TEA.

REPORTS ON THE VISIT OF THE CEYLON DELEGATION TO THE TEA DISTRICTS OF NORTH INDIA.

The Director of Agriculture and Messrs. M. L. Wilkins and J. Horsfall were invited by the Sub-Committee of the Planters' Association and the Estates Proprietary Association responsible for the inauguration of the Tea Research Scheme to proceed to Assam to investigate the work of the Scientific Department of the Indian Tea Association and the work of tea estates in North India. The object of the deputation was to study how the various scientific problems affecting the cultivation and manufacture of tea were being tackled, and how far the results of the investigations of scientific workers were being adopted by the industry. It was felt that such an enquiry would secure information which would be of value to the tea industry of Ceylon and particularly to the Board of Management of the Tea Research Institute about to be formed.

The deputation sailed on the s.s. "Domala" on October 25th and returned to Ceylon on November 27th. The headquarters of the Indian Tea Association at Calcutta were visited by the Director of Agriculture, whilst the Heads of various large firms interested in the Indian Tea Industry were interviewed by Messrs. Wilkins and Horsfall. The three of us then visited Tocklai, the seat of the offices, laboratories and experiment stations of the Scientific Department of the Indian Tea Association and certain estates in Jorhat, and subsequently Mr. M. L. Wilkins proceeded to estates in the Dooars and the Darjeeling districts and Mr. J. Horsfall visited Upper Assam.

ASSAM.

The scientific work of the Tea Industry of India is carried out by the Scientific Department of the Indian Tea Association. This Department obtains the bulk of its funds from the Indian Tea Association which collects a special acreage tax from the estates owned by its members and from grants and subscriptions from the Governments of Assam and Bengal and District Planters' Associations. The estimates of the receipts for 1925 are as follows;—

(a)	Indian Tea Association (Calcutta)	...	Rs.	178,133 1 0
(b)	United Planters' Association, Southern India, Madras (for 1924 Rs. 5,000, and for 1st half year 1925 Rs. 5,000)	...	,,	10,000 0 0
(c)	Government of Assam	...	,,	10.000 0 0
(d)	Government of Bengal	...	,,	4,000 0 0
(e)	Assam Branch	...	,,	4,992 1 0
(f)	Surma Valley Branch	...	,,	2,745 0 0
(g)	Dooars Planters' Association	...	,,	2,500 0 0
(h)	Darjeeling Planters' Association	...	,,	500 0 0
(i)	Terai Planters' Association	...	,,	300 0 0
(j)	South Indian Association, London £50 (1924)		,,	750 0 0
(k)	Sale of Books and Journals	...	,,	4,000 0 0
	Total	...	Rs.	217,920 2 0

The grants by the Governments of Assam and Bengal are made in order that small growers may receive scientific advice and assistance when required.

The expenditure, which has been increased gradually during recent years as the demand developed for more scientific work, now amounts to about 7 annas (44½ cents) per acre and comprises about 80% of the total funds of the Indian Tea Association.

The total expenditure of the Department on capital account will stand at the end of 1925 at approximately Rs. 350,000. This has been incurred on building and equipment of laboratories, for buildings on the experiment stations and for housing of staff.

All the financial work of the Department is conducted in Calcutta at the Headquarters of the Indian Tea Association, and all accounts are kept there. The Chief Scientific Officer has a cash advance from which he pays the subordinate staff and labourers at Tocklai and all small miscellaneous expenses incurred there, and he submits a monthly statement of such expenditure to Calcutta. This latter office prepares a monthly expenditure statement, which is printed and circulated to the members of the Tea Association. A copy of such a statement is appended for the information of the Ceylon Tea Research Board.*

Meetings of the Scientific Department Sub-Committee of the Indian Tea Association are held fortnightly in Calcutta and all excesses on the votes for the Department have to receive the sanction of this Sub-Committee before they are incurred. This Sub-Committee has also the power to sanction adjustments between votes. Every quarter the Chief Scientific Officer attends a meeting of this Committee and reports on work that has been carried out during the period under consideration, and on the work at present in hand by the various scientific officers.

TOCKLAI.

In the early days of the Scientific Department the staff consisted of one Scientific Officer and his Headquarters were in Calcutta. Subsequently another officer was added. Both these officers were chemists and paid special attention to soil problems and to problems of manufacture. It was subsequently decided that Calcutta was not a suitable centre for the Headquarters of the Scientific workers and Tocklai was established upon lands which were obtained from the Jorhat Company.

Tocklai dates from 1910 and comprises an area set aside for laboratories and bungalows and of 10 acres of tea under experiments. The buildings at present consist of (1) the Administration building, (2) the Chemical laboratory, (3) the Entomological laboratory and (4) the Mycological and Bacteriological laboratories. It was also found that a large area of land was required, for field experiments and a special grant of land was secured at Borbhetta about 2½ miles away from Tocklai. Of this land, 40 acres have been fully opened and divided into experimental blocks—the principal plantings having been done in 1916, 1920 and 1921.

The administration building and the laboratories are more or less uniform in type, the internal arrangements differing in order to suit the

*Not reproduced.—Ed. T. A.

