ARTIFICIAL FARMYARD MANURE.

By

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In the era of coffee in Ceylon, manuring consisted principally of the application of cattle manure, herds of cattle being maintained for the purpose. In the early days of tea planting, the practice was continued, but except for a few estates upcountry it has now been practically abandoned as far as tea is concerned, though it is still in vogue, in one form or another, on coconut and cacao estates. The principal difficulties in the way of the employment of cattle manure are the absence of convenient areas of pasture land and the cost of transport of such bulky material by coolie labour. Consequently the tea planter relies on artificial fertilisers, with organic material in the form of poonacs.

It is, however, generally recognised that artificial fertilisers are not a complete substitute for farmyard manure. Russell states "farmyard manure behaves differently from artificial manures and is not wholly replaceable by them;" and in discussing the famous Rothamsted experiments, he writes " For the first few years the artificials considerably enhanced the fertility of the soil, but after a time their effect began to fall off. Farmyard manure, on the other hand, showed a smaller falling off, and though, both at Rothamsted and Woburn, it began by being less effective than artificials it was finally more effective; the difference has now become rather marked."

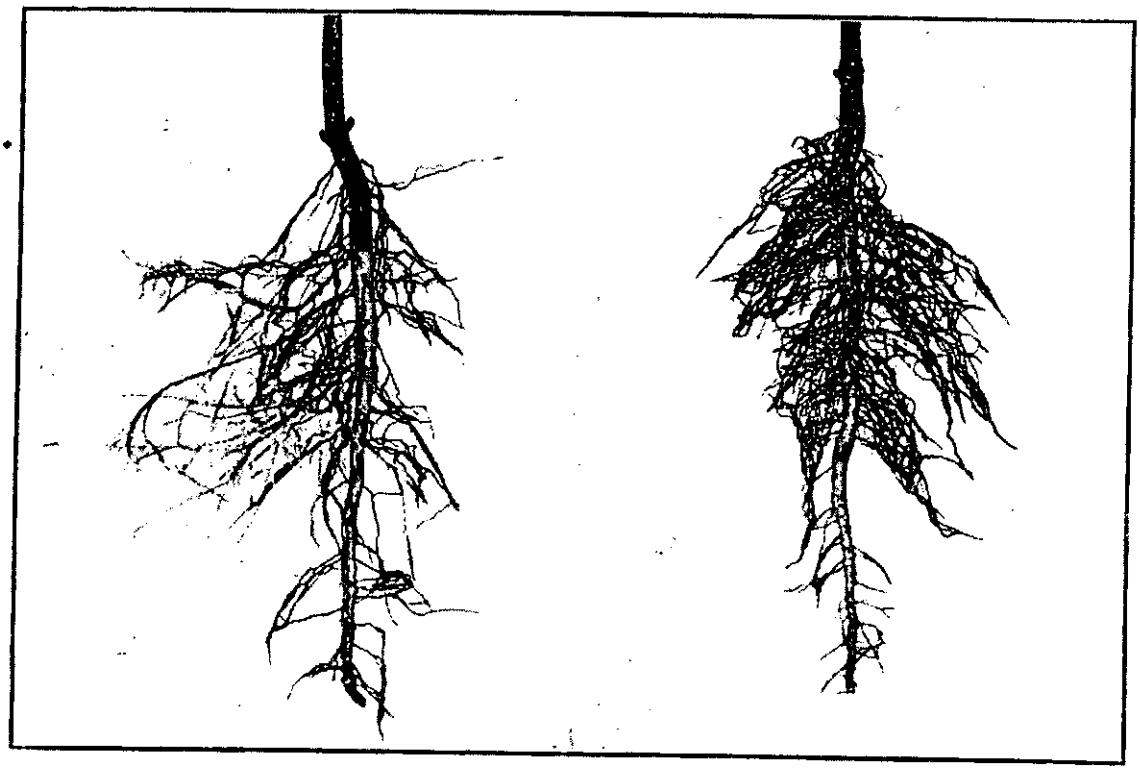

PLATE I.

Fig. 1.
Root system of a tea seedling grown in a culture solution at pH 4.5

X 3/5

Fig. 2.
Root system of a tea seedling grown in a culture solution at pH 7.5.

X 3/5

This superiority of farmyard manure is to be attributed not so much to the nitrogen and mineral substances it contains as to the organic matter, the decaying vegetable matter of which it is chiefly composed. The vegetable matter increases the humus content of the soil, and so alters its physical composition and possibly its bacterial flora. Humus alters the character of the soil and assists it to retain moisture, so that crops grown with farmyard manure are less liable to suffer from seasonal variations than those grown with artificials only.

In Ceylon, this defect of artificial manures is being avoided by the practice of green manuring, which has been steadily extending during the last twenty-five years. Although this practice was originally introduced into Ceylon with the idea of utilising atmospheric nitrogen by the agency of leguminous plants, and is still often discussed from that standpoint only, it is now realised that one of the important functions of a green manure is the addition of humus to, and the consequent improvement of the condition of, the soil.

During recent years, scientific investigations have shown the possibility of converting vegetable refuse, without the intervention of animals, into an "artificial farmyard manure," and this process is now being tried out in different parts of the world, under widely different climatic conditions. Our readers will be familiar with the accounts of these trials in other countries which have already been published, but it appears worth while to record the following details concerning an experiment in the manufacture of artificial farmyard manure in Ceylon.

