GENERAL AGRICULTURE.

NOTES ON A VISIT TO INDIA.

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In the previous number of the *Tropical Agriculturist* were included the reports of the Ceylon delegation to the Tea districts of Northern India. After leaving Assam, I had the opportunity of visiting various agricultural institutions in India and the following notes extracted from my official report to Government may be of general interest:—

VISIT TO THE IMPERIAL RESEARCH STATION AT PUSA.

A careful investigation was made of the work of the Imperial Agricultural Institute, and I am indebted to Dr. Clouston, the Agricultural Adviser to the Government of India, and the staff of specialists at that Station for their hospitality and assistance during my visit.

The main work of this Institute is to establish general principles which can be applied to the different problems of the various Provincial Departments of Agriculture. The Institute itself is divided into the following sections:-

Agricultural under the Imperial Agriculturist
Botanical under the Imperial Economic Botanist
Chemical under the Imperial Agricultural Chemist
Mycological under the Imperial Mycologist
Entomological under the Imperial Entomologist

Attached to the Institute also is the Secretary of the Indian Sugar Bureau and under the general supervision and control of the Agricultural Advisor are the Imperial sugar-cane breeding station at Coimbatore, the Imperial Institute of Animal Husbandry and Dairying at Bangalore, the cattle breeding farms at Karnal and Wellington and the Imperial Institute of Veterinary Research at Muktesar.

The total annual expenditure of the Research Institute amounts to approximately Rs. 700,000.

PUSA.

Agricultural Section.—This section has charge of the farm and the pedigree dairy herd. The farm comprises 1,200 acres of which about 620 acres was under cultivation. 500 acres of this area are unirrigable and 100 acres are irrigated and devoted solely to the production of green fodder for the dairy herd. About 100 acres are devoted to field experiments but the balance of the farm is utilized for maintaining the dairy herd of Montgomery (Sahiwal) and Montgomery-Ayrshire cows and which now number 500. These animals are kept out in the open as far as possible, but receive in the sheds maize silage and oat straw. Berseem (Egyptian clover) is now being largely grown and is irrigated from the river by 3 pumps—1 oil and 2 steam. The cows in milk graze in the Berseem when it is large and they are then followed by the dry cows. (Our trials with Berseem in

Ceylon have not up to the present been successful and it is thought that temperatures may be too high. Further trials are however being made and the Pusa methods of sowing and treatment are being tried. At Pusa, Berseem is a cold weather crop). The chief crops on the farm are maize in the hot weather May to August, and dhall, gram and oats in the cold weather. Manurial experiments are being carried out with these crops and the value of green manuring with superhosphate has been clearly demonstrated. Seed selection is carried out and there is a demand for seed maize and oats from the farm. Experiments in conjunction with the Mycologist were being conducted in regard to the selection and trial of varieties of dhall immune to wilt and with the Chemist on green manuring problems. Chilli selection has also been begun on a small scale and sugar-cane trials with improved varieties raised at the sugar-cane station at Coimbatore were being made.

I was particularly struck with the work in the Pedigree Milk Herd. The best yielding Montgomery cows are kept pure, but those giving smaller yields are crossed with Ayrshires. These first generation half-breds give almost double the yield of milk of their parents, but should not be used for breeding purposes for sake of their progeny. After the first generation the results are not satisfactory and whereas a half-bred cow is almost invariably a good animal, the progeny of a half-bred are on the whole poor and not worth their keep. These conclusions are however in my opinion based upon too small numbers and although they may be accepted by the practical man should not prevent further and more extensive trials being made by the Agricultural Departments of India. Exact data regarding the influence of the bull was also shown to me, and the results are of the greatest importance to all cattle breeders. A good bull can improve a bad herd but a bad bull invariably gives inferior milkers. Mr. Henderson stressed the point that the bull is more than half the herd and also the importance of keeping the bull until his progeny had been tested. Pusa has lost several bulls which have given excellent progeny by their being sold from the herd before their progeny had been fully tested. The yields of the pure-bred Montgomeries have been almost doubled in 15 years and no animal giving less than 4,000 lb. per lactation period of 10 months is kept pure. Such poor yielders are invariably crossed. The herd now totals 500 and the milk is disposed of in Pusa and at a Depot opened in the Bazaar at Muzafferpur whence it is transported by motor lorry. The ration of concentrates consists of 1½ lb. maintenance ration and 3 lb. for every 3 lb. of milk produced. Milking is done at 11 a.m. and 11 p.m. and delivered at 2 p.m. and 6 a.m.