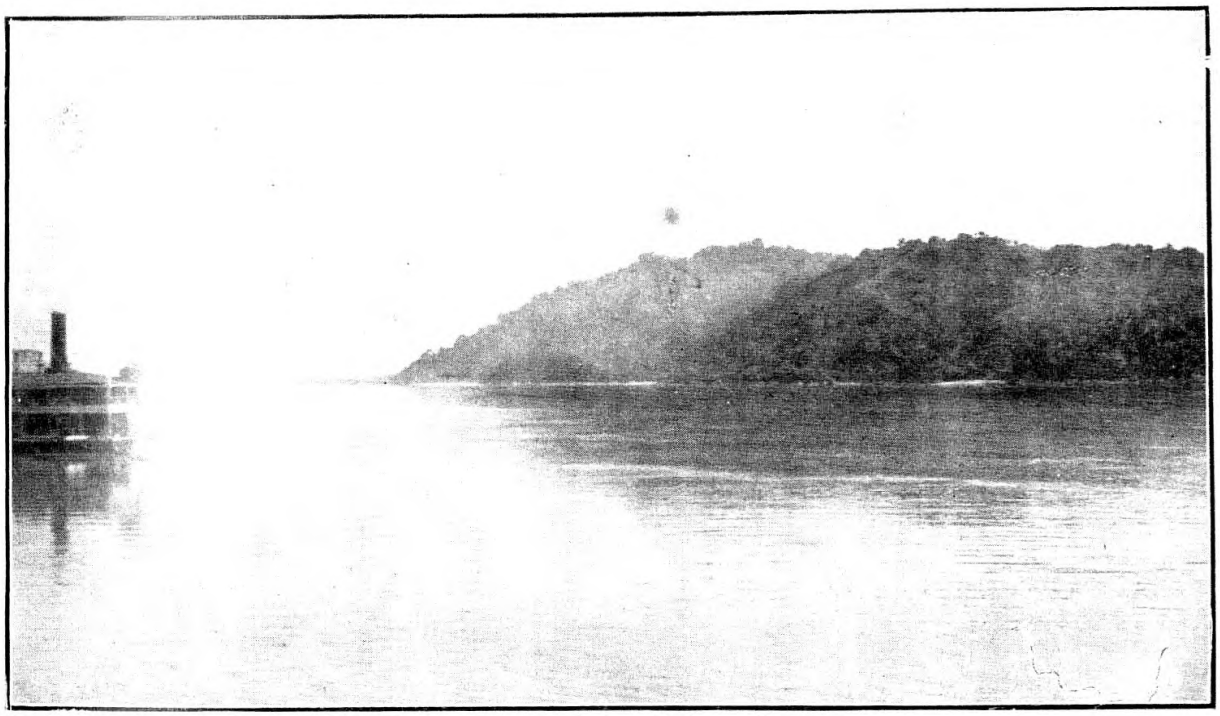

Fig 1. CROSSING THE BRAHMAPUTRA

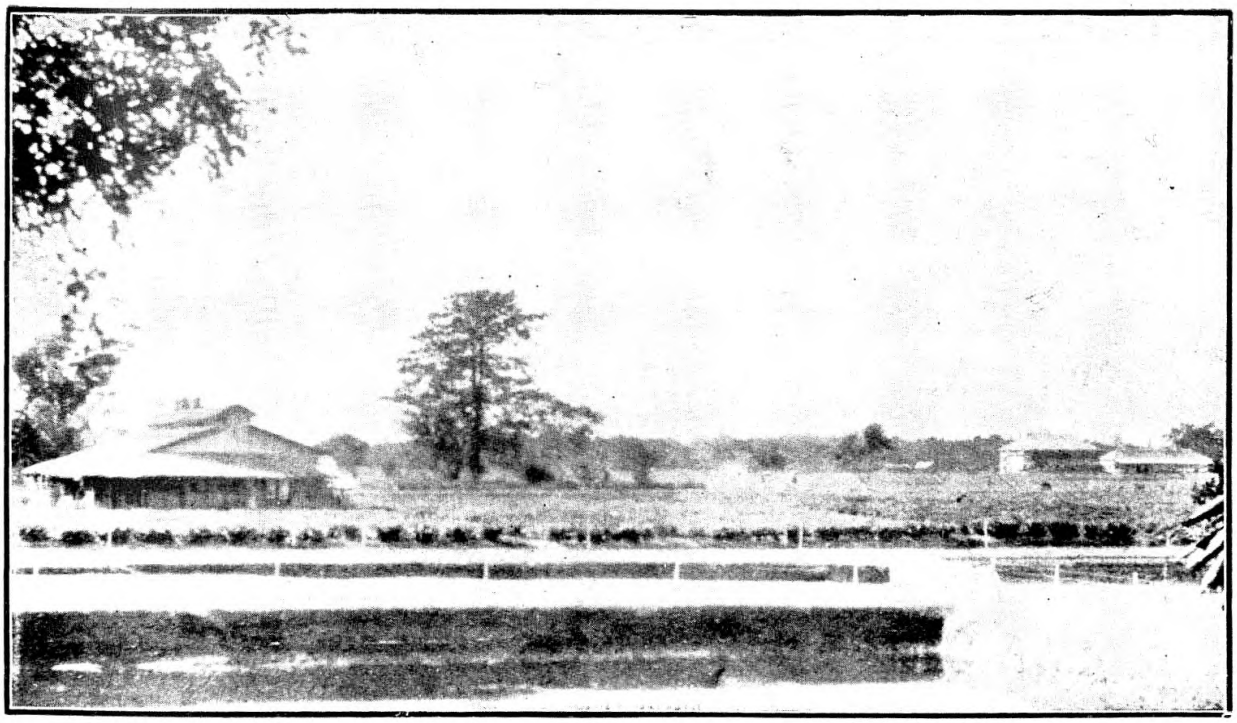

Fig 2. EXPERIMENTAL PLOTS—TOCKLAI

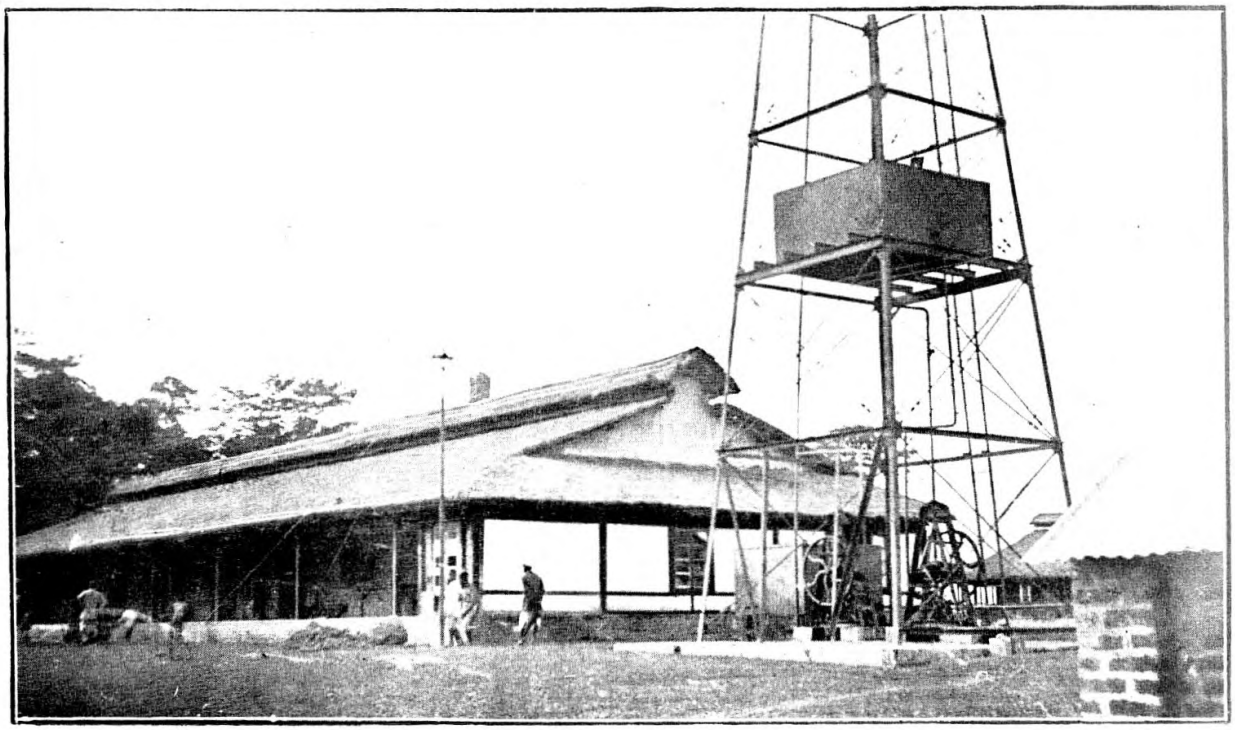

Fig 3. CHEMICAL LABORATORY—TOCKLAI

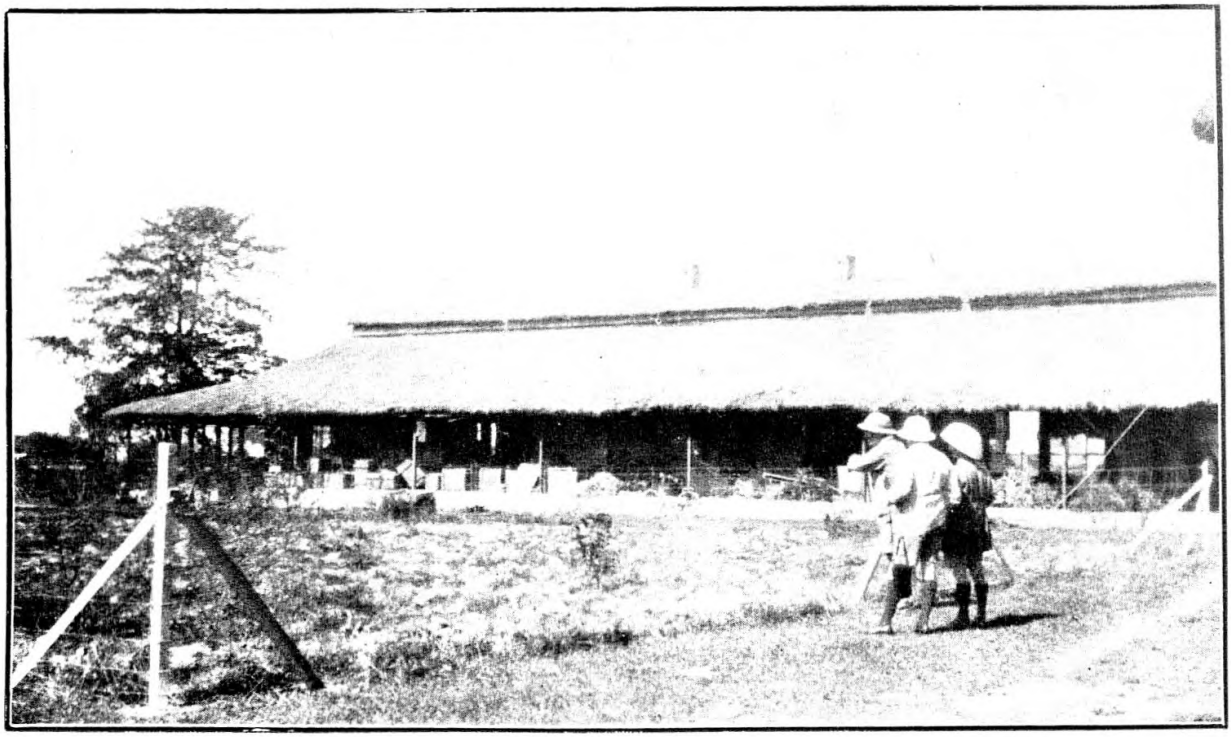

Fig 4. PART OF THE MYCOLOGICAL LABORATORY—TOCKLAI

particular requirements of the various branches of work. The administration building provides for office accommodation for the Chief Scientific Officer and the clerical staff, and a large hall which is utilized for the lecture courses for estate managers and assistants which are now held annually. The chemical laboratory is the oldest building and will require to be enlarged if the chemical work continues to increase at the rate that it has done during the past two or three years. The mycological laboratory and the entomological laboratory are new buildings. In the former the newly appointed bacteriologist is to be housed and attached to the latter is an insectory. Photographs of those various buildings are appended hereto and rough sketch plans were made for the information of the Tea Research Scheme if required.

The buildings are steel frame buildings with brick walls and are covered with corrugated iron roofing covered with thatch.

The staff of the Scientific Department now consists of the Chief Scientific Officer (Chemist), three Chemists, one Entomologist, one Mycologist and one Bacteriologist. The enlargement of the staff in recent years was found to be necessary on account of the complexity of certain of the problems which required investigations and was especially brought about by the Mosquito pest requiring detailed bio-chemical investigations when the entomological side of the problem had been exhaustively studied. It was emphasized by members of the Administrative Sub-Committee of the Indian Tea Association responsible for the control of the Scientific Department and by the staff at Tocklai itself, that Ceylon would be wise to start its Research Institute with as complete a staff as possible from the outset rather than build it up gradually as had been done at Tocklai. So many agricultural problems require co-operative team work of a number of scientists and unless those various specialists are available progress must be slow and often unsatisfactory. The subordinate staff at present consists of 4 Assistant Chemists and 4 Analysts in the Chemical branch, one Assistant Entomologist and one Insectary Assistant in the Entomological Branch : one Assistant Mycologist, one Senior Laboratory Assistant and 6 Junior Laboratory Assistants in the Mycological branch, one Assistant in the Bacteriological laboratory ; and one Field Assistant in the Field Branch. Some of those Assistants are graduates of Indian Universities, but others have been trained at Tocklai itself.

