Green Manure.*

W. S. BURNETT,
Wanaraja Estate, Dickoya.

ONE of the greatest problems the agriculturist has to face all over the world, has to deal with the replenishment of organic matter in his soil, which is so subject to yearly losses. In the tropics these losses occur more rapidly than in temperate climates and the maintenance of the organic matter in the soil under tropical conditions is consequently more difficult.

We in Dickoya are not alone in the problem we have to face, and the factors chiefly involved are leaching and soil erosion. The lay of the land, clean weeding and tropical downpours are chiefly responsible for the latter.

In America, where perhaps conditions are not so unfavourable as those we have to contend with, it is estimated that 4,000,000 acres have already been ruined by soil erosion and 8,000,000 acres greatly damaged.

As the wheat belt moved slowly on, it left in its wake hundreds of thousands of acres of derelict farms, which shows how unsuccessfully the problem was handled there, while it also reflects on their farming methods.

Standing as we do in the gateway to Up-Country tea (Hatton) one may well wonder whether something similar is not occurring in Ceylon. We are surrounded by Estates, which, if one cannot call them derelict or abandoned, are in anything but a flourishing condition, and from an agricultural point of view, one can only regard them as monuments to the lack of prevision on the part of our predecessors and excellent illustrations of the penalties which have been exacted for ignorance or neglect.

With our attention fixed on these, the question I would ask you to-day is, " Are we as a body ensuring that our inevitable yearly losses are being replaced ? "

I would ask you to ponder over this. To my mind the answer is an emphatic negative.

The importance of organic matter cannot be over-stressed. When decomposed it forms humus on which the micro-organic

* Read at a meeting of the Dickoya Planters' Association, held at Adam's Peak Hotel, Hatton, on Monday, 28th November, 1927.

life of the soil depends, and on which we in our turn depend for the full benefit of our artificials. Without it the soil becomes sterile and micro-organic life is stilled.

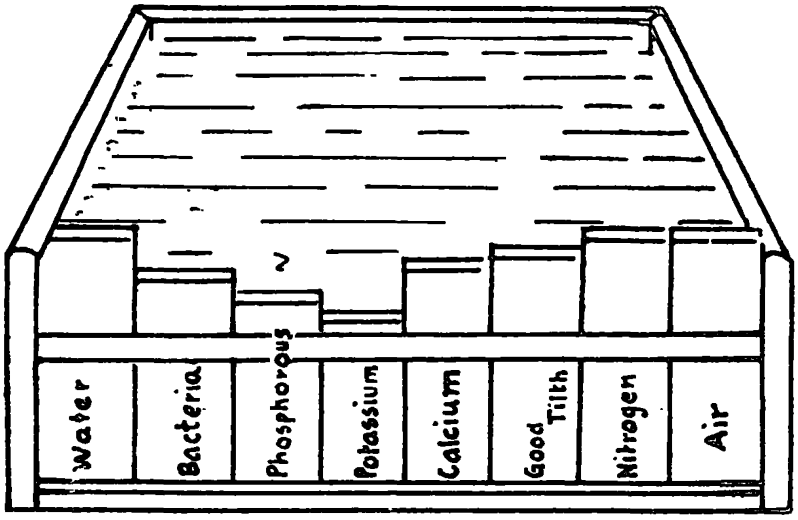
Authorities all recognise the deficiency of humus in Ceylon soils and such being the case, let us see what this deficiency implies.

An American writer very clearly illustrates his argument by comparing soil to a concrete water tank, one side of which is composed of wooden staves:—

" The capacity of the tank for holding water represents " fertility or the power of the soil for producing a good or " high yield. The staves which determine the water-hold- " ing capacity of the tank represent the positive factors " which determine soil fertility. The tank being free from " any leaks represents the negative factor viz:—the absence " of harmful agents."

" If all the staves were as high as the concrete sides of " the tank, the tank would then hold its greatest amount " of water. If all the fertility factors were most favour- " able, the soil would have power for producing maximum " yields."

" Just as the water-holding capacity of the tank may " be limited by the shortest stave, so fertility or the produc- " tive power of a soil may be limited or brought to naught " by one deficient element or an unfavourable soil condition. " Thus it is possible for a soil to lose its fertility or produc- " tive power through the depletion or loss of a single " fertilizing element."