Botanical Section.—The area of land devoted to the work of the botanist is about 50 acres and is completely under his control. Ploughing is done by iron ploughs and inter-cultivation by means of Planet Junior and spring tooth cultivators. Harrows are also used. The work consists of the selection of pure types and the production by hybridization of high-quality types of wheat, tobacco, linseed, safflower, gram, gingelly, dhall and chillies. Details of the hybridization work with tobacco and of selection work with chillies were taken, as also of the threshing floors which have been made and the storage drums which are used. In chillies only the first year work has been completed. The testing of varieties of dhall for wilt resistence in co-operation with the mycological division was inspected and should prove to be of considerable value if a disease-resistant strain can be evolved.

Mycological Section.—The chief work in hand is at present in connexion with the wilt disease of dhall and a particular study is being made of its spread in the soil. Work on sugar-cane mosaic is also in hand and upon other diseases of cereals and ginger. Work has also recently been done on the diseases of potato in Assam and upon a disease of Cinchona. A large herbarium is maintained and list of the contents of the same has recently been published.

Bacteriological Section. Work on the nitrogen fixation in soils is being continued. There appear to be certain factors which may produce a limitation of nitrification. The fermentation of tea was also fully discussed with Dr. Hutchinson who had carried out investigations in Assam several years previously. The problem of green manuring investigations was also fully discussed and details of experimental work on decompositions examined. The preparation of Electrolytic Chlorogen was examined. This preparation is now the standard disinfectant at Pusa and in various hospitals and gaols. It is being used at the Pusa dairy for the washing of udders before milking.

The use of the cinema in agricultural propaganda has been investigated and a number of films have been prepared. I was able to see one such film on Pusa dairy methods and another upon the preparation of silage. The total cost of the outfit and twelve rolls of films amounted to Rs. 6,000. The use of such cinema films in Ceylon by the Agricultural, Sanitary and Veterinary Departments is to be recommended.

Chemical Section.—Nitrification problems are also being investigated in this section particularly in regard to the movement of nitrates in the soil and sub-soil. This work is of considerable interest as it shows that the upward movement of nitrates in the sub-soil is not so great as was generally supposed and consequently considerable losses of nitrates may occur unless root development is deep. The decomposition of green manures under Pusa conditions is very rapid and under favourable conditions taking about a month or six weeks. The use of green manures in Ceylon tea soils was discussed as also the effect of green manuring of paddy soils. It is probable that the effect in paddy soils may be largely mechanical allowing of better root development and of better drainage. Special investigation is also being made of the methods of estimation of availiable phosphoric acid in soil analyses and work on the qualities of milks from selected cows has also been begun.

Entomological Section.—This section has its work divided amongst a number of assistants who specialize in various groups. Pests of sugar-cane, paddy, cotton and stored grains are receiving special attention, but much of the work is developing along systematic lines. The preparation of coloured plates has been a feature of this section and the work in this direction has greatly improved during the past two or three years. Details of the cost of the production of these plates have been secured.

Post-Graduate Training.—In each section at Pusa a small number of graduates of Indian Universities received specialized post-graduate training. These number from two to four per section and are specially selected for this training in methods of modern agricultural research.

VISIT TO BOMBAY.

The work of the Indian Central Cotton Committee was explained to me fully by the Secretary, Mr. B. C. Burt, and a thorough investigation was made of the Technological Laboratory. The whole object of this laboratory is to test Indian cottons—especially those being produced by the Provincial Agricultural Departments—and an attempt is being made to correlate various factors with scientific data secured in these tests. The laboratory consists of two sections—an experimental spinning plant supplied with standard spinning machinery and a testing section. Special rooms are provided for Chemical, Physical and Microscopical examinations. The results of the tests recently made of Ceylon-grown cotton were fully discussed. The cotton was somewhat irregular in length of staple but resembled a Missisippi cotton which had been examined. Its average length was '99 inch and its general strength was satisfactory.

The work on cotton in India emphasizes the desirability of a policy on single crops when they are of sufficient importance to warrant the full staff. The general mixing of problems with a large number of crops retards progress and the Cotton Committee has already opened two special cotton stations—one in Indore and another in the Punjab and is likely to open up a third in South India.

Agricultural Education and Co-operation were discussed at length with Mr. Burt as he has had considerable experience of both questions. Under Indian conditions agricultural education in the vernacular was required, with a special higher training course in English extending over 4 years if the public demanded it. Several instances of agricultural co-operation having been started and fostered by agricultural officers were quoted and it appeared that where the needs of the people in rural areas—dependent as they are solely upon agriculture—are looked after by trained agricultural officers most successful results in co-operation have been secured. Agricultural development and co-operation must go hand-in-hand and the general policy should be controlled by one Department. Otherwise it is evident that the credit side of co-operation is likely to be unduly emphasized and the organization, along business lines, of co-operative buying, selling or supplying agencies neglected. The agriculturist is more often in need of the latter form of organization, and it is only when be obtains it that his economic conditions improve.