Staff Officers are appointed upon agreements drawn up and signed in Calcutta. The agreements are continuous but are renewable at definite periods. Leave is granted on full pay after every three hot weathers in Assam. This leave is for 6 months from the date of leaving Calcutta and a passage equivalent to 1st Class P. & O. from Calcutta is granted to the officers—the return passage being granted if the agreement is renewed. These passages at present are provided only for the officers themselves, but they anticipate that as the Government of India has adopted the recommendations of the Lee Commission regarding passages for the Indian Service there will be an improvement in this connection. The salary scale of officers is equal to that of Indian Government Agricultural Service with free quarters and an addition of Rs. 100—120 per mensem in lieu of pension rights. The minute of the Chairman of the Indian Tea Association on this subject is appended for the information of the Ceylon Tea Research

Board.* The pay of the subordinate officers corresponds to certain Indian Scales, but are lower than what would have to be provided in Ceylon for assistants of similar training and educational qualifications.

The work of the different branches was investigated thoroughly, and we desire to take this opportunity to state that the Tea Industry of Ceylon owes its special thanks to Mr P. H. Carpenter, the Chief Scientific Officer and the staff at Tocklai for the manner in which they placed all information concerning their work for the Indian Tea Industry at our disposal and for the frank manner in which they answered the various questions raised by us during our lengthy discussions on this work. It is impossible here to detail these various discussions but the following notes may not be without interest.

ADMINISTRATION.

All correspondence goes through the Chief Scientific Officer, and all reports from the officers in the various branches are made to him. These reports or extracts from them, if the Chief Scientific Officer considers desirable, are transmitted to the Tea Estates. All correspondence is with the Tea Estates as it has been the desire of the Scientific Department to keep in the closest touch with Managers of estates and to encourage them to send their problems to it for solution. At the end of every month, each branch has to submit to the Chief Scientific Officer a monthly report covering all the work and investigations of that period. These reports are scrutinized by the Chief Scientific Officer and submitted with a covering report to the Calcutta Sub-Committee for the confidential information of members. The names of all tea estates are omitted from these reports as it has been found in practice that it was desirable to do so.

In the filing system, the correspondence with each garden is kept separate.

All laboratories are fitted with gas generated by weight driven petrol gas plants, but electricity was at the time of our visit being also installed throughout.

CHEMICAL LABORATORY.

Analyses of soils and manures are not at the present time carried out by the Department except in so far as they relate to special problems and investigations on which the Department is engaged. This has been found to be necessary as otherwise this work would tend to swamp all research. Soil analyses are now carried out by Analysts in Calcutta, but the Tocklai Authorities fix the analytical methods to be used in order that uniformity of methods may be secured and the interpretation of the figures from the various analysts made possible. The methods are changed from time to time as circumstances demand and check samples are periodically analysed by Tocklai in co-operation with the various analysts. The advice of Tocklai for manuring programmes is sought by all Agencies having Tea Estates in Assam and the rotation of manures recommended varies with the district and estate conditions. A five-year rotation is a common manuring programme recommended somewhat on the following lines :—

First Year—Cattle manure or an oil cake
Second Year—Phosphates and low-growing green manures
Third Year—Sulphate of Ammonia and Potash
Fourth Year—Green Manures
Fifth Year—Green manure trenched and sulphate of ammonia.

* Not reproduced. Ed. "T. A."

The results of applications of lime in tea were fully discussed and the experimental work on the Tocklai and Borbhetta Experimental Stations was subsequently inspected.

The beneficial results of lime applications on the growth of green manure were seen and the depressing effect of heavy dressings of lime on tea was also most marked at Tocklai. The results of these experiments have recently been published in the *Quarterly Journal of the Indian Tea Association* Part 1, 1925, and reproduced in the *Tropical Agriculturist*, Vol. LXV, No. 3 (September—1925). The lime used in Assam is usually ground lime stone and occasionally burnt lime stone. Finely ground lime stone appears to be more favoured than burnt lime stone.

The work on what constitutes quality in tea was interesting and it is at present held that the best quality is obtained when there is a long length of old wood, and a short flush and from crop grown under medium shade. The acidity of Assam soils was also discussed. A considerable amount of work has been done on this question, but the full significance of the results is not yet understood.

ENTOMOLOGICAL LABORATORY.

The work of the Entomologist on mosquito blight and his potash work were fully discussed. The bio-chemical problems which arose in this investigation have led to an expansion of the staff of the Department. The mosquito blight problem has been a difficult one and has required lengthy research. The various nettle grubs and bag worms on Indian Tea estates were examined and discussed. Shot-hole borer is not found in Indian tea and the Indian species of Tortrix—*Homona menciana*—does not do much damage. Enquiries were made as to whether parasites of this species were known but Mr. Andrews stated that he not did know of this pest being parasitized. Information was also sought regarding scale insects affecting tea, but these appear to be rare. Mr. Andrews informed us that they often did considerable damage to coffee in South India, but that this was generally much less on heavily shaded properties. It is therefore worth consideration whether the green bug problem in the Haputale district might not be met by an increase in shade.

The work that has been done in India with spraying tea was also discussed and the use of lime and sulphur was recommended as the materials were cheap and easily obtainable. Spraying is now adopted by a number of estates in Assam.

The insectory attached to the Entomological branch was well equipped and some notes of this equipment were made by the Director of Agriculture.

MYCOLOGICAL LABORATORY.

