and cause serious loss of vitamin C, particularly when storage is long continued. Losses are reduced when storage is near the freezing point. Shipped-in vegetables may lose substantial quantities of vitamin C during shipment and incidental marketing operations. This is not true in the case of most fruits and such acid vegetables as tomatoes and rhubarb. Properly packaged frozen fruits and vegetables show practically no losses in any of the vitamins even after long storage at 0°F or below.

Destruction of vitamin C is very rapid when frozen fruits and vegetables are defrosted in air. Little loss in vitamin C occurs if solidly frozen vegetables are cooked in boiling water without previous defrosting. Sun-drying is more destructive to vitamins A and C than artificial dehydration. Fermentation of fruits and vegetables is injurious to vitamin C.

In general, heat treatments such as cooking and canning are not injurious to any of the vitamins, but the accompanying oxidations and other destructive reactions, unless carefully controlled, are decidedly injurious to vitamins B and C. Fruits or vegetables containing added acid may be heated with less destructions to vitamins B, C and G than non-acid foods. Thus, canned fruits retain vitamin C very well, while canned vegetables lose much of their original C. Modern methods of vacuumization and air removal and sealed packaging now used in the food preservation industries are practical aids in preventing vitamin losses through oxidation. It is not believed that cooking and canning are harmful to the vitamins A, G, D and E of fruits, vegetables and cereals.

Heat in the presence of alkalies is very destructive to all the vitamins. Rapid cooking, with minimum exposure to air, serves to minimize losses of vitamins C, A, and B.

Food manufacturing operations such as blanching, openkettle cooking, pulping, and filling containers are ordinarily destructive to vitamins C and probably to a lesser degree to B and A as well.

There is no satisfactory evidence that foods once canned lose appreciable quantities of any vitamins on storage. Losses of vitamins C and A in reheating canned foods for table use are small. Large quantities of the water-soluble vitamins B, C, and G are dissolved in the cooking water of fruits and vegetables and are lost unless this cooking water is utilized. In conclusion, it should be borne in mind that this field of research is in an active state of change. The literature is being multiplied very rapidly. There is still need for much more research before all the effects of environmental factors on vitamin stability can be stated with finality.

Studies of the Physiology of Coffea arabica. I. Photosynthesis of Coffee leaves under natural conditions. Nutman F. J. *Ann. Bot.* (N. S.) 1 : (3) 353—367 (1937).

The disease of *Coffea arabica* known as 'overbearing and die-back' prevalent in the coffee growing areas of E. Africa is explained as due to the heavy demands for carbohydrate by the developing crop which exceed the total daily photosynthetic activity. The branches then die-back, roots degenerate and the tree is

injured and remains unproductive. Since shortage of carbohydrate is associated with this disease, the author has presented the results of his investigations into the rate of carbon assimilation under field conditions by leaves of *Coffea arabica* growing in the Northern Province of Tanganyika Territory.

The apparent rate of assimilation for whole trees as well as the diurnal march of assimilatory rate for single attached leaf are determined under different degrees of sun and shade and full data are presented which show that the rate varies directly when the intensity of light is low but is inversely proportional in high light intensity. The total daily assimilation is greater under a moderately shaded condition than in full sunshine, and that during cloudy weather, the assimilation rate remains at a fairly constant though low value, while in the sun the rates show a large depression during the midday hours. These studies show why the coffee plant assimilates better under shade and why the plant can stand heavy bearing better under shady conditions than under exposure to intense sun-light.

V. T. B.

The control of the leaf spot disease in young Coconuts. Tammes, P. M. L. *Landbouw*, 13 : 69—73 (1937). The writer's observations in Java indicate that freedom from grey spot or leaf blight of coconuts (*Pestalozzia palmarum*) : R. A. M., xv, p. 15) may be ensured by the provision of light shade, e. g., *Sesqania grandiflora* cuttings, during the first two years after planting. Such conditions frequently obtain in native plantings, where the seed nuts are kept under shade in the gardens or planted out in maize fields. In a test in 1936 the incidence of infection in shaded plots was only 2 per cent. compared with 46 per cent. in exposed sites. Excessive shade, however, should be avoided as tending to weaken the development of the plants. (*Rev. Appl. Mycol.* 16 : 529).

Gleanings.

Controlling Growth of Weeds. Sulphuric acid spray as a method of controlling the growth of weeds in fields of grain is gaining ground in the United States. Tests covering several years and several thousand acres of grain fields in California have demonstrated the effectiveness of this method. During the present season more than 6000 acres are being kept free from weeds by spraying with solutions of sulphuric acid which kill weeds but do not injure the growing grain. This is a meagre beginning when in California alone there are more than half a million acres that could be benefited and when the vast grain fields of the mid-west and the Pacific Northwest have not yet been touched. In France the treatment is already applied to more than 500,000 acres and its use is growing in England and on the Continent. The California development includes testing new, more efficient types of sprayers to cover larger areas more effectively. (*Scientific American*, September 1937).

Treat ulcers by continuous drip of milk into stomach. A continuous feeding of milk, drop by drop, into the patient's stomach is the new method of treating stomach ulcers reported by Dr. Asher Winkelstein of New York.

Frequent feeding of small amounts of milk and cream has for years been part of the standard medical treatment of stomach ulcer. The milk, together with alternating doses of alkaline powders such as bicarbonate of soda, is given to neutralize the acid normally secreted by the stomach but which irritates the ulcer and prevents its healing.

Dr. Winkelstein's modification of this method into a constant feeding of milk, a drop at a time through a tube, is based on studies of stomach secretion, especially at night.