VISIT TO POONA.

Loni Vernacular Agricultural School.—The cost of the buildings at this school was about Rs. 25,000. The cost of the school is annually about Rs. 9,000 in addition to the cost of the staff which consists of a Headmaster (a Graduate of the Agricultural College), a Trained Teacher from the Education Department and a Field Officer. This staff is responsible for all the work of the school whilst the students have to do all the work of the farm—the only paid labour being one man for each pair of bullocks. This provision is made to ensure works being continued during the holidays. The receipts of the school amount to something over Rs. 6,000 per annum. The education is free and Government allows Rs. 10 per mensem towards the boarding expenses of the boys. The total area of the cultivated land of the farm is 22 acres and the syllabus includes reading and writing, agriculture, nature study, agricultural arithmetic and surveying, physical geography and in the last year subsidiary farm industries, sanitation, rural legislation and local

government. The students must be between 14 and 17 years of age and must be the sons of landholders owning at least 30 acres of dry land or 10 acres of irrigated land. The aim of the school is to train the sons of landholders who will return home for work upon their fathers' lands. The course is a two years' one and at the time of my visit there were 43 students at the school of which 15 were in the second year. Each student has a plot of his own and he may dispose of the crops for his own benefit. The crops grown on the farm are sugar-cane, millet, cotton, ground-nuts, gram, dhall, etc. An oil engine drives a chaff cutter and a small grinding mill and this is looked after by the students in turn.

A class of teachers similar to the class at Peradeniya was being given a one year's practical course for those elementary schools in the Presidency which have an agricultural bias. The work in these schools is somewhat on the lines of the school garden work in Ceylon, but actual school gardening is difficult in Bombay owing to water difficulties.

There are six vernacular agricultural schools in the Presidency and some are doing good work. The character of their work is stated to be variable, but they are all under one Inspector who visits the schools at regular intervals and stays about a week at a time during each visit. He also has charge of the inspection of the agricultural work in these schools which have been given an agricultural bias and was for several years the Headmaster of one of these Vernacular Agricultural Schools.

There is no connexion between these Vernacular Agricultural Schools and the Agricultural College at Poona the class of work done in each being totally different in character.

Sugar Experiment Station.—This Station, also known as the Mangiri Farm, was started in 1894 when a plot of nine acres was selected for the study of a more economic system of manuring and irrigating sugar-cane in the canal section of the Deccan. The Experiment Station now consists of 62 acres and is equipped with a three rolled mill driven by an oil engine and the juice is made into gul (jaggery) in large, shallow open pans. The rotation consists of sugar-cane, then jaur (millet) and then sunn hemp which is ploughed in. The planting of the cane is done in February and the reaping the following January. Juices are rich—18° Brix—and the purities are high (90*o/o* and over). Cane crops amount to 30-40 tons of cane per acre and an extraction of 72*o/o* is obtained in the mill. The juices are not clarified and each pan gives a break of about 1,300 lb. which is run into moulds about 6 inches across and 5-6 inches deep. All the sugar-cane is irrigated and the payment for water amounts to Rs. 57 per acre per annum, but will be increased to over Rs. 60 per acre per annum from the present year. Sugar-cane cultivation under irrigation is the most profitable cultivation in the Deccan, and at present the prices for jaggery are at a higher parity than the prices for sugar. Various types of mills, pans, and furnaces have been experimented with and recommendations made to cultivators in consequence. At the present time the following experiments are being carried on :-

1. Varietal tests with different varieties of sugar-canes—mainly seedlings.
2. Manurial trials. The best results are obtained in the order named from the following manures
   (1) Sulphate of Ammonia
   (2) Sulphate of Ammonia plus Safflower cake
   (3) Safflower cake.
3. Cultivation trials. Iron ploughs have been tested, clod breakers, harrows and ridgers of different types used. Planting distances have also been tested and canes are now planted 4 feet apart to allow of a one bullock cultivator being used.

4. Investigations into root development.
5. Nursery work with new varieties of canes.
6. Mill and furnace trials.

The work of the Station is being well carried out, but it is possible that too large a variety of canes is being experimented with and a more rigid selection will have to be made in order to reduce numbers to reasonable limits.

