EDITORIAL.

TEA SUPPLIES

A survey of the tea growing on the majority of estates in Ceylon reveals much more marked differences in uniformity and jât than is apparent in other countries. The indication to be drawn from this is that our sources of supply are in urgent need of attention in order that a greater degree of uniformity may be attained within the jâts available for planting.

The Institute is anxious to be of assistance to estates in this direction and, as a step towards this end, has been endeavouring to obtain the fullest possible information in regard to seed-bearers in Ceylon. It is to be regretted that in response to the request for such information made in the last *Tea Quarterly* only three replies were received. The pooling of information in regard to existing jâts in Ceylon would facilitate the Institute's attempts to help those interested in supplying seed to improve their types and another appeal is made for co-operation in this matter.

It should perhaps be made clear that the Institute, for obvious reasons, cannot undertake to recommend to estates any particular sources of seed. It is considered, however, that the Institute can help in improving these sources and it must then remain the responsibility of any prospective purchaser of seed to satisfy himself that the bearers under consideration are of satisfactory type and uniformity.

In addition to attention to existing seed-bearers, the Institute is actively engaged in selection work, the aim being of course to obtain types of better quality and with higher-yielding capacity. At the same time the question of the multiplication of such selected material is under investigation.

At present such selection has to be conducted on local material. The importation into Ceylon of tea seed from North-East India, where a much wider variety of better defined jâts is available, is still prohibited under the Plant Pest Ordinance in order to avoid the risk of introducing new pests or diseases. It is considered, however, that such a risk would be reduced to a minimum in the case of small quantities of seed imported under suitable precautions by the Institute and kept under the constant observation of the Institute's technical staff. An application is therefore to be made for a relaxation of the regulations under the Plant Pest Ordinance in

respect of seed required for the Institute's own selection experiments. If this be successful, it will be possible considerably to enlarge the range of material available for selection.

In such work close contact is being maintained both with Java and India where similar investigations are in progress.

APPLICATION OF SCIENCE IN TEA CULTURE

In the January (1938) number of *The Empire Journal of Experimental Agriculture*,* Mr. P. H. Carpenter, the Chief Scientific Officer of the Tocklai Experimental Station, Assam, gives an interesting review of recent trends of research work on tea. In view of what has been written above it will be of interest to include the following quotation from Mr. Carpenter's article:—

> "Tea is planted out from seed collected from many sources, but the first tea-gardens were established with plants brought directly from China, or from seed imported from China. Subsequently tea was found growing wild in Assam which was at first thought to differ so greatly from the Chinese variety that it was unlikely to make commercial tea. This view was, however, disproved, and it is from this source that the modern tea-gardens have developed. Seed from Assam has been sent to the other tea-growing countries, and these in their turn have developed their own seed-gardens. The original seed of the Assam type was collected in the jungles and was used for making seed-gardens. Owing to carelessness and ignorance of methods likely to ensure effective selection, there exists to-day no commercially known pure-line variety of tea. The progeny from all seed-gardens is much hybridized, and it is evident to any casual observer that the plants raised from any one seed-garden give progenies which differ considerably amongst themselves in appearance. Experiments have shown also that the characteristics of the tea manufactured from individual bushes differ considerably. In a broad way it is recognized that certain kinds of tea plant are suitable for certain cultural and climatic conditions, but even so, the variation found among plants from any commercial type of seed is likely to be as great as that between the commercial types themselves. Very great improvement would result if uniform characteristics could be achieved in the product from any one seed-garden.
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> "In the Netherlands East Indies much work has been done in the direction of selecting bushes for some desirable quality and vegetatively reproducing such bushes by budding. The botanist of the Thee Proefstation, Java, has now a number of such clones undergoing trial. Of more recent years intensive work has been begun in Russia along the same lines, employing either budding or cutting as the method of vegetative reproduction.

* P. H. Carpenter.—"The Application of Science to Modern Tea Culture."—*The Empire Journal of Experimental Agriculture*, 1938 (VI, 1).

Particular attention in this case has been paid to the development of frost-resistant strains. Tunstall, at Tocklai, undertook experiments on the production of tea bushes from cuttings, but no systematic work was possible in the absence of a botanist, and it was not until 1930 that one was appointed. Since then work in this direction has been in progress. Attention is also being paid to selection work in Ceylon. This work is in its early stages and has not yet been developed commercially. In Java, however, one seed-garden raised by budding is to-day established and yielding seed.