The importance in connection with stomach ulcers of nervous over-secretion of acid by the stomach was emphasised by Dr. Winkelstein.—Science Service. (*Scientific American*, September 1937).

Oil and Cake Products from Coffee. It is stated that German chemists have been co-operating with the Brazilian authorities in order to discover uses for the surplus Brazil coffee crop and that the President of the National Coffee Department has received a report from the Brazilian technical representative in Germany reporting the success of an experiment for the extraction of subproducts from coffee. It is claimed that 13% of high quality oil has been extracted from coffee beans, compared with 20% extracted from soya beans, while the residue provides first class cattle cake. It is hoped that the discovery will in future prevent the unnecessary destruction of surplus coffee. (*Chemistry and Industry*, September 18, 1937.)

Review.

The Punjab Fruit Journal. Feroz Printing Works, Lahore.

The *Punjab Fruit Journal* is a quarterly journal and an organ of the Punjab Provincial Co-operative Fruit Development Board. It is perhaps the first of its kind in India, and the most important feature of the Journal is its bilingual character. The articles are published in English and in Urdu. The journal meets the keen demand that exists for popular literature on cultivation of fruit plants, and preservation of fruits. It aims at building up the fruit industry of the Punjab on scientific and economic basis and it has rendered much help in uniting the fruit growers, and keeping them informed of the beneficial activities of the Punjab Fruit Development Board.

In the third issue of this journal there are four interesting articles in English, namely, "Is there real danger of over-production of fruit in Punjab", "Some salient points about nitrogen carrying fertilizers". "Physiology and nutrition of pruning", and "Tomato juice—its preparation and preservation" and the notable items in the Urudu section are "Propagation of stone fruits", "Manuring of oranges", "List of fruit commission agents of U. P." and "Seasonal hints".

The annual subscription is low, being Rs. two only; it can be had from the Secretary, Punjab Provincial Co-operative Fruit Development Board, Lyallpur.

(J. S. P.)

Crop & Trade Reports.

Paddy—1937-38—First Forecast Report. The average of the areas under paddy in the Madras Presidency during the five years ending 1935-36 has represented 15·3 per cent. of the total area under paddy in India.

The area sown with paddy up to the 25th September 1937 is estimated at 5,893,000 acres. When compared with the area of 6,010,000 acres estimated for the corresponding period of last year, it reveals a decrease of 1·9 per cent.

The estimated area is the same as last year in Coimbatore and Tinnevelly; it exceeds the corresponding area of last year in West Godavari, Kistna, Kurnool, Cuddapah, Nellore, South Arcot, Salem, Tanjore, Ramnad and the Nilgiris. The decrease in area in other districts is generally attributed to insufficiency of rains and of water supply in tanks.

The first crop of paddy is being harvested in parts of Tanjore and on the West Coast. The yield is expected to be about normal. The condition of the standing crop is generally fair.

The wholesale price of paddy, second sort, per imperial maund of 82⅔ lb. as reported from important markets on 4th October 1937 was Rs. 2-12-0 in Chittoor, Rs. 2—10—0 in Vellore, Madura and Tinnevelly, Rs. 2—9—0 in Virudhunagar, Rs 2—7—0 in Masulipatam and Trichinopoly, Rs. 2—6—0 in Vizianagaram, Ellore, Bezwada and Guntur, Rs. 2—5—0 in Cocanada and Rajahmundry, Rs. 1—15—0 in Negapatam and ranged from Rs. 2—2—0 to Rs. 2—4—0 in the other markets. When compared with the prices published in the last report, i. e., those which prevailed on 8th February 1937, the prices reveal a rise of 30 per cent. in Trichinopoly, 29 per cent. in Negapatam, 25 per cent. in Kumbakonam, 23 per cent. in Cocanada, 20 per cent. in Madura and Tinnevelly, 17 per cent. in Mangalore, 16 per cent. in Rajahmundry and Cuddalore, 15 per cent. in Ellore and Masulipatam, 12 per cent. in Bezwada and 9 per cent. in Guntur.

Sugarcane—1937—Second Report The average of the areas under sugarcane in the Madras Presidency during the five years ending 1935—36 has represented 3·4 per cent. of the total area under sugarcane in India.

The area planted with sugarcane up to the 25th September 1937 is estimated at 90,780 acres. When compared with the area of 109,690 acres estimated for the corresponding period of last year, it reveals a decrease of 17·2 per cent.

The decrease in area is general except in Vizagapatum, Ramnad, Tinnevelly and South Kanara. The estimated area is the same as last year in Tinnevelly; it exceeds the corresponding area of last year by 11·5 per cent. in Vizagapatam and by 3·8 per cent. in South Kanara. The decrease in area elsewhere is generally attributed to the low price of jaggery which prevailed at the time of planting of cane.

The condition of the crop is generally satisfactory except in Chittoor and North Arcot where the crop has been affected by drought to some extent. If a normal season is experienced during the rest of the growing period, the yield is estimated at 259,120 tons of jaggery as against 308,820 tons for the corresponding period of last year.

The wholesale price of jaggery per imperial maund of 82⅔ lb. as reported from important markets on the 4th October 1937 was Rs. 5-8-0 in Adoni, Rs. 4-12-0 in Mangalore, Rs. 4—11—0 in Trichinopoly, Rs. 4—10—0 in Erode, Rs. 4—2—0 in Salem and Coimbatore, Rs. 3—15—0 in Rajahmundry and Cuddalore, Rs. 3—5—0 in Cocanada and Vellore, Rs. 3—10—0 in Chittoor, Rs. 2-14—0 in Vizagapatam. Rs. 2—12—0 in Vizianagaram, Rs. 2—7—0 in Bellary. When compared with the prices published in the last report, i. e., those which prevailed on 6th September 1937, the prices reveal a rise of 14 per cent. in Trichinopoly, 9 per cent. in Vizagapatam, 3 per cent. in Rajahmundry and 2 per cent. in Cuddalore and a fall of 5 per cent in Cocanada, the prices remaining stationary in the other centres.