The Agricultural College, Poona.—At this college a number of students from Ceylon have been trained and at the time of my visit there were eleven Ceylonese students under training. I inspected the work of the college carefully and discussed with the Ceylonese students the work that they were doing. I saw the students at work on ploughs and on plots in the fields doing insect and disease control work, ploughing with bullocks and at work on individual plots. The main crops consisted of cotton, jaur, sugar-cane, onions, chillies and dhall. The stock of standard implements is good and there is also a good engineering workshop for repairs to tools and implements and in this shop the students receive instruction. Horticultural work with guavas, grapes, figs and oranges were also carried on. No selection work was being done and there are no facilities for paddy work. Work with paddy can be done only during the last term by the spending of week-ends at the paddy station on the West Coast. The lecture rooms and laboratories for agriculture, chemistry and botany were adequate, but it would appear that little Physics is now being done and a change in the large physical laboratory is being made. The Agricultural Chemist was doing research work on nitrification and also has annually to make a large number of analyses of manures (cakes) and irrigation and drinking waters for cultivators. These analyses are all made free of charge.

The curriculum of the college appears to be drawn up on sound lines. I personally would like to see it made more agricultural and less help given by the college to the students in the working of their individual plots. The crops grown are not those usually cultivated in Ceylon and the general climatic and agricultural conditions are very different from those of Ceylon. About 700 students have completed courses at the college and most of these look for salaried appointments in the Agricultural, Co-operative, Educational and Revenue Services. Several are now finding employment as Science Teachers and supervisors of agricultural purchase and sale societies and as advisers to large land owners. The Agricultural Department takes in seven as probationers every year. This probationary period is for two years and they are attached to various officers of the Department for varying times during this period. They receive as probationers Rs. 100 per mensem and if appointed upon the staff of the Department receive Rs. 105 rising to Rs. 300 per mensem which is the graduate scale for all Government Departments. Officers of the Department are after satisfactory service eligible for selection for promotion to the higher service of the Deparment, and later on to the Imperial Grade.

Agricultural Dairy, Poona.—This dairy was in process of re-organization. In the past there appears to have been a complete lack of object and the expenditure on it was greatly in excess of its revenue. It has been decided to put the dairy on a commercial basis and its revenue at the present

time is covering expenditure. The sheds are of the simplest and the milk is sold in Poona at the equivalent of 20 cents per lb. Scindi cows and Gujerat buffalos are kept. The greatest demand is for buffalo milk for the purpose of making curd. The Scindi cows average 15 lb. of milk per diem and the best milkers give 23 lb. shortly after calving. The food consists of 45 lb. per diem of jaur straw or chaff and concentrates according to the milk yielded with a maximum of 7 lb. of concentrates per animal. The cost of feeding approximates very closely to the costs of feeding the Peradeniya Farm School Dairy herd. It has been found at Poona that jaur is better for milk production than guinea grass. Lucerne also grows well at Poona and gives heavy crops. It is regularly irrigated and can be cut every 4-6 weeks.

Discussions were had with Dr. Mann on *Agricultural Education and Demonstration Farms.* He is a firm believer of an agricultural bias being given to all elementary schools in village areas. He thinks well of some of his vernacular agricultural schools, but states that they are limited in their scope. Small agricultural schools or schools provided with small areas of land could not be made to pay their way unless they were so situated that they could sell market garden produce at good prices. In some parts of the Bombay Presidency the growing of vegetables yields Rs. 1,000 per acre and in these areas small agricultural schools could be made to be profitable. Demonstration farms are causing some anxiety as several of them have served their purpose and cannot be scrapped owing to the capital expenditure which has had to be made in their equipment. Dr. Mann favoured experiment stations for definite problems and for separate crops and when the results of experiments had been secured of demonstrations upon the growers' own lands.

Co-operation in Bombay.—I had a discussion with the Assistant Registrar on co-operation. Formerly the Co-operative and Agricultural Departments were under one head, the Director of Agriculture, but in 1918 a separation was made. At the present time all non-credit work (seed supply societies, agricultural purchase and sale societies, etc.) is under the control of the Agricultural Department—the audit of the accounts of such societies being prepared by the co-operative staff. All co-operation propaganda work in the districts is done by agricultural officers, as co-operative officers have little or no time for propaganda. Their time is fully taken up with inspection and credit. There are 4,000 societies in all in Bombay and there are seven Assistant Registrars and one Inspector and one Auditor for every 120 societies. Loans from Government funds for land improvements (Takavi loans) to the extent of Rs. 300,000 are being given through the medium of Co-operative Societies. In practically every case no loan is given until a record has been obtained from an officer of the Agricultural Department that the improvement proposed is possible and is likely to be profitable to the proposer. The establishment of mortgage land banks is under consideration and for the work of such banks assessors will be required. All previous attempts to redeem previous debts in urban areas have been failures and therefore any result of the present deliberations will be directed to the rural areas, and the business will be done by the district banks and financed by the provincial bank organized under the co-operative movement. It is likely that repayments in 15-20 years will be adopted.

Visits were paid to the Empress and Bund Gardens. At the latter the Bougainvillaeas were beautiful, as also a pink Poinsettia.