The first question discussed with the Mycologist was the Tea *blister blight*. This is now found in all districts except Cachar and Sylhet. In some districts the disease occurs only in certain gardens and it was generally rare around Jorhat. No garden could be said to be free unless it had been specially inspected. In some areas spraying with lime-sulphur was now generally employed for the control of this disease and considerable losses occurred unless this was done. Mr. Tunstall stated that he considered that live spores would not travel for very considerable distances

nor did they thrive when temperatures were high. The Director of Agriculture is, however, convinced that Ceylon would be very unwise to commence the re-importation of Indian tea seed as the introduction of blister blight into this island might be disastrous to the tea industry—especially up-country. Tea seed is still exported to Java but this has to be accompanied by a certificate from the Scientific Department of the Indian Tea Association. The work of examining this seed was being carried out by the Entomological and Mycological branches at Tocklai during our visit, and we were all impressed by the thorough manner in which this was being done by the Entomologist and the Mycologist.

It is expected that over 100 consignments of seed will be examined this season and as the charge is Rs. 100 per consignment—the revenue from this work to the Station amounts to more than Rs. 10,000. In view of the importance of safeguarding Ceylon tea from the introduction of pests we recommend that Government should amend its Plant Pests Regulations so that certificates as to freedom from pests and diseases be required from a properly constituted scientific department with all tea seed introduced into Ceylon from Java and Sumatra.

Branch Canker.—The North Indian types are not the same as Ceylon and almost invariably are the consequence of bad pruning. The South Indian type more closely resembles the Ceylon trouble.

Diplodia is common in some districts but it can be checked by application of potash. It occurs very frequently on soils where phosphoric acid is in excess or more probably where the ratio of potash to phosphoric acid is not satisfactory.

Where *Sphaerostible* occurs soil conditions are invariably unsatisfactory. It is generally worse on soils with a high acidity.

Various forms of thread blights were also examined and discussed. *Brown blight* occurs commonly where excesses of soluble nitrogen have been employed, but this can be corrected by applications of potash.

The Mycologist impressed us with his belief that in Assam diseases become prevalent when the bushes are of low vitality or are becoming moribund as the result of faulty cultivation, pruning or manuring, and that where these conditions are rectified matters invariably improve. He personally had considerable faith in the use of manures—particularly nitrogen and potash—in the treatment of certain diseases and in the use of lime and sulphur spray in the control of others. Much heavier yields have been secured from sprayed areas and it is thought that the use of sulphur as a manure is worth investigation as it has undoubtedly produced marked effects on alkaline soils.

Interesting work on certain factors associated with quality has also been recently undertaken, but as these have not reached any definite stage further reference to this work cannot be made.

TOCKLAI AND BORBHETTA EXPERIMENT STATIONS.

At Tocklai. tests of the yields of different jats of tea and of pruning were being investigated. A further series of pruning experiments was also being carried out, and also the effect of lime on tea was being experimented