He labels his staves, Water, Bacteria, Phosphorus, Potassium, Calcium, good Tilth, Nitrogen, Air, and of these let it be noted, Water, Bacteria, good Tilth, Nitrogen and Air, are wholly dependent or partly dependent on the supplies of humus in the

soil. This then is the limiting factor so far as we are concerned and to ignore the needs of the soil in this respect, while we pour in millions of rupees in the form of artificial fertilisers, is poor agriculture. It is not only poor but extravagant and wasteful.

It is extravagant because one is paying Rs. 100 to 150 per ton for organic manures containing 4% to 6% nitrogen. Rs. 170 to Rs. 250 per ton for inorganic manures containing 15% to 20% nitrogen, when this requirement can be obtained by other methods, at little or no cost at all.

It is wasteful as one is not catering for the micro-organic needs of the soil, the agents which break down and make available as plant food, the expensive mixtures we apply.

Nitrogen is one of the main requirements and moreover the most expensive. It is readily leached out unless abundant supplies of humus are available to retain it.

Having thus briefly indicated the crying need of our soils and the importance to be attached thereto, let us turn to methods of replenishment, and to that form of adding organic matter which is known as green manuring and which is the subject matter of this paper.

This consists of ploughing in or burying organic matter obtained from plants, the favourite ones being those we term "leguminous," and which the text books describe as plants which have the power of taking and fixing free nitrogen from the air.

From our agricultural point of view and for purposes of discrimination we might classify these under headings of "high shade," "low shade" and "ground cover."

As regards the former. When I first came to the District I was impressed with the very limited types available or subject to common knowledge. To an outsider, they appeared to consist of Acacias, condemned by our scientists as tending to spread a leaf disease of tea, Albizzias, a very moribund proposition, and dadaps.

Without disparaging the magnificent mixed cover possessed by individual estates, Dickoya in the main appeared rather dependent for its supply of organic matter on a few diseased and rather miserable Albizzias.

Failing anything better, and at the moment I want nothing better, I decided upon concentrating work on dadaps.

Surely these three leguminous trees are not the only shade trees we can draw on, and if you agree with me that Albizzias are doomed, or at any rate that their chance of survival is a poor one,

we are then reduced to the dadap as the only high shade we have to rely on, a state of affairs, I fancy you will agree, which is extremely unsatisfactory.

One occasionally comes across sporadic outbreaks of energy where other trees have been experimented with.

Acrocarpus fraxinifolias is noticed on the road to Dimbula and near Warleigh church. It is ornamental, as it has handsome foliage, while I believe its timber is of a slight value, but on the whole it is in my opinion unsuitable.

One tree however does impress me and that is *Dalbergia Assamica* which is well worth a trial, although it is a little difficult to establish.

In any case I think various types should be introduced and experimented with.

Of low shade, many and various types have been tried; the commoner and more popular ones being Boga medaloa and the Crotolarias, while *Tephrosia Vogelii* also grows sturdily in Dickoya.

Though excellent for young rubber, with tea they are inclined to bush out over the plucking surface and interfere with plucking, while loss of crop is brought about by run-up branches or excessive shade.

I would not however lightly dismiss them, as they undoubtedly can be made to serve and to be of immense value in soil management and improvement, if controlled and persisted in. The point to remember about them is that their removal is advisable before excessive woody developmnt of their stem or root system sets in.

We now are free to deal with ground covers which have lately been engaging attention and of these *Vigna*, *Indigofera* and *Desmodium*, are perhaps the best known.

My own experience with the two former has been, that although they undoubtedly have a smothering effect on weeds and prevent wash, their chief drawbacks are that they admit grass, which is toxic to tea and although control can be exercised over them fairly easily, neither being really vicious climbers, they are inclined to climb the tea as well.

They moreover encourage *Drymaria*, and clean weeding is very impractical under such conditions.

Two interesting questions now naturally arise. Is clean weeding such a vital necessity, and are not the drawbacks referred to more than compensated for by the prevention of erosion? Can we condemn in tea two creepers which are proving of such value in rubber ? Surely for some estates anything is better than the terrible scouring they are continually being subjected to?

Of *Desmodium triflorum*, perhaps the less said the better. Its matted root growth appears to affect tea detrimentally, soil aeration is prevented, and I believe its use has been practically discontinued.

We are thus, for the time being at any rate, apparently confined to high shade, and although with age it becomes unwieldy and cumbersome, its more vigorous roots open fresh avenues to exploring tea roots, and one has good reason to believe that shade is beneficial to tea.

The disadvantage mentioned can be overcome by periodical uprootings and fresh interