Green Crops.

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The Need for Organic Manure.

IN order that a soil shall maintain its fertility a constant supply of organic matter is necessary. One of the reasons why a jungle soil maintains its high state of fertility is that it annually receives considerable additions of organic matter in the form of falling leaves and withering under-growth.

On land that has been growing tea for many years and which has been consistently cultivated, the rate of loss of organic matter exceeds the supply given by the yearly fall of leaf and the light prunings returned to the soil. On this account the organic matter or humus steadily decreases till it reaches a very low level. The result is a soil giving a small crop. It must be remembered that a jungle soil receives no cultivation, and accordingly the decomposition of the humus proceeds at a slow rate, and is consequently conserved to such an extent that the soil gathers humus as time passes.

It thus follows that as a rule the tea soils of North-East India are deficient in organic matter, and whilst the necessity for replenishing this soil essential is realised, it not infrequently happens that green cropping as a method for supplying organic matter is out of the question because some soils fail to grow such crops. This may be due to the shortage of some soil mineral like lime or phosphoric acid; to the shortage of organic matter and nitrogen; or even to the prevalence of some fungus disease. This latter contingency arose at Borbhetta a few years ago when the presence of *rhizoctonia* in the soil, a root disease attacking some plants but not pathogenic to tea, completely arrested the growth of Boga medeloa.

The increased development of thatch grass on old tea land can be taken as evidence of the necessity for adding organic matter. Not that thatch grass prefers poor soil to rich but that on a poor soil the competition from other weeds is reduced.

In some cases soils rich in organic matter also fail to grow tea and many instances of deteriorated bheels may be quoted where the organic matter of the soil is as much as 20 to 30 per cent. but the tea does not thrive. In these cases the addition of organic matter either as green crop or as cattle manure failed to revive the tea for the fault lay in the physical state of the organic matter in the soil. Bheels which have thus deteriorated have done so because alternate drying and wetting has robbed the humus of its colloidal, "sticking" properties.

Under the climatic conditions experienced in North-East India which include the two factors, heavy rainfall and high temperatures, the steady loss of humus calls for the systematic addition of organic matter to the soil. This can be accomplished in several ways.

Organic matter is best added as cattle manure or good top dressing material, but few gardens are in the happy position of possessing either of these materials in sufficient quantity or in an economically available position. Every endeavour should be made to collect and utilise the cattle and line manure available. This often requires careful organization but such effort is amply repaid in the results obtained. The use of bheel soil as a top dressing should also receive careful consideration but it is necessary here to issue a word of warning that the appearance of such material is often misleading. It is always advisable to have accurate data, obtained from analysis, of the percentage of organic matter and also of the nature of the remainder of the dressing, whether it is a heavy clay or of a sandy nature.

Green Cropping.

The majority of gardens have to seek some other source of organic matter and this is most conveniently found in green cropping. The supply of any form of green plant material benefits the soil but it has been found most economic to utilise plants able to make use of atmospheric nitrogen in their growth. Such plants belong to the order Leguminosae. Plants other than Leguminosae supply organic matter equally well but are unable to utilise nitrogen directly from the air.

Ordinary plants obtain the nitrogen used in growth from the soil and when they are cut and buried, merely return to the soil the nitrogen which they have previously taken from it. It pays to carry jungle from hallahs and outside areas and to bury it on the garden, but it has been shown that such jungle gains in efficiency if it is rotted off the garden before it is buried.

There are many substances used as nitrogenous manures which also supply organic matter to the soil. Oilcake, fish manure, animal meal and blood meal are manures of this type, but they are expensive, costing from Rs. 3 to Rs. 6 per maund. It is possible to add large quantities of green manure,—4 or 5 tons—for a cost of about Rs. 10. The green crop contains about 80 per cent. moisture so that a five-ton crop represents about one ton of dry organic matter. This corresponds with about two tons cattle manure (containing about 50 per cent. moisture) or about 32 maunds oilcake (containing 10—15 per cent. moisture) so far as organic matter is concerned although no account of the nitrogen content is taken here.

Systematic Manuring.

It was thought at one time that it might be possible to add all the nitrogen required by the tea plant entirely in the form of green organic matter. Experiments carried out at Tocklai have shown that over a period of five years the annual application of 30 lb. nitrogen in the form of green organic matter brought in from outside and buried in the plot has not resulted in nearly as good a crop increase as that shown by the annual application of the same quantity of nitrogen given in a soluble form. The condition of the soil has however been greatly improved by this constant green manuring and the bushes have a healthier appearance than those receiving only soluble manures.