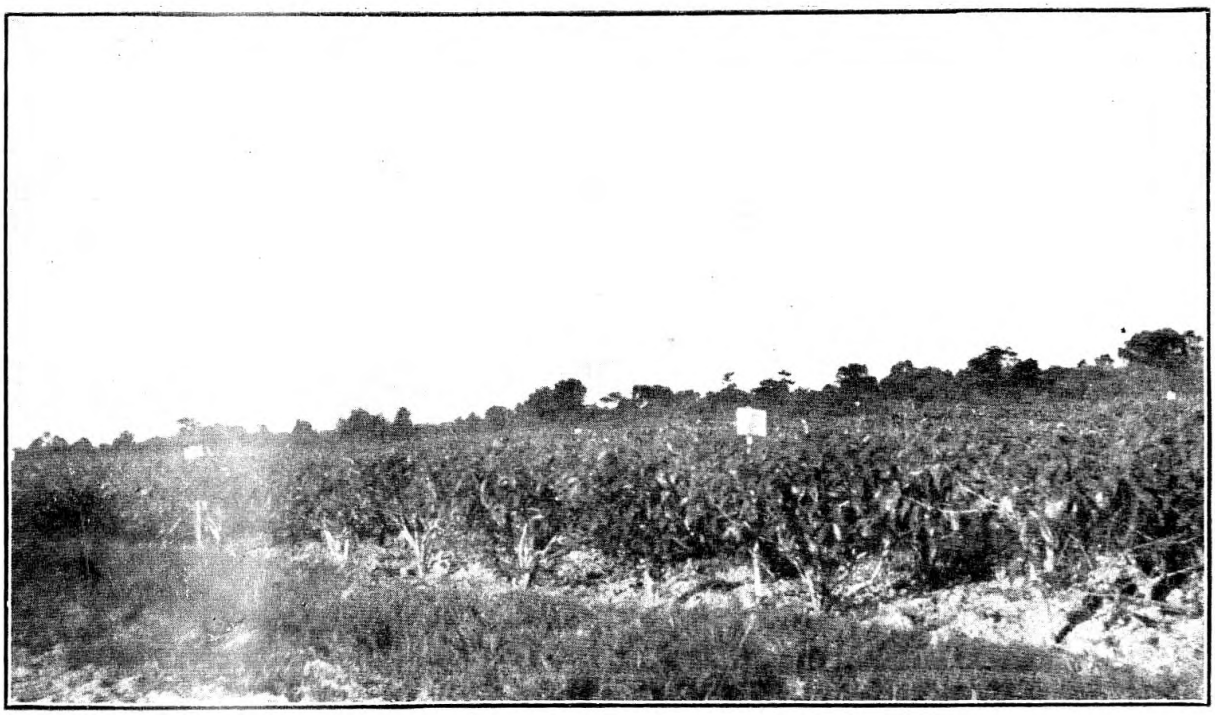

Fig 5. EXPERIMENTAL PLOTS—BORBHETTA

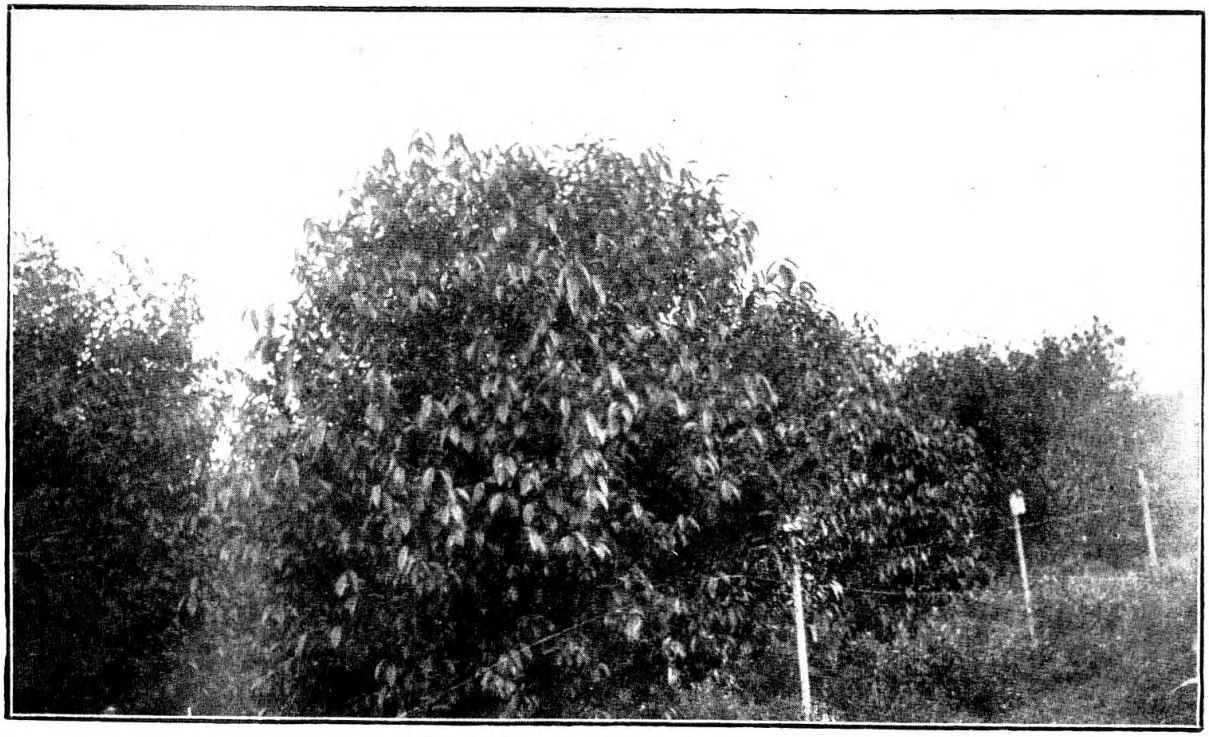

Fig 6. TEA SEED BEARERS—TOCKLAI

Fig 7. THE LIME EXPERIMENTAL PLOTS—TOCKLAI

Fig 8. A FIELD OF TEA IN THE DOOARS

with. Seed bearers—spaced 16 feet apart—attracted our attention. They are pruned every year to maintain a pyramidal shape of bush. It is thought that the results from seeds of comparatively young tea seed-bearers are better than those from very old trees, particularly if these have not been carefully cultivated and attended to. A study of the different jats of tea was interesting, and the changes that may occur with differing cultivation were also brought to our attention.

At Borbhetta, green manure plots have been carefully laid down. These are in plots of 72 bushes, and the manurial treatment of each plot is repeated 5 times in order to make it possible to reduce the experimental errors common to all field experiments. For two years previous to beginning the experiments the initial fertility of the different plots is taken. Cultivation experiments are also being conducted and the best plots are those which receive one deep hoeing and 3 shallow hoeings per annum, and the clean weeded plots with shallow hoeings. Pruning experiments with various forms of nitrogen are also being carried out. The nitrogen experiments at the present show the best results in the following order: (1) sulphate of ammonia: (2) nitrate of soda: (3) and green manures. For green manure Boga medeloa is grown in separate plots and added to the plots under treatment. It is thought that methods of treatment may effect considerable changes in what is known as jat and experiments to test these are being conducted. The plots on both stations have been very carefully laid out on very uniform flat alluvial soil, and the growth of the tea is throughout as uniform as could possibly be hoped for. Even under these conditions, the individuality of the different bushes and the difficulties of experimenting with a permanent crop which require weekly yields to be recorded have made it necessary to take at least two years' initial yields and renders it impossible to arrive at definite conclusions until the records of at least five years are available from a sufficiently duplicated number of plots.

GREEN MANURE TREES.

Albizzia stipulata is the green manure tree most commonly empolyed in Assam and affords a reasonably high shade. Others which attracted our attention were *Derris robusta* and *Dalbergia Assamica*. The Director of Agriculture proposes to secure seed of these in February or March next and will be pleased to book any orders, from estates in Ceylon which desire to experiment with them. At Tocklai, in the experimental plots there is no shade at all, so that shade factors and other complications are avoided. When Boga is grown in tea as a green manure, better results have been obtained when it has been left during the dry weather than when it has been cut out. Boga is now usually cut out after the drought. This result is probably due to the effect of the sun on the soil and to increases of soil temperatures. Any excess of evaporation from the soil by the boga is certainly counterbalanced by the shading effect during dry weather, and it is only in a certain few particular soils that tea appears to suffer during drought if there is no adequate cover of shade or green manure plants.

COURSES FOR MANAGERS.

During our visit to Tocklai preparations were being made for the fourth of the series of lecture courses for estates managers and assistants. These consist of weekly courses for three consecutive weeks in November and

early in December. Twenty are received in each batch or sixty each year. They are housed in temporary housing accommodation and mess at the Jorhat Club. The number of applicants for this year's course was 250, but the allocation is done in Calcutta and care is taken to have each tea district represented in each batch so that the fullest discussion possible may follow each lecture. A copy of the programme drawn up for this year is appended. This programme is drawn up at Tocklai and copies of this together with the abstracts of lectures are given to those attending the courses on arrival. Each course is made complete in itself and the lectures are given in simple language—technical terms being used as little as possible.

These courses have become popular and could be usefully followed in Ceylon. The Director of Agriculture has seen the results of similar courses of lectures in the West Indies and Mauritius, and there is little doubt that they stimulate interest in scientific research and are a means of bringing the worker into close touch with the practical man and his problems.

The expenses of estates managers and the assistants attending these lectures are paid by their respective employers.

EXTENSION OF WORK.