The experiment in question was carried out by Mr. P. G. Boileau, of Dunkeld Estate, who has kindly furnished the following particulars. The analyses were executed by the firm of Bamber and Bruce.

Approximately 8 tons of material (mostly Mana grass) was placed in a pit at the beginning of February, 1927. Nitrolim was used as a starter. Water was added at the rate of approximately 125 gallons per ton when the pit was first filled, and subsequently at the rate of about 12 gallons per ton per day in dry weather.

During the dry weather the pit was left uncovered, and watered daily. During the wet months it was covered.

The result of an analysis of the material made in July, 1927 was as follows.

	Sundried material.	Original material.
Moisture lost in the sun, 66·0%.		
Moisture lost at 100°C.	6·7%	68·84%
Ash	56·4%	18·84%
Organic matter	36·9%	12·32%
	100·00	100·00

	Sundried material.	Original material.
Nitrogen in the organic matter	0·8 %	0·27%
Phosphoric acid in the ash	0·48%	0·16%
Potash in the ash	0·63%	0·21%
Humus	2·4 %	0·80%

The degree of humification is small, amounting to only about 6·5%, and probably indicating that sufficient time had not elapsed for the manure to mature.

Another analysis, of material taken from the same pit five weeks later, yielded the following results.

Moisture lost in the sun, 50·4%.	Sundried material.	Original material.
Moisture lost at 100°C.	11·00%	55·85%
Ash	34·78%	17·24%
Organic matter	54·22%	26·91%
	100·00	100·00
Nitrogen in the organic matter	1·26%	0·63%
Phosphoric acid in the ash	1·02%	0·51%
Potash in the ash	0·60%	0·29%
Humus	13·08%	6·04%
Nitrates	nil	nil
Degree of humification	24·12%	24·12%

The percentage of ash in these samples may be due, in part, to the accidental inclusion of soil from the sides of the pit when it was being filled.

For the sake of comparison, we reprint analyses of artificial farmyard manure, made by the pit system at Peermade (South India) using lemon grass, with nitrolim as a " starter," and of similar manure, made by the heap system in Trinidad, using dry grass, with Adco reagent. On the natural sample, these are as follows.

	Dunkeld. %	Peermade. %	Trinidad. %
Moisture lost at 100°C.	55·85	78·08	77·38
Ash	17·24	13·44	6·86
Organic matter	26·91	18·53	15·76
	100·00	100·00	100·00
Nitrogen in the organic matter	0·63	0·30	0·51
Phosphoric acid in ash	0·51	0·095	0·81
Potash in ash	0·29	0·047	0·26

Calculated on the dry weight at 100°C., these become

	Dunkeld. %	Peermade. %	Trinidad. %
Ash	39·05	49·83	30·33
Organic matter	60·95	50·17	69·67
Nitrogen in the organic matter	1·42	1·11	2·25
Phosphoric acid in ash	1·15	0·34	2·69
Potash in ash	0·65	0·17	1·15

The question has arisen, in what quantity artificial farmyard manure should be applied to tea. This is naturally a matter for field experiment, but assuming that artificial farmyard manure behaves in exactly the same way as natural farmyard manure, there is one point which must be borne in mind when considering the equivalent values, as regards nitrogen content, of artificial farmyard manure and the manure mixtures in general use; and that is their difference in rate of availability.

In temperate climates, the nitrogen in (real) farmyard manure is available much less rapidly than that in dried blood or poonac.

Roughly the nitrogen in farmyard manure is available about half as rapidly as that in dried blood, cotton seed poonac, or green vegetable matter. Consequently farmyard manure ranks among the slow-acting manures, and where annual crops are grown, its nitrogen, in general, is not all consumed by the plant in the first year. Its effects are not confined to the season of application, but persist over several years Hence when a farmer gives up his farm, he is compensated for the unexhausted value of the manure, and it is customary, in the second year after its application, to allow one-quarter the value of the nitrogen originally in the manure.

The bearing of this on the application of artificial farmyard manure to tea will be evident, if we assume that its behaviour in the tropics is similar to that in temperate climates. The manures usually applied to tea are relatively quick-acting manures. If it is desired to obtain the same effect by manuring with artificial farmyard manure, it is not enough to apply that quantity which will give an equivalent amount of nitrogen, since part of this nitrogen will not become available in the same time as the nitrogen in the customary manure mixture. Nor is it economic to increase the quantity of the artificial farmyard manure. It will be necessary to supplement the latter with some quick-acting source of nitrogen.

Among the difficulties confronting the use of artificial farmyard manure on the average tea estate in Ceylon are (1) the absence of suitable material on the estate, (2) the area required for its preparation, (3) the labour required for the transport of the manure. As regards the latter, it may be noted that on the first Dunkeld analysis approximately 5 tons of manure are required to supply 30 lbs. of nitrogen.

It would seem that the combination of artificial fertilisers and green manures, at present in vogue on Ceylon estates, affords a more practical solution of our manuring problems than the use of artificial farmyard manure. But the latter might prove of great value on areas on which green manures cannot be grown.