Groundnut—1937—Third forecast report. The average of the areas under groundnut in the Madras Presidency during the five years ending 1935-36 has represented 47·7 per cent. of the total area under groundnut in India.

The area sown with groundnut up to the 25th September 1937 is estimated at 3,656,400 acres. When compared with the area of 2,853,100 acres estimated for the corresponding period of the previous year, it reveals an increase of 28·2 per cent.

The estimated area is the same as last year in Nellore, and falls short of the corresponding area of last year only in Trichinopoly. The increase in area which is noticeable elsewhere is attributed to the incentive of favourable prices at the time of sowing.

The summer crop throughout has been harvested. The yields were generally normal. The yield of the early crop in Salem and Coimbatore is reported to be generally normal.

The condition of the main crop is reported to be below normal outside Kistna, Guntur, Salem, Trichinopoly, the South and Malabar due mainly to drought. In parts of South Arcot, the crop has also been affected by an attack of hairy caterpillar.

The wholesale price of groundnut (shelled) per imperial maund of 82⅔ lb. as reported from important markets on 4th October 1937 was Rs. 5—8—0 in Cuddalore, Rs. 5—5—0 in Vizagapatam, Rs. 5—4—0 in Vizianagaram, Rs. 4—10—0 in Erode, Rs 4—8—0 in Cuddapah, Rs. 4—6—0 in Nandyal, Rs 4—3—0 in Bellary and Vellore, and Rs. 4—0—0 in Adoni. When compared with the prices published in the last report, i. e., those which prevailed on 2nd August 1937, these prices reveal a fall of 18 per cent. in Vellore. 17 per cent. in Adoni, 13 per cent. in Vizagapatam, 12 per cent. in Bellary, 11 per cent. in Vizianagaram, 10 per cent. in Erode, 9 per cent. in Cuddapah, and 8 per cent. in Cuddalore.

Gingelly—1937-38—Second Report.

The average of the areas under gingelly in the Madras Presidency during the five years ending 1935—36 has represented 15·2 per cent. of the total area under gingelly in India.

The area sown with gingelly up to the 25th September 1937 is estimated at 468,000 acres. When compared with the area of 437,200 acres estimated for the corresponding period of last year, it reveals an increase of 7 per cent.

The estimated area is the same as last year in Malabar; it exceeds the corresponding area of last year in Vizagapatam, Nellore, the Central districts (Trichinopoly excepted), the South (Tinnevelly excepted) and South Kanara and falls short of it elsewhere. The variations are marked in West Godavari (−17,000 acres), North Arcot (+14,000 acres), Salem (+26,500 acres) and Coimbatore (+27,500 acres).

The early crop of gingelly has been harvested in parts. The yield was generally normal except in Vizagapatam. The condition of the standing crop is fairly satisfactory except in Bellary, Anantapur, Cuddapah, South Arcot, Chittoor, North Arcot and Madura where it has been affected by drought to some extent. The crop has also been affected by an attack of hairy caterpillar in South Arcot and by insect pests and fungus diseases in Madura.

The wholesale price of Gingelly per imperial maund of 82⅔ lb. as reported from important markets on 4th October 1937 was Rs. 6—15—0 in Trichinopoly, Rs. 6—8—0 in Cocanada, Rs. 6—7—0 in Ellore and Cuddalore, Rs. 6—6—0 in Tinnevelly, Rs. 6—3—0 in Tuticorin, Rs 5—14—0 in Rajahmundry, Rs. 5—12—0 in Salem, Rs. 5—10—0 in Vizianagaram and Rs. 5—7—0 in Vizagapatam When compared with the prices published in the last report, i. e. those which prevailed on 9th August 1937, these prices reveal a rise of eleven per cent. in Trichinopoly, eight per cent. in Cocanada, four per cent. in Vizagapatam, two per cent. in Tinnevelly and a fall of four per cent. in Cuddalore and one per cent. in Vizianagaram, the prices remaining stationary in the other centres.

Ginger—1937—First Forecast Report. The area under ginger up to the 25th August 1937 in the Malabar district, is estimated at 11,000 acres as against 10,000 acres for the corresponding period of the previous year. The condition of the crop is satisfactory.

Pepper—1937—First Report. The area under pepper up to 25th August 1937 in the districts of Malabar and South Kanara is estimated at 104,150 acres (95,500 acres in Malabar and 8,650 acres in South Kanara) as against 102,600 acres (94,000 acres in Malabar and 8,600 acres in South Kanara) estimated for the corresponding period of last year. The condition of the crop is satisfactory in South Kanara. In Malabar, early rains brought about flushing before the normal season and subsequent rains having caused a second flushing, a yield below the normal is expected.

The wholesale price of pepper per imperial maund of 82⅔ lb. as reported from important markets on 6th September 1937 was Rs. 13—5—0 in Calicut, Rs. 13—11—0 in Tellicherry and Rs. 13—12—0 in Mangalore. When compared with the prices in the beginning of January 1937, these prices show a fall of about 20 per cent. in Calicut, of about 22 per cent. in Tellicherry and of about 24 per cent. in Mangalore.

Cotton—1937-38—Second Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1935—36 has represented 9·5 per cent. of the total area under cotton in India.