INDIAN SCIENCE INSTITUTE — BANGALORE.

This Institute owes its origin to the munificence of the late Mr. Tata and to his sons Sir D. T. Tata and Sir R. J. Tata. The students here now number between 60 and 70. They are all graduates of Indian Universities, and selection for admission to the Science Institute at Bangalore is very carefully made by the Senate. The Departments at the Institute are at the present time (1) General and Organic Chemistry with a Professor for Inorganic and another Professor for Organic Chemistry, (2) Department of Biochemistry and (3) a Department of Electric Technology.

The course of training in Research work is for 2 years in the Chemical and Biochemical Departments but is for 3 years in Electric Technology—one year having to be spent in an engineering college. I was taken through all Departments by Dr. M. O. Forster, the Director of the Institute and was shown the work in hand. I was also fortunate in being able to attend a colloquium on Plant Alkaloids. Members of the staff and students took part in this discussion. The Organic Chemistry section has carried out a considerable amount of work on essential oils, upon plant alkaloids and has also begun work on drugs used in native medicines. The Biochemical Department is at present chiefly engaged upon nitrification and sewage disposal and upon the problems involved in the culture of lac. The different species of lac insect are being investigated and their action on various hosts. *Acacia Farnesiana* has been found to be a very useful host for all species and some species can be induced to go from one plant to another if an intermediate generation is bred upon this *Acacia*. Dr. Norris considers that there is a future before lac cultivation and plantations are at the present time being made in Behar. A separate Lac Research Institute is being established at Ranchi by the Indian Lac Association by means of a special Government collected cess upon all lac exports. The Department of Electric Technology is specializing upon Hydro-Electric problems and upon wireless in anticipation of a considerable extension of the demand for fully trained engineers with Hydro-Electric or with wireless knowledge. Graduates of the Colombo University College desirous of securing post-graduate training in Applied Chemistry, Biochemistry or in Electric Technology could not do better than proceed to the Science Institute at Bangalore and I was informed that the Senate might be prepared to consider the admission of a limited number. The cost of fees at the College and of boarding amounts to about Rs. 70-00 per mensem. I also inspected the Activated Sludge system of sewage disposal which has been installed at this Institute. It has worked throughout quite satisfactorily and appears to be quite suited for adoption under tropical conditions. Full particulars were secured with a view to seeing if a similar system could be installed at Peradeniya—where the Sanitary problem is becoming more and more complicated with the increase of the Headquarters staff of the Department.

Imperial Institute of Animal Husbandry and Dairying.—This Institute now gives a two years' diploma course in Dairying and Animal Husbandry. It was an old Military Farm devoted to crossing Scindi and Montgomery cows with Ayrshires up to what are known to cattle breeders as $\frac{3}{4}$ or $\frac{7}{8}$ths Ayrshires. This experiment was not a success and the policy now is to get back to more blood from Indian breeds. The Ayrshire is recommended by

the Imperial Dairy Expert for crossing with Indian cattle. First crosses with Ayrshires give double the quantity of milk of the mothers and the bulls are good cart animals. It has however been proved that they should not be used for stud purposes. The second cross produces smaller animals of a dark red colour and they generally are not satisfactory. A small herd of pure bred Scindi animals is also being kept at this Institute and attempts are being made to improve their milking capacity by selection. The milk at this Institute is pasteurized and sold in Bangalore at 3¼ annas per lb. During the war period this pasteurized milk was being sent quite satisfactorily to Madras and in fact pasteurized milk is being sold in Calcutta and Bombay from another cattle-breeding farm situated at Karnal in the Punjab. There is no doubt that much could be done in Ceylon by the establishment of dairies in rural areas and then pasteurizing the milk before it is sent to the urban areas for distribution. A beginning in this direction has already been made, but much greater progress is possible and there is no reason why Ceylon should continue to remain one of those countries with an insufficient and indifferent milk supply in its towns. Milk is also separated and cream sold in small containers similar to those used in Europe. Butter and Cheddar cheese are also made, and both are of excellent quality. The feeding of the cows consisted of 40 lb. of grass or silage per diem and 4 lb. of concentrates as a maintenance ration and 1 lb. of concentrates per 3 lb. of milk produced. The silage is made in pit silos and at the time of making the silage plenty of water is added to it. A much better quality silage is prepared if it is thoroughly damp when put into the silo. New buildings have also been erected to serve as type plans for the students and for those interested in dairying. At this Institute the Imperial Physiological Chemist is conducting feeding experiments and a study of the rations for milk production and of the nutrition of young dairy animals, but he was absent at the time of my visit and therefore I was unable to discuss with him personally the results obtained up to date. The work for the students at this Institute is essentially practical and I was informed that a limited number (one per annum) of Ceylonese students could be received if they were recommended by the Department of Agriculture.