The extension of the work of the Scientific Department which is at present taking place consists of the commencement of bacteriological work, particularly in regard to the manufacture and quality of tea. A small substation is being opened in the Dooars and will be under the charge of an ordinary officer from that district, and a larger station has been selected for South India. This will be opened early next year and the officer who has been selected to take charge of this station was working at Tocklai at the time of our visit in order to familiarize himself with all the results obtained at that station prior to taking over work in South India. This station in South India will be in all about 40 acres in extent, as it was thought that South Indian tea problems differed considerably from those of North India and would require a larger station than was being laid down for the substations contemplated for North Indian districts. This larger station is however to be developed gradually and is being assisted by a fairly substantial grant-in-aid from the Government of Madras.

THE CEYLON PROPOSALS.

The Ceylon proposals were thoroughly and exhaustively discussed with the Chief Scientific Officer and with the Secretary of the Indian Tea Association in Calcutta.

The essential conclusions which we arrived at as the outcome of these discussions may be summarized as follows :—

(1) A Central Station is essential. Research work must be done at a Central Station and as complete a staff as possible should be secured from the beginning.

(2) Sixty per cent. of the work at Tocklai is chemical, and the necessity for a strong chemical section in the Ceylon Tea Research Institute was apparent.

(3) The Central Station should be of not less than 50 acres, of which some should, if possible, be already planted in tea. Otherwise field results will be not possible under Ceylon conditions within a period of less than ten to twelve years.

Fig 9. TEA CULTIVATION IN JORHAT

Fig 10. TEA CULTIVATION IN JORHAT

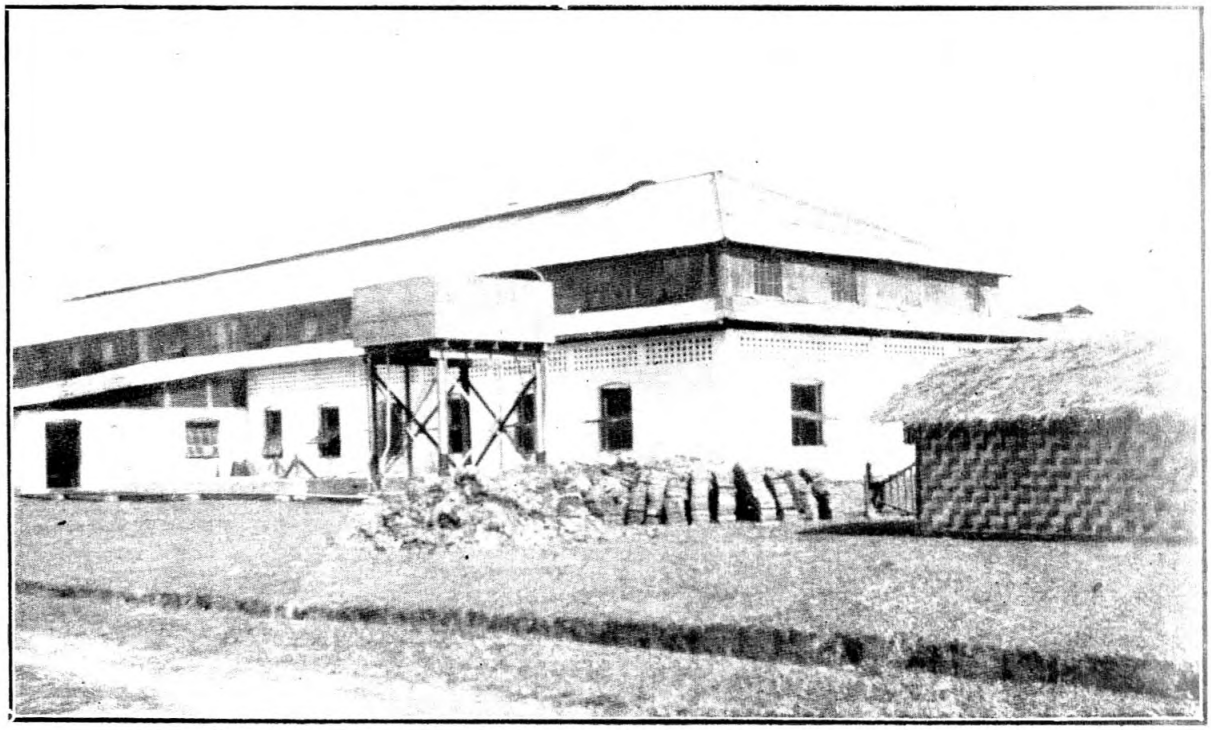

Fig 11. A TEA FACTORY IN JORHAT.