"It is in the direction of variety selection and the production of uniformity in the progeny of tea seed-gardens that the next big development in tea culture is likely, and indeed might almost be said to have begun, for the importance of research in this direction is now recognized throughout the industry."

In regard to the application of science generally in the tea industry, Mr. Carpenter points out that Java was the first to appreciate the need for such work. A few years later, in 1899, the first scientific officer was appointed to the Indian Tea Association. In Ceylon investigations on tea soils were first begun by Bamber in 1898, but it was not until 1925 that the Tea Research Institute was inaugurated. Other research stations now exist in South India, Russia, Japan and East Africa.

One of the first questions to be investigated was the question of soil fertility and Mann first introduced the systematic use of nitrogenous fertilisers in tea, rape cake being applied at the rate of about 400 lbs. per acre. Somewhat later arose the practice of growing leguminous crops in the tea to enrich the soil with nitrogen and improve the tilth.

Carpenter gives an interesting summary of the developments that have since occurred in manuring practice. As the result of field experiments carried out at Tocklai, the use of inorganic forms of nitrogen was begun, though there was at first considerable prejudice, not yet extinct, against such a practice.

Carpenter's conclusions which of course relate to Indian conditions, and are based on long continued experiments at the Tocklai Station, are indicated by the following quotation from his article:—

"Fully replicated field experiments in all the tea-growing countries have, however, demonstrated the value of nitrogen in the inorganic form of sulphate of ammonia. At Tocklai replicated field experiments have now been carried on for over 17 years in which the same kind of manure has been added annually to the same plots. The results show that sulphate of ammonia, if used to supply an equal quantity of nitrogen, gives results as good or

better than those obtained from organic manures such as oilcake, cattle manure or green manure, or cuttings of leguminous plants, (*e.g., Tephrosia candida*).

"It is often maintained that cattle manure is valuable not only because it supplies nitrogen but also because of its bulk of organic material. Experiments carried out at Tocklai have shown that over a period of 4 years an annual application of 5 tons of cattle manure supplying 60 lb. of nitrogen has given an increase of 765 lb. of tea per acre, whereas in another experiment an annual application of 60 lb. nitrogen as sulphate of ammonia has given over the same 4 years an increase of 1,580 lb. of tea per acre. Similar results have been obtained in other experiments, indicating that for the same application of nitrogen, cattle manure possesses about one-half to one-third the efficiency of sulphate of ammonia. It is sometimes claimed that cattle manure is slow-acting and that its effect will be felt over a large number of years. Actual trial, however, shows that one application of 20 tons per acre of cattle manure containing 160 lb. of nitrogen produces a crop-increase over 4 years, but for no longer. An application of an equal quantity of nitrogen as sulphate of ammonia gives about double the increase in crop over the same period of time. It does not, therefore, appear from these experiments that cattle manure is an efficient manure, nor does it give increases of crop over any long period of time.

"Nitrogenous manures seem to give an increase in crop proportional to the amount of nitrogen supplied :—

Nitrogen applied annually	Average annual gain in crop in lb. of tea per acre
lb.	lb.
40 ...	256
80 ...	535
120 ...	721

"The crop-increase obtained is proportional to the amount of nitrogen that becomes quickly available to the tea plant, and a slow-acting manure is generally synonymous with an inefficient manure. The amount of increase obtained per lb. of nitrogen applied varied with the soil and other conditions. Broadly speaking, the higher the natural cropping capacity of the soil the less the response from nitrogenous manuring.