THE AGRICULTURAL COLLEGE AND RESEARCH STATION, COIMBATORE.

This forms the Headquarters of the scientific staff of the Madras Department of Agriculture. I was met here by Mr. Hilson, the Acting Director of Agriculture, Madras, and by the Acting Principal of the College.

The organization at Coimbatore comprises the Agricultural College with its Central Farm and consisting of sections of agriculture, botany, entomology, mycology, agricultural chemistry and veterinary science and the Research side consisting of sections for mycology, entomology and agricultural chemistry and specialists for cotton, millet and paddy respectively.

New buildings costing Rs. 375,000 are in course of construction for the teaching side of the college and then the present buildings will be handed over to the Research side. The new buildings provide accommodation for a Principal and Chemical, Botanical, Agricultural and Veterinary sides and will accommodate 150 students.

Research Work.—The Entomological work in hand at the time of my visit was in connection with the parasitic control of the coconut caterpillar. A serious outbreak of this pest at Mangalore which had resulted from an introduction from Travancore was checked in one year by means of parasites. The Spodotera paddy pest was also being worked upon, and the outbreak of mealy bug on pepper after spraying the pepper with Bordeaux mixture for the pepper disease was discussed. The poster work for propaganda work regarding the control of pests was being well done.

In the Mycological division work was being done on Palmyrah bud-rot, coffee die-back and areca disease. The general outline of work in hand was rather indefinite but the illustrative and propaganda side of the work was being extremely well done. In the chemical division analyses of soils and manures for estates was being carried on at fees which were extremely reasonable. Work was also being done on nitrification of manures. The nitrification of horn contrary to expectation has been found to be rapid. The nitrification of ground nut cake is slightly more rapid than that of castor cake and is generally complete within three months. With Mahua cake there is practically no nitrification at all and in consequence it is valueless as a manure. The use of cynamide as a paddy manure has been investigated and it has been found that it can be used safely if applied at least 24 hours before transplanting and at least 7 days before broadcasting seed. The best results have been secured with paddy with green manures and phosphates but sulphate of ammonia has also given good results. The Adco process was being examined. Paddy straw does not break down very well under this process as it is too silicious.

The Cotton Specialist is in charge of all the cotton breeding and selective work. He has complete control over the cotton station which comprises 28 acres with 3 pairs of bulls. A field laboratory has been equipped on the station and here all the results of different cottons are tabulated and analysed. The average rainfall is 26 inches and this falls in September-October, early November with light showers in April and July. Cotton at Coimbatore is sown in September and irrigation given if necessary. The crop is harvested in February-March. The land is then ploughed and fallowed from May-June to early September. It is then ploughed again and prepared ready for sowing. Cotton is followed by a cereal crop (cholam) and this by cotton and this again by sunn-hemp which is ploughed in green. Selections and crossings of Cambodia cotton are made and several of the types sent out from Coimbatore have proved to be considerably superior in point of yield and general vigour than the ordinary strains and now cover a very considerable area of the cotton of the Madras Presidency. The cotton station at Coimbatore is irrigated by means of an oil-engine pump from a large rectangular well. Cotton at Coimbatore is seriously affected by the stem borer and the spotted boll worm. Smooth leaved types of cotton cannot be grown owing to the prevalence of a leaf-hopper.

Cotton forms one of the principal money crops of the ryots of the Madras Presidency and now covers 2,300,000 acres of which 265,000 acres are under improved types. The District Agricultural Officers secure their supplies of seed for trial by the growers from the Central Cotton Station at Coimbatore and make multiplications upon the various district experimental farms.

The appointment of a millet specialist has been sanctioned only recently and the millet station has only been opened for one year. It consists of 35 acres with 5 pairs of bulls and has a contingency vote of Rs. 5,000. The principal work at present is concentrated on cholam. A collection of the different types from all over the Madras Presidency has been made and it is thought that not less than 150 different types will be isolated. Crossings in millets are fairly common and the segregation of characters is being studied. In the Madras Presidency the looser headed types of millet are the most common as the close headed types so common in Northern India mildew badly in all districts when there is rain or mist during the flowering and ripening periods. The black and red types are the more hardy, but the white kinds are the better appreciated by consumers and are grown in those areas where they will thrive. Work has also been begun with ragi (kurrakan) and with Italian millet (Tenai or Tanahal). The station is irrigated by means of a well and a 5-inch centrifugal pump, all irrigation main channels being in cement and provided with iron sluice gates. A field laboratory and store have been erected and housing accommodation provided for the staff of the millet specialist. All buildings were erected by the millet specialist according to plans sanctioned by the Public Works Department and this procedure has resulted in the full equipment of the station with its necessary buildings in the shortest possible time. The total staff consists of the millet specialist, 2 assistants, 2 Field men, one clerk and one draughtsman.