Whilst then green crops can be used to supply some of the nitrogen needed by the tea plant it is preferable to use it to supply organic matter and to add nitrogen in the artificial form as calcium cyanamide, sulphate of ammonia or nitrate of soda. Taking this principle as a basis it is possible to construct a manuring scheme suitable for gardens where a supply of organic matter in excess of that given by falling foliage and light prunings, is necessary. As examples the following two cycles are suggested.

Three Year Cycle.

First Year.—Quick growing green crop such as cow-peas and phosphoric acid added as 2 mds. basic slag, superphosphate or bone meal, or 2 cwt. Belgian Flour Phosphate.

Second Year.—30 lb. readily available nitrogen 20—30 lb. Potash per acre, broadcast with early rain.

Third Year.—Rahar in alternate lines, lopped at intervals and buried at end of season.

Fork in a quick acting mixture round the bushes which shall give — 30 lb. readily available nitrogen, 20—30 lb. Potash, 20—30 lb. phosphoric acid, per acre.

The heavier dose of Potash and lighter dose of Phosphoric acid should be applied to a sandy soil and the opposite to a clay soil.

Five Year Cycle.

First Year.—As above in three-year cycle.

Second Year.—As above in three-year cycle.

Third Year.— Boga medeloa in alternate rows; complete mixture as above forked round bushes.

Fourth Year.—Complete mixture as above forked round bushes.

Fifth Year.—Bury Boga medeloa at beginning of the year.

Common Green Crops.

It is sometimes difficult to know which green crop should be grown, and in deciding this, local knowledge is most valuable. It is important to obtain the greatest weight of green matter as opposed to woody material, and the crop chosen should be that which is known to grow most luxuriantly upon the particular type of soil. Apart from this there is no particular virtue in one crop over another apart from convenience.

The same crop should not be grown year after year on the same area otherwise the soil may become "sick." If a scheme based on that suggested above is followed then this factor is eliminated.

The table below supplies a few details of the more commonly grown green crops.

Name of plant.	Rate of seed per acre.	Planting	Crop	Growing period.
Cow-peas (*Vigna catiang*)	40 lbs.	every row	3 tons	6-10 weeks
Mati kalai (*Phaseolus mungo*)	30 ,,	,,	,,	,,
Bhotmas Soy bean (*Glycine hispida*)	40 ,,	,,	,,	,,
Sunn Hemp (*Crotolaria juncea*)	40 ,,	,,	,,	,,
Dhaincha (*Sesbania arculeata*)	40 ,,	,,	,,	,,
Arhar or Rahar (*Cajanus indicus*)	10 ,,	alternate rows	5 tons	8-10 month
Boga medeloa (*Tephrosia candida*)	10 ,,	,,	,,	2 years
Indigofera dosua	10 ,,	,,	,,	4-5 years

Cow-peas, Mati kalai and Soy beans are twining plants whilst Sunn Hemp and Dhaincha grow straight up. Arhar, Boga medeloa and Indigofera need to be well-lopped into an umbrella shape or otherwise a serious

loss in tea crop will be experienced. At the end of one year Boga medeloa should be thinned out to clumps about 12 feet apart. Indigofera is more suited to the hills than the plains.

Both Boga medeloa and Indigofera may be used for filling in trenches but if the woody material is buried there is a danger that root rot may spread along the trench. It is safe when trenches are made to leave a few inches uncut every few yards and this block of soil will act as a stop to diseases which are carried by dead wood in the trenches.

It is not advisable to grow Boga medeloa for more than two years, although if soil is in good condition it may be left up for three years. Indigofera may be grown for several years but it is susceptible to the root disease *Ustulina Zonata*, as it ages. The roots of old Indigofera are difficult to remove from the soil but if left in they may act as a source of infection to the tea.

Both perennial and annual green crops are of particular value in ridding an area of thatch grass although it is recognised that a better method of achieving this end is by a heavy application—15 tons—of cattle manure or by a top dressing of about 20 tons per acre.

Many green crops are failures because the rate of sowing is too small so that when the race between jungle and crop starts with the early rains the jungle is able to choke out the green crop. The seed quantities recommended above are liberal and if a seed bed is well prepared and the seed sown carefully so as to ensure a high percentage of germination then smaller quantities could be used. In some gardens it is found possible to weed the green crop in its early stages and this has been found to pay, especially with crops like Rahar and Boga medeloa, which are left growing for one or two seasons.

With care, good green crops can be grown in fully grown tea which has been ordinarily top pruned. In some cases the soil is so poor in nitrogen that a green crop cannot get a start. In this case a small application of nitrogenous manure, for example, one maund nitrate of soda per acre, is advisable. This, with two maunds of basic slag per acre, will ensure a successful green crop on practically any tea soil in North-East India.—*Quarterly Journal of the Scientific Department of the Indian Tea Association*, Part IV., 1926.