Place	Crop increase in lb. of tea per acre per lb. N for doses of 40 lb. N per acre per annum
Tocklai (Assam)	6.4 lb.
Tulsipara (Bengal, Dooars)	5.1 ,,
St. Coombs (Ceylon)	4.4 ,,

"For a certain quantity of nitrogen added annually to the soil the tea crop will increase until it reaches a certain maximum dependent upon the amount of nitrogen added annually. This rise to a maximum does not take place at once; there is a steady increase, which at Tocklai with an application of 40 lb. of nitrogen reaches a maximum in about the fifth year of continuous manuring. On experimental plots the increased crop in lb. of tea per acre for an application of 40 lb. of nitrogen per acre is :—

First year	...	3.3 lb. crop per lb. nitrogen
Second year	...	5.0 ,, ,, ,, ,, ,,
Third year Fourth year	...	6.4 ,, ,, ,, ,, ,,
Fifth year	...	8.0 ,, ,, ,, ,, ,,

"A commonly expressed opinion, backed however by no evidence, is that the continual use of a manure, such as sulphate of ammonia, to tea results eventually in the depletion of organic matter in the soil. Such opinion has strongly advocated the use of bulk organic manures for tea. An experiment that has now been continued for 17 consecutive years compares the effect of sulphate of ammonia with that of cuttings from *Tephrosia candida* supplying an equal quantity per acre of nitrogen. So far no advantage is shown from the use of the bulk manure in the condition of either tea bush or soil. Throughout the experiment sulphate of ammonia has proved superior and still continues to do so.

"An important experiment has shown that the use of sulphate of ammonia continued annually has resulted in an increase of soil nitrogen and organic matter varying with the amount of sulphate used.

Fertilizer nitrogen applied annually over 7 years lb.	Loss on ignition of dry soil (organic matter). per cent	Nitrogen in dry soil per cent
0	2.80	0.094
40	2.93	0.096
80	3.09	0.101
120	3.10	0.104

"The supposition that the use of 'artificial' nitrogen on tea soils 'exhausts' the soil of organic matter and nitrogen is the reverse of the truth. These results may at first seem somewhat surprising, but a little knowledge of tea culture permits a simple understanding of the facts. Tea bushes are planted about 4½ feet apart, and by pruning and plucking are

maintained at a height of about 3 feet to 4 feet from the ground. During the year new growth develops, part of which is removed by plucking; most of the remainder is buried at the next pruning. In North-East India, and in the particular instance under consideration, the pruning was done annually, and the weight of prunings which were turned into the soil increased with the weight of manure used.

Nitrogen applied annually over 7 years lb. per acre		Dry weights of prunings tons per acre
nil	...	1.0
40	...	1.5
80	...	2.0
120	...	2.3

"With the increased doses of nitrogen there is an increased growth of bush, and consequently an increased weight of prunings that are returned to the soil. The prunings, whether from very heavily manured or from unmanured plots, had the same composition. Such prunings provide an annual addition of organic matter to the soil which in decomposing is able to render at least a part of its nitrogen available to the bush. Part, however, remains unavailable and accumulates in the soil. Whether the prunings are buried with or without the addition of soluble nitrogen appears to make no difference to the crop return that is obtained, beyond that which would be expected from the additional soluble nitrogen. In other words there is no interaction between the effect of prunings and the sulphate of ammonia so far as nitrogen supply is concerned. It would seem that nothing would be gained by composting such material, a procedure that has been much advocated of late. These results make it clear that at any rate for tea culture there need be no fear that the use of an inorganic manure, such as sulphate of ammonia, will deplete the soil of organic matter so long as the tea prunings are incorporated in the soil. It would also seem that the incorporation of the weight of organic matter as prunings into the soil is sufficient for the soil's requirements, and consequently no gain in crop is obtained by the use of bulky organic manures."

Experiments in Ceylon have likewise indicated the suitability of inorganic forms of nitrogen for tea and very great economy in the cost of manuring has resulted from their use. In Ceylon the comparison has chiefly been between sulphate of ammonia and 'organics' such as bloodmeal or groundnut cake. In these cases there has been but little difference in the yield between the different treatments.

In regard to other manurial constituents such as phosphoric acid and potash, the Indian findings reported by Carpenter suggest that potash has had a slight adverse effect on quality. In Ceylon the position is reversed in that omission of potash has been detrimental. The reason for the difference may be, as Carpenter suggests, that Assam leaf normally has a much higher potash content than Ceylon leaf.

Carpenter also reports some interesting observations on the results of cultivation. In Assam, speaking generally, it has been found that undue disturbance of the soil, *i.e.*, cultivation in excess of that required to suppress weed growth, has depressed yields.

In Ceylon, where of course soil conditions are totally different, more vigorous cultivation is generally favoured. These are not wanting indications, however, that even here this may be overdone and that soil stirring *per se* may not be beneficial.

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