The paddy station consists of 28 acres of land with 5 pairs of bulls with a contingency vote of Rs. 6,000. This station is under the Paddy Specialist and three other paddy stations are now in course of being established in other parts of the Presidency. Pure line selection work and hybridization are being carried out. One crop per annum is grown and irrigation is done by means of a well and pump. All the paddy is transplanted at 6 inches apart and a space of 1 foot is left between each test lot. Comparative tests are made in strips 40 x 40 feet and are repeated 8 times. Outside rows of each strip are discarded as they have been found to give 25*o/o* more than the inside rows. Uniform manuring with castor cake is done and on the Station manuring with green manure is not carried out owing to the difficulty of spreading the green manure evenly. The inheritance of characters has been worked on and some useful information secured. This work at present has not much practical value, but it is information that must be secured before satisfactory hybridization work on scientific lines can be conducted. Several pure lines have been isolated which are being appreciated by growers and increased yields of 15-25*o/o* over comparatively large areas have been recorded. It is estimated that it takes 7-8 years before any pure line can be recommended with confidence and the need for small test stations in different paddy growing tracts under the control of District Agricultural Officers have been greatly felt, as it has been recognized that it is impossible to recommend to growers any type for a particular area until it has been tested there.

It is possible that a specialist for pulses will be approved by the Madras Government at an early date.

The Imperial Sugar-Cane Station of the Government of India is also situated at Coimbatore and here the raising of new types of sugar-cane is undertaken by the Imperial Sugar-Cane expert,

Agricultural College.—Students must have matriculated in Madras University before they are admitted to the College and the course will be of University Standard for the B.Sc. (Agriculture). It has been thought advisable to require this higher standard of general education and to dispense with the lower diploma courses. The field work of the students at the Agricultural College is done upon the Central Farm and here particular attention is paid to the rotation of crops. The Veterinary division has charge of the instructional dairy and at this 30 cows in milk are maintained. These are cross-bred Ayrshire Scindis and some pure Scindis. The lay-out of this dairy is not as good as others I saw in India and the general policy of it is not well defined. The milk is all sold fresh at Coimbatore. Poultry are also kept for instructional purposes—the breeds kept being White Leghorns, Rhode Island Reds, Light Sussex and Andelusians.

I discussed with the Acting Director of Agriculture and with the Veterinary Surgeon at Coimbatore the work of the Department at its Cattle Breeding Farm at Hosur. Time did not however permit of examining the work of this breeding station in detail.

The general arrangements for the accommodation and teaching of students at this College are very good, although I am rather inclined to the view that the teaching in some respects may be too theoretical. When the new buildings are opened I was informed that it might be possible to receive students from Ceylon provided that their educational qualifications are equivalent to those demanded for entrance. The number of students at Coimbatore has fallen after the principal demands of the Agricultural College were filled, but I was informed that there is now some demand from private employers for men trained at the College. The general type of student is not thought to be as high as it used to be and 14 vacancies in the Department remain unfilled at the present time owing to first class men not being available.

Work of District Officers.—I discussed in detail with the Acting Director of Agriculture, Madras, the work of District Agricultural Officers particularly in regard to propaganda work, the work of Experimental Farms and of Demonstrators, and to the organization of district and manure stores and implement supply agencies. Agricultural middle schools in Madras have not been successful and a report on these schools has been prepared for the Indian Board of Agriculture. The work of the Madras coconut experiment stations was discussed and I gathered that the cultural work was satisfactory and giving interesting results, but little headway was being made with the manurial experiments.

MADRAS.

Visit to Registrar of Co-operative Societies, Madras.—I discussed many co-operative problems with the Registrar of Co-operative Societies. He informed me that long term loans to land owners through Revenue officers (Takavi loans) have never been popular in Madras and rarely did much good. The loans were invariably discounted and the cultivator had strong objections to submitting his land and subsequently the operations on his lands to frequent inspections. The inspections which were made by Government officers while the works were in operation were particularly resented.