The area under cotton up to the 25th September 1937 is estimated at 656,700 acres. When compared with the area of 756,700 acres estimated for the corresponding period of last year, it reveals a decrease of 13·2 per cent. The decrease in area is marked in Kurnool and Bellary where the area fell from 392,000 acres to 295,000 acres, i.e. by 24·7 per cent. owing mainly to want of timely and sufficient rains.

The area in the central districts and the south relates partly to the last year's crop and partly to the current year's sowings which have commenced in parts.

The condition of the standing crop is generally satisfactory, except in Bellary where the early cotton crop suffered from drought and from an attack by the red hairy caterpillar.

The wholesale price of cotton lint per imperial maund of 82⅔ lb. as reported from important markets on 4th October 1937 was about Rs. 18-15-0 for Cocanadas, Rs. 18—11—0 for white Northerns. Rs. 18—8—0 for red Northerns, Rs. 16—12—0 for Westerns (*mungari* crop), Rs. 18—14—0 for Westerns (*Jawari* crop), Rs. 25-4-0 for Cambodia, Rs. 26—15—0 for Coimbatore-*Karunganni*, Rs 21—8—0 for Tinnevelly-*Karunganni*, Rs. 19—7—0 for Tinnevellies and Rs. 21—8—0 for *Nadam* cotton. When compared with the prices published in the last report, i.e. those which prevailed on 6th September 1937, the prices reveal a fall of six per cent. in the case of Westerns (*mungari* crop) and Tinnevellies, five per cent. in the case of Westerns (*Jawari* crop), four per cent. in the case of Cambodia, Tinnevelly-*Karunganni* and *Nadam* and two per cent in the case of Coimbatore-*Karunganni*, the price of Cocanadas remaining stationary. (*Director of Industries. Madras*).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1937 to 15th October 1937 amounted to 475,668 bales of 409 lb. lint as against an estimate of 533,100 bales of the total crop of 1936—37. The receipts in the corresponding period of the previous year were 558,873 bales. 365,588 bales mainly of pressed cotton were received at spinning mills and 197,791 bales were exported by sea while 93,814 bales were imported by sea mainly from Karachi and Bombay. (*Director of Agriculture, Madras*).

College News and Notes.

H. E. the Governor's visit. His Excellency the Governor of Madras and Lady Erskine accompanied by their personal staff arrived at the Agricultural College Estate on the 10th afternoon. His Excellency and party stayed on the College premises throughout their stay of four days at Coimbatore. The Principal's bungalow which was suitably furnished for the purpose was placed at the disposal of H. E. and party by Mr. Broadfoot, Principal of the College. H. E. had a crowded programme in Coimbatore, and wherever he went he was accorded a very warm reception. On the 10th evening, H. E. visited the Government of

India Sugarcane Breeding Station, where he was taken round by Rao Bahadur T. S. Venkatraman, C.I.E., the Government Sugarcane Expert and Mr. N. L. Dutt, the Second Sugarcane Expert. On the 12th afternoon H. E. accompanied by Mr. P. H. Rama Reddi, Director of Agriculture, visited the various sections of the Agricultural Research Institute, where the activities of the Department were explained to him by the heads of research sections. Later in the day H. E. was shown round the Freeman Building, the students' play fields, the College Dairy and the Central Farm. His Excellency's interest in the welfare of the rural population and in the improvement of agricultural conditions was evident from the intelligent interest he showed in the various aspects of the work of the Department.

Director of Agriculture, Madras. The new Director of Agriculture, Mr. P. H. Rama Reddi, who took charge on the 15th September, took an early opportunity of visiting the College and Research Institute towards the end of the month. He arrived here on the 23rd and remained for six days and visited the various sections and stations. The Director again paid a visit to the College in connection with the visit of Their Excellencies.

Students' Corner: Students' tour. The students of III year B. Sc. class accompanied by Mr. M. U. Vellodi, Lecturer in Agriculture and Mr. K. Ramaswami Iyer, Assistant Lecturer, went on tour to Hosur, Krishnagiri, Gudiyattam, Cuddalore, Salem, Mettur and Erode, etc., and returned to Coimbatore on the 21st October.

Games—Cricket. In the Y. M. C. A. Cricket Tournament conducted under the auspices of the Coimbatore Athletic Association, the College team had an unbeaten record and annexed the Rhondy shield. The last match of the tournament was played against the Scout Recreation Club and the College won the match by 5 wickets and 75 runs. The Scouts who batted first were dismissed for 64 runs. For the College, Kodandaraman captured 5 wickets for 35 runs. The College replied with 139 runs for 5 wickets of which Shiva Rao made 55 and Dinker Rao 27. Our star-batsmen, C. Ramaswami and C. N. Baboo enjoyed a well earned rest and did not bat.

Other Matches. The Annamalai University Cricket team played the Agricultural College on the 9th instant. The visitors batting first put on a modest total of 110 runs. Panikkar (25), Venkatraman and Sreenivasan (18 each), and Sambandam and Balasubramaniam (13 each) were the chief contributors to this total. Dinker Rao claimed 3 wickets for 30 runs and Varadarajan 2 for 14 runs. The College replied with 127 for two wickets, C. Ramaswami (79) and Rajaram (30) not out) were the chief scorers. The brilliant single-handed running catch made on the boundary line by Venkatesan to dismiss Ramaswami will long be remembered in the annals of Coimbatore cricket.