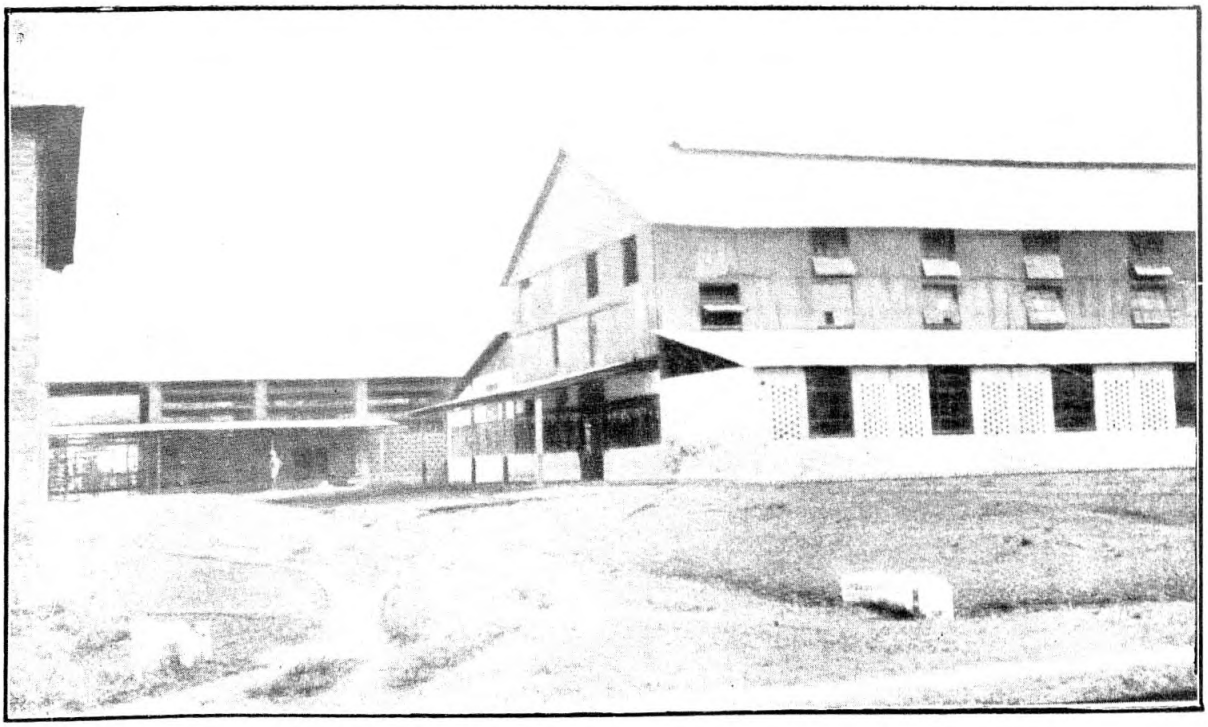

Fig 12. A TEA FACTORY IN JORHAT.

(4) The land for this Station should be uniform in character and as flat as possible. It should be slightly below normal fertility. The Chief Scientific Officer stressed the necessity for uniform land and its being essential that it should be flat if possible.

(5) A model factory should be attached to this Central Station.

(6) This Central Station need not be in the centre of the tea growing area. It should be in a place which was easily accessible to tea planters and if possible near to a centre where they periodically meet. Tocklai was selected on account of its being in the centre of the Jorhat district and near the Jorhat Club, which has regular meetings during the year at which a large number of tea planters foregather.

(7) Small sub-stations should be opened in different districts later on and should be staffed by officers who have had experience in the central station and who will act as advisory officers and not as research officers.

(8) These sub-stations should not be started until the Central Station has accumulated sufficient information with which the sub-stations could begin their demonstrations and experiments in co-operation with estates under these advisory officers.

(9) The most essential work is research on soils and manures and work on manufacture. For soil and manure work a soil chemist is necessary and for the manufacturing problems a bio-chemist, and bacteriolcgist if possible with brewing experience is recommended.

These conclusions were arrived at only after the most careful discussion, and we would emphasize that we are convinced that the Ceylon tea industry requires its soil and agricultural problems investigated as early as possible. The factory problems also require attention but are not so pressing as the soil investigations.

CONCLUSION.

In conclusion we desire to record our high appreciation of the hospitality and the manner with which Mr. Carpenter and his staff placed their time at our disposal at Tocklai. We were impressed with the work that is being carried out there and feel that as the experimental work in the field progresses further data of very considerable value to the tea industry of Northern India will be secured. The conditions of Ceylon tea differ so greatly from the conditions in Assam that a separate Research Institute is clearly warranted, but we do feel that the closest co-operation between the scientific workers at the existing Research Station at Tocklai and the Station about to be started in South India and of that proposed for Ceylon should be encouraged and fostered. We also recommend that arrangements should be made for a periodic exchange of results between these different stations and for occasional exchanges of visits between the scientific officers.

Separate reports on various aspects of the Assam Tea Industry are also submitted in the hope that they will be of interest and of use to the Tea Industry of this Colony.

F. A. STOCKDALE
M. L. WILKINS
J. HORSFALL

December 19th, 1925.

APPENDIX I.

Provisional Programme for the Short Courses of Instruction, 1925.

SYLLABUS.

Time	Lecture Subject	Lecturer
Monday.		
9-15 a.m. to 10-15 a.m.	The food of plants. Sources of supply. Air. Soil. General functions of the soil. Variation in fertility. Classes of soil and methods of their formation. Influence of sizes of particles noticed. Soil space. Soil matter. Soil micro-organisms, etc.	P. H. Carpenter
10-30 a.m. to 11-30 a.m.	Insects	E. A. Andrews
11-45 a.m. to 12-45 p.m.	Mycology	A. C. Tunstall
2-30 p.m. to 4-0 p.m.	Demonstrations (a) Pruning (b) Plucking (c) Entomological (d) Mycological	
Tuesday.		
9-15 a.m. to 10-15 a.m.	Properties of sand, silt, clay and organic matter. Mechanical analysis—methods demonstrated. Classification of soils according to mechanical analyses.	C. R. Harler
10-30 a.m. to 11-30 a.m.	Pruning and Plucking	P. H. Carpenter
11-45 a.m. to 12-45 p.m.	Mycology	A. C. Tunstall
2-30 p.m. to 4-0 p.m.	Demonstrations (b) Pruning (c) Plucking (d) Entomology (a) Mycology	
Wednesday.		
9-15 a.m. to 10-15 a.m.	Soil water and Drainage ...	H. R. Cooper
10-30 a.m. to 11-30 a.m.	The relationship between Insects and Plants ...	E. A. Andrews
11-45 a.m. to 12-45 p.m.	Manufacture ...	P. H. Carpenter
2-30 p.m. to 4-0 p.m.	Demonstrations (c) Pruning (d) Plucking (a) Entomology (b) Mycology	

Time	Lecture Subject	Lecturer
Thursday.		
9-15 a.m. to 10-15 a.m.	Chemical analysis of soil. Methods and meaning of results	C. R. Harler
10-30 a.m. to 11-30 a.m.	Tea manufacture ...	C. J. Harrison
11-45 a.m. to 12-45 p.m.	Manuring ...	H. R. Cooper
2-30 p.m. to 4-0 p.m.	Demonstrations (d) Pruning (a) Plucking (b) Entomology (c) Mycology	
Friday.		
9-15 a.m. to 10-15 a.m.	Cultivation— Objects. Dangers. Variation to suit different soils. Soil pans. Trenching. Discussion of the soils	H. R. Cooper
10-30 a.m. to 11-30 a.m.	Manufacture	P. H. Carpenter
11-45 a.m. to 12-45 p.m.	Insect Control	E. A. Andrews
2-30 p.m.	Borbhetta	
Saturday.		
9-15 a.m. to 10-15 a.m.	Mycology	A. C. Tunstall
10-30 a.m. to 11-30 a.m.	Manuring	H. R. Cooper
11-45 a.m. to 12-45 p.m.	Meteorology	C. R. Harler