Rural co-operative societies were now very firmly established and were a power for good. Federated Unions now provide the supervision and the

major portion of the propaganda work—the co-operative department providing inspection and audit. Every society is inspected at least twice a year and one inspector is expected to deal with 100 societies although it is being found that 60-65 is all that he can inspect satisfactorily. The District Central Banks depend entirely upon the audit inspections for guidance. They will usually make a loan of up to ¾th of the unencumbered credit sheet of members, but less than this when the Society is newly formed. The credit sheet is recognized as a guide only and no loan is given until a report has been furnished by the Co-operative Inspector and in fixing the loan which a society may be granted such factors as industry of the members, nature of crops grown, average yields of crops, whether seasons are reliable or not and whether failure of crops are common or not are taken into consideration. The credit sheet has to be revised whenever a new loan is applied for and no second loan is made until after a further detailed inspection has been made by the Inspector. Limits are also put upon the borrowing power of any member—particularly in the initial stages in order to safeguard against excessive borrowing and against a few members gaining preferential treatment over the majority. The general average of the limit is Rs. 500. District Central Banks cannot satisfactorily be entrusted with the work of inspecting Rural Societies as townspeople, although very useful in these urban financing agencies, command no respect amongst the rural cultivators. Central Banks must therefore depend upon the Registrars' Staff for information regarding the credit worthiness and the general working of the rural societies.

Some rural societies give long term loans but the funds at their disposal are generally not adequate to provide the funds required. These long term loans issued by Societies are generally for terms of 7 years and as there has been a demand for loans upon the mortgage of lands this matter has been very thoroughly investigated.

Model by-laws for co-operative land mortgage banks have been drawn up and approved by Government. The object is to redeem the mortgages of agricultural land, as it is being found that the cultivators are unable to reap the full benefits of co-operation on account of their being seriously encumbered with mortgage debts. The Government has undertaken to take up half the debentures in these Banks to the extent of Rs. 200,000 provided that an equal amount of debentures are taken up by the general public. The Government debentures carry interest at 6o/o while the debentures issued to the public carry interest at 7o/o. It is expected that 3 such banks will be possible and probably at a later date two others may be formed. The Registrar informed me that arrangements had practically been completed for the formation of one bank. The idea of this bank is that a number of landowners in a specified area, who have mortgaged land to money-lenders, to combine together to form a co-operative land mortgage bank. They will then re-mortgage their lands to the bank which will proceed to issue debentures on the security of these mortgages. The maximum period for which the bank will make loans to its members is 20 years. The Banks will be managed by a Board of Directors and they will appoint a Trustee whose function it will be to see that the Bank fulfils its obligations to the debenture holders. This Trustee at the commencement is specified as the Registrar of

Co-operative Societies or someone selected by him. After the Banks have worked for some time it is proposed to select a non-official to take the place of the Registrar of Co-operative Societies as Trustee.

A copy of the model by-laws for these Co-operative Land Mortgage Banks has been obtained for the information of Government.

The Madras Central Bank is now an Apex bank and Government has agreed to allow local authorities to invest their surplus funds in this Bank. Certain Trust funds are also allowed to be deposited as well as Railway Cess Funds. The individual members in this Bank are gradually being reduced as it is desired to make it as co-operative as possible and reduce the number of individual members to about 100. These are required for the proper provision of financial control and for general efficiency.

DETERMINATION OF SEED VITALITY.

The vitality of seeds can now be determined within twelve hours, according to the Boyce Thompson Institute for Plant Research, at Yonkers, New York, U S A. The prolonged and costly method of determining by germination, whether seeds are dead or alive may be supplemented or displaced, as circumstances indicate, by quick test, resulting in safe seed buying and more certain results in planting The uncertainty of seed purchases in the past, has been a sore point with the planter. With no way of detecting good seed from bad, to say nothing of intermediate quality; except by the slow germination test, the farmer's or nurseryman's investment in time and labour, as well as the initial purchase, has often been a sort of lottery.

The New York World states that at the laboratories of the Boyce Thompson Institute, under the supervision of the Director, Dr. William Crocker, Prof. Wilmer E. Davis, of the Kansas Agricultural College, a visiting investigator, has developed such a method, based on the catalase activity of seeds. This being interpreted means that a living, vital seed produces a substance known as catalase, which has the property of breaking up peroxide of hydrogen into water and oxygen, with the foaming noticed when peroxide is poured on a cut or wound. In dead seeds, however, the catalase may still be active but is more easily disorganised. Herein lies the distinctive factor. Live seeds soaked in water at 126 deg F. for two hours (or for twelve hours at 90 deg. F.) will still be active under the catalase test ; but seeds that have been injured by frost, heat, or age will show greatly decreased activity if any. Thus a measure of the vitality of the seed is accurately and quickly established.

By another discovery, it is now possible to curtail the period of dormancy in live seeds and force them into growth much more promptly. Seeds that normally require several years to germinate (for example the rose family including the peach and apple), will do so in four or five months if kept at a constant, low temperature (about 41 deg. F.) This is of special importance to rose growers who might otherwise wait and work, for five or six years before finding out the results of experimental hybridising. Such seeds formerly sown in beds, and subjected to the seasonal variations in temperature were alternately awakened and put to sleep, to the nurseryman's loss. — Indian Scientific Agriculturist, Vol. VII, No. 2.