The holiday on the 14th instant was utilized by some local lovers of cricket to assemble the best talent in Coimbatore to play a match against the Agricultural College. Though handicapped by the absence of our star-bowlers, who happened to be on a tour with the III year class, the College team acquitted themselves splendidly against an array of brilliant all-rounders collected from the Coimbatore Cricket Club, Coimbatore College, Forest College, etc. Winning the toss, the visitors put in the College to bat. Though faced with early disaster, the partership between C. Ramaswami and C. N. Baboo completely changed the aspect of the game. Baboo's masterly innings of 71 and C. Ramaswami's brilliant knock of 59. which included a glorious six off Venkatachalam which landed in front of the M. A. S. U. building were the chief features of the College battings. Other useful contributions were Varadarajan's 19, Shiva Rao's 17, Nagaraja

Rao's 15 (not out) and Shetty's 14 (not out). The College declared at 230 for the loss of 5 wickets. The visitors were dismissed for a paltry 56 runs, the only player who offered some resistance being Venkatachalam who scored 39. C. Ramaswami who bowled unchanged captured 6 wickets conceding only 26 runs. K. M. Thomas claimed 3 wickets for 19 runs.

Hockey. Taking advantage of the visit of the Annamalai University Cricket team, a match was played between the University team and the Agricultural College. Both sides were not fully represented, but the game turned out to be fast and interesting, ending in a draw of 3 all.

The Agricultural College Officers' Club. The annual Club Day which marked the culmination of a series of tournaments and other competitions in indoor and outdoor games, was celebrated on Saturday, 23rd October 1937. This was preceded by a dinner on the 22nd night which was attended by over 160 members and their friends. The beautifully decorated club drew a large crowd of spectators on the Club Day morning, when it was known that Mr. C. Ramaswami was to play in the tennis finals. The tennis finals was followed by field sports and after an interval of an hour, indoor games, elders' and children's races and table tennis finals were held.

The generous award of six more rolling cups by some of the members of the club aroused keen competition in all the Club Day sports.

The celebration came to a close on the 23rd night when the prizes and trophies of the various competitions were given away and this was followed by a variety entertainment and fire-works.

The following are the winners of the different trophies:-

Donor.	*Game.*	*Winners.*
Rao Bahadur G. N. Rangaswami Ayyangar.	Tennis Doubles.	C. Ramaswami & C. N. Baboo.
Mr. C. Ramaswami.	Tennis Singles.	M. K. Krishnaswami (C. Ramaswami not participating).
,, T. S. Ramasubrahmanyam (Padmanabha Memorial Shield).	Contract Bridge.	T. V. Reddi & R. L. N. Ayyangar.
,, N. L. Dutt.	Contract Bridge.	S. Srinivasan & T. S. Lakshmanan.
,, K. Ramiah.	Auction Bridge.	K. Krishnamurthi Rao & K. Hanumantha Rao.
,, M. C. Cherian.	Table Tennis.	K. Raghavan.
,, K. Krishnamurthi Rao.	Carrom Singles.	C. H. Krishnan.
,, H. Shiva Rao.	,, Doubles.	N. Muthuswami & C. H. Krishnan.
,, M. U. Vellodi.	Chess.	D. S. Rajabhooshanam.
Dr. K. Narayanan.	Tenekoit.	A. Mariakulandai & N. C. Tirumalachari.

Weather Review—SEPTEMBER 1937.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	5·2	−2·3	34·3	South	Negapatam	2·5	−1·3	14·4
	Calingapatam	4·0	−3·4	21·5		Aduthurai *	2·6	...	13·5
	Vizagapatam	2·9	−3·6	19·7		Madura	6·3	+1·2	13·3
	Anakapalli *	4·5	−2·9	31·2		Pamban	1·0	−0·2	15·5
	Samalkota*	5·5	−1·0	27·5		Koilpatti*	1·8	−0·2	11·4
	Maruteru *	3·4	−3·1	23·4		Palamkottah	0·4	−0·9	8·5
	Cocanada	5·0	−0·8	29·9					
	Masulipatam	3·3	−2·9	23·7					
	Guntur*	5·1	+1·2	22·4	West Coast	Trivandrum	2·1	−2·0	39·7
						Cochin	5·4	−3·6	102·4
Ceded Dists.	Kurnool	4·6	−1·6	17·7		Calicut	4·9	−2·8	110·5
	Nandyal*	5·7	−0·4	24·8		Pattambi *	3·0	−6·3	69·3
	Hagari *	7·1	+1·9	13·3		Taliparamba *	...	...	...
	Bellary	3·3	−1·8	11·0		Kasargode *	11·9	+3·1	153·6
	Anantapur	7·0	−0·3	19·7		Nileshwar*	9·7	−0·2	140·9
	Rentachintala	8·1	...	27·7		Mangalore	9·3	−1·1	132·2
	Cuddapah	3·7	−2·6	14·3					
	Anantharaju-pet *	2·7	−3·7	17·9	Mysore and Coorg	Chitaldrug	7·7	...	15·1
Carnatic	Nellore	2·2	−2·6	37·4		Bangalore	3·0	...	25·5
	Madras	4·0	−0·9	19·1		Mysore	4·2	...	26·4
	Palur *	3·6	+0·4	13·0		Mercara	7·1	−3·6	107·3
	Tindivanam *	5·1	+1·4	16·8					
	Cuddalore	2·4	−3·7	11·1					
Central	Vellore	10·1	+2·8	24·4	Hills	Kodaikanal	10·7	+3·5	41·6
	Salem	3·4	−3·2	19·7		Coonoor	1·8	...	35·9
	Hosur*	1·6	−0·9	22·4		Ootacamund *	5·6	−1·1	40·1
	Coimbatore	2·2	−0·7	12·6		Nanjanad *	5·2	+0·3	35·9
	Coimbatore A. C. & R. I.*	0·9	−0·2	14·5					
	Trichinopoly	4·2	−0·6	25·3					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in Fort St. George Gazette.

Summary of weather conditions. The Bay of Bengal branch of the monsoon was active during the first two weeks of the month, in Malabar, Deccan, and along the West Coast and later withdrew.

The unsettled conditions in the Andaman Sea which appeared on 25th, formed a low pressure area in the North Bay of Bengal and later intensified into a cyclone near Sangor Island and weakened thereafter. Conditions also became unsettled in the Arabian Sea off Kathiawar Konkan coast, where a low pressure was formed on 27th and extended from off Malabar coast to off Kathiawar Coast and became less marked on 29th.

There was general rain throughout the Peninsula during the month, and in the last week thunder showers were fairly widespread in the Konkan, Mysore, and South east Madras.

Rainfall was in large defect in Circars, Ceded Districts and Central Stations
Chief falls reported were :—

Rentichintala	5·7″	Recorded on 24th.
Kurnool	2·9·1	
Vellore	3 2″	27th.
Kodaikanal	3·0″	27th.
Nandyal	3·2″	
Hagari	3·0″	
Kasargod	3·0″	

Weather Report of the Research Institute Observatory : Report No. 9/37.

Absolute maximum in shade	93·5°F.
Absolute minimum in shade	66·0°F.
Mean maximum	89·5°F.
Departure from normal	+0 5°F.
Mean minimum in shade	70·8°F.
Departure from normal	+0·2°F.
Total rainfall for the month	0·90″
Departure from normal	−1·54″
Heaviest fall in 24 hours	0·63″ recorded on 29th.
Total number of rainy days	2 days.
Mean daily wind velocity	2·3 M. P. H.
Mean humidity	72 0%
Departure from normal	−3·0%

Summary. Rainfall was in large defect. The maximum and minimum were about the normal while humidity is below normal by 3·0%. The skies were heavily clouded.

P. V. R. & P. G.

Departmental Notifications.

Postings.

M. R. Ry. D. V. Krishna Rao, Permanent Upper Subordinate Agricultural Section and temporary junior assistant in the Gundlakama scheme—to officiate as Assistant in the chemistry section, *vice* Mr. S. V. Kuppuswami on other duty

M. R. Ry. S. Kanakaraj David, Temporary junior assistant in the Gundlakama scheme to officiate as Assistant in the Chemistry Section, *vice* Mr. P. Satyanarayana on other duty.

M. R. Ry. T. Arunachalam, Agri, Demonstrator, under training in Tinnevelly to be Agricultural Demonstrator, Tiruchendur, with effect from 1—10—37 until further orders.

M. R. Ry. P. Krishna Rao on relief at Hagari will revert as Assistant, Millets section, Coimbatore.

M. R. Ry. G. Ranganathaswami, on the expiry of his leave is posted to A. R. S Anakapalli.

Transfers.

Name of officer	From	To
Mr. C. Vadamalai	F. M. Hagari	A. D. Anantapur.
„ D. S. Subramania Iyer	A. D. Tinnevelly	A. D. Srivilliputhur.
„ P. V. Samu Ayyar	A. D. Srivilliputhur	A. D. Tinnevelly.
„ S. Muthuswami	A. D. Tirumangalam	A. D. Dindigul.
„ M. C. Krishnaswami Sarma	A. D. Dindigul	A. D. Tirumangalam.
„ A. K. Ganesa Ayyar	A. D. (on leave)	A. D. Paramakudi.
„ James Colaco	Asst., Chemistry Section	A. R. S. Sriuguppa.
„ K. Sriraman	Asst., Chemistry Section	A. R. S. Sriuguppa.

Leave.

Name of officer	Period of leave.
Mr. S. V. Doraiswami Iyer, F. M. Guntur	Extension of l. a. p. on m. c. for one month from 27—9—37.
„ C. Annamalai, A. D. Palamaner	l. a. p. for one month from 4—10—37.
„ P. Kannappa Pillai, on leave	Extension of leave on half average pay for 3 months from 4-8—37.
„ B. N. Padmanabha Iyer, F. M., P. B. S., Cbe.	l. a. p. for one month from 5—10—37.
„ K. P. Anantanarayana Iyer, Asst., Entomology Section	l. a. p. for one month from 11—10—37.
„ R. Sankara Iyer, Asst., Cotton Section	Leave without allowance for a period of 12 months from 1—11—37.
„ C. S. Krishnaswami, Asst., Mycology Section	l. a. p. for one month from 11—10—37,
„ K. Bhushanam, Asst., Chemistry Section	l. a. p. for one month from 15—10—37.
„ A. Abdul Samad, Asst. in Soil Physics	l. a. p. for one month from 25—10—37.

ADDITIONS TO THE LIBRARY, SEPTEMBER 1937.

A. Books.

1. *Development, Classification and Properties of Soils.* Scarseth, G. D. (1936). 2. *The Cycle of Weathering tr. by A. Manir.* Polynov, B. B. (1937). 3. *An Introduction to the Scientific Study of the Soil.* Comber, N. M. (1936). 4. *Soil Conditions and Plant Growth. 7th Edn.* Russell, E. J. (1937). 5. *Resisting Drought.* Van Reenen, R. J. (1935). 6. *Mohenjo-Daro and the Civilization of Ancient India with reference to Agriculture.* Chaudhury, N. C. (1937). 7. *Farm Machinery and Equipment.* Smith, H. P. (1937). 8. *The Vegetable Oil Industry.* By An Industrialist. (1936). 9. *The International Grain Trade.* Hooker, A. A. (1936). 10. *The Oxford Economic Atlas* Bartholomew, J. (1937). 11. *Life and Labour in a Gujarat Taluka.* Shukla, J. B. (1937). 12. *Denmark: The Cooperative Way.* Howe, F. C. (1936). 13. *Intermediate Botany.* Sabhesan, M. S. (1937). 14. *Methods in Plant Physiology.* Loomis, W. E., Etc. (1937). 15. *Biological Laboratory Technique.* Gatenby, J. B. (1937). 16. *Mineral Nutrition of Farm Animals.* Mitchell, H. H. & McClure, F. J. (1937). 17. *Second International Congress for Microbiology—Proceedings.* John-Brooks, R., Ed. (1937). 18. *Clinical Diagnostics of the Internal Diseases of Domestic Animals, Tr. by J. R. Mohler.* Malkmus, B. (1936). 19. *Practical Veterinary Pharmacology, Materia Medica and Therapeutics.* Milks, H. J. (1936). 20. *Cheap and Healthy Homes for the Middle Classes of India.* Despande, R. S. (1935). 21. *Graphs: How to make and use them.* Arkin, H. & Cotton, R. R. (1936). 22. *Preparing the Research Paper.* Schmitz, R. M. (1935).

B. Annual Reports.

1. Madras Agricultural Chemist, Entomologist, and Mycologist Administration Reports for 1936-37. 2. Madras Agri-Horticultural Society Annual Report for 1935-36. 3. Nilgiri Agri-Horticultural Society Annual Report for the year ending 31st December 1935. 4. Mysore Coffee Scientific Officer's Annual Report for 1936-37. 5. Madras, Chemical Examiner's (Public Health) Annual Report for 1936. 6. I. C. A. R.—Research Schemes—Special Reports. 6(a). Burma, Rice Research Officer's Annual Report for the year ended 31st March 1936. 6(b). Assam, Deep Water Paddy Research Farm Annual Report for 1935-36. 6(c). Padegaon Sugarcane Research Station Annual Report for 1934-35. 6(d). Padegaon Sugarcane Research Station Annual Report for 1935-36. 6(e). Dacca Sugarcane Seedling Testing Station Annual Report for 1934-35. 6(f). First Report on the Work done under the Scheme for Research on the Genetics of Sugarcane by Dr. E. K. Janaki Ammal. 6(g). Punjab Sugarcane Research Station Annual Report for the years 1934-35 and 1935-36. 6(h). Mushari Sugarcane Research Station Annual Report for 1934-35. 6(i). Jorhat Sugarcane Research Station Annual Report for the year ended 31st March 1935. 6(j). Patna, The Manufacture of Khandsari Sugar by the Open Single Pan Method: Annual Report for 1934-35. 6(k). Mysore, Report of Work Done on the Breeding of Thick Canes in the Mysore Farms during 1933-35. 6(l). Mosaic and other Diseases of Sugarcane: Annual Report for 1935-36. 6(m). Sabour Horticultural Research Station Annual Report for 1935-36. 6(n). Sheep Breeding Industry in Upper Garhwol: Report. 7. Sind: Department of Agriculture Annual Report for 1935-36. 8. Bihar, Indian Lac Research Institute Annual Report for 1936-37. 9. United Kingdom: Agricultural Research Institutes Annual Reports for 1934-35. 10 England: National Institute for Research in Dairying Annual Report 1936. 11. Canada Dominion Grain Research Laboratory Tenth Annual Report 1936. 12. Hong Kong: Botanical and Forestry Department Annual Report for 1936. 13. St. Kitts-Nevis: Agricultural Department Annual Report for 1936. 14. Massachusetts Agricultural

Experiment Station Annual Report for the year ending November 30, 1936, 15. Utah: Agricultural Experiment Station Annual Report from July 1, 1932 to June 30, 1934.

C. Special Publications and Proceedings.

16. The Allahabad Cottage Industries, Bhatty, E. C. 17. The Market and Marketting, Bhatty, E. C. 18. The Reserve Bank and Agricultural Credits. Ramaiya, A. 19. Premikisan (An Agricultural Drama). Md. H. H. Nashter. (Tr. into English). 20. Co-operation: Principles and Practices, Christensen, C. L, Etc. 21. Proceedings of the Conference on Maternity and Child-welfare, 1936. (Madras Health Propaganda Board Pub.). 22. Indian Central Cotton Committee —24th Proceedings—1937. 23. Indian Sugar Mills Association—Annual Report—1935-36. 24. Transactions of the Highland and Agricultural Society of Scotland —1937. 25. Canada Agricultural Department—Summerland, B. C. Experimental Station Results 1932—1936. 26. Agricultural Produce (Grading and Marketing), England: Statutory Rules and Orders No. 632 of 1937. 27. Proceedings of the Association of Land Grant Colleges and Universities (U. S. A.) 1936. 28. Agricultural Research Through Fifty Years 1885—1935. (Minnesota Agr. Expt. Stn. Special Report). 29. Transactions of the Iowa State Horticultural Society for 1936. 30. Official Grades for Fruits and Vegetables in Pennsylvania—1937. 31. Farm Tenancy in Washington: Report of the Committee; and 32. Reclamation: A Sound National Policy. Washington State Planning Council's Publications.

D. Bulletins, Memoirs, Etc.

33. Production of Grass Seed; 34. Insects and other pests Injurious to the Production of Seed in Herbage and Forage Crops; and 35. The Influence of Climatic Conditions on Type Composition. *Eng. Imp. Bur. Plant Genetics Herbage Pub. Ser. Bull. 10, 20 and 21.* 36. Methods for the Chemical Analysis of Biological Material in Nutrition Investigations. *Scot. Imp. Bur. Animal Nutrition Tech. Communication No. 9.* 37. Further Experiments on the Nitrogenous and Phosphatic Manuring of Cotton. *Egypt Royal Agr. Soc. Bull. No. 30.* 38. The Effects of Light and of Oxygen on the Uptake of Sugar by the Foliage Leaf. *Trinidad Cotton Res. Stn. Mem. Ser. B. No. 10.* 39. Citrus Irrigation Practices with special reference to Soil Moisture studies in Two Orchards in the Eastern Transvael. *Union of S. Africa Dep. Agr. Sci. Bull. No. 159.* 40. Veld Management Investigations at the School of Agriculture, Potchefstroom. *Union of S. Africa Dep. Agr. Bull. No. 166.* 41. Report on Soil Erosion in Cyprus. *Cyprus Dep. Agr. Bull. No. 3.* 42. An Economic Study of Potato Production in New Brunswick. *Canada Dep. Agr. Pub. 562, Tech. Bull. No. 8.* 43. Soil Drifting Control in the Prairie Provinces. *Canada Dep. Agr. Pub. 568, Farmers' Bull. 32.* 44. The Influence of Some Factors on the Storage Quality of Eggs. *Arkansas A. E. S. Bull. No. 341.* 45. Chemical Investigations of the Tobacco plant; V. Chemical Changes that Occur During Growth; 46. The Improvement of Naturally Crosspolinated Plants by Selection in Self-Fertilized Lines. II. The Testing and Utilization of Inbred Strains of corn; and 47. The Universal Soil Testing System. *Connecticut A. E. S. Bull. 374, 376 and 392.* 48. Soil and Plant Material Analyses by Rapid Chemical Methods; and 49. Soil and Plant Material Analyses by Rapid Chemical Methods, II. *Hawaiian Sug. Planters' Asso. Exp. Stn. Bull. No. 50 and 51.* 50. Housing Farm Poultry; and 51. Suggestions for Profitable Dairying. *Idaho Univ. Coll. Extension Dvn. Bull. No. 99 and 102.* 52. Milk Transportation Problems in the St. Louis Milkshed. *Illinois A. E. S. Bull. 430.* 53. Manual for Milk and Cream Testers in Maryland. *Maryland Agr. Exp. Stn. Bull. No. 401.* 54. The Effect of Processing on Vitamins in Fruits and Vegetables: A Review. *Massaclusetts A. E. S. Bull 1.* 55. Vegetable Gardening; 56. Potato Pointers; and 57. Perennial

Weeds and their Control. *Minnesota Agr. Extn. Dvn. Spl. Bull. 174, 182 and 183.* 58. A Preliminary Report of Livestock Costs and Returns; 59. Tractor Costs and Rates of Performance; 60. Report of a Farm Management Survey of 130 Dairy Farms; 61. Report of a Farm Management Survey of 120 Dairy Farms; and 62. A Preliminary Report of Crop Production Costs. *Minnesota Agr. Econ. Mime. Rep. No. 85, 84, 79, 80 and 81.* 63. Marketing Oregon Fruits: A Review of Economic Conditions Including Trade Practices with Recommendations and Suggestions for Legislation. *Oregon State Agr. Invest. Comm. Report, 1937.* 64. Superheating as a Control for Cereal Mill Insects; 65. Comparison of Some Methods of Growing Onions; 66. Soybeans: Their Adaptation and Production in Montana; and 67. The Effect of Tillage Method, Crop Sequence and Date of Seeding upon the Yield and Quality of Cereals and other Crops Grown under Dryland Conditions in North-Central Montana. *Montana A. E. S. Bull. No. 297, 305, 335, and 336.* 68. Permanent Pasture Studies; and 69. Types of Farming and Farm Business Studies in South Carolina. *S. Carolina A. E. S. Bull. 308 and 310.* 70. Hemorrhagic Septicemia. *Dakota A. E. S. Bull. 307.* 71. A Holding Test at Room Temperature as an Indication of the Keeping Quality of Butter in Storage; and 72. Alkali Disease or Selenium Poisoning. *Brooking A. E. S. Bull. 308 and 311.* 73. Drainage and Irrigation, Soil, Economic, and Social Conditions, Delta Area, Utah. *Utah A. E. S. Bull 273.* 74. Soil Erosion and Stream Flow on Range and Forest Lands of the Upper Rio Grande Watershed in Relation to Land Resources and Human Welfare. *Wash. Dep. Agr. Tech. Bull. 567.* 75. Soil Defence in the Piedmont; and 76. Strip Cropping for Soil Conservation. *Wash. Dep. Agr. Farmers' Bull. 17 and 1776.* 77. Crop Rotations; and 78. Farm Labour in the Yakima Valley, Washington. *Wash. A. E. S. Bull. No 344 and 343.*

E. Leaflets, Etc.

79. Further Observations on Soil Erosion and Sand Drift, with Special Reference to South-Western Queensland. *Commonwealth of Australia Pamphlet No. 70.* 80. Grape Culture in Georgia. *Georgia Agr. Ext. Ser. Cir. No. 265.* 81. Poultry Rations and How to Mix them; and 82. Fumigation for the Control of Household Insects. *Idaho Univ. Coll. Agr. Ext. Cir. No. 44 and 50.* 83. Beekeeping in Kentucky. *Kentucky Univ. Coll. Agr. Cir. No. 288.* 84. Beekeeping in Pennsylvania; and 85. Diseases and Enemies of the Honeybee. *Pennsylvania A. E. S. Cir. 141 and 156.*

F. English Translations of Scientific Articles.

(i) The Groundnut (*Arachis hypogaea*) by Z. Luzina (from Russian). (ii) Monograph on Groundnut by M. Chevalier (from French).

G. New Periodical.

1. The Economic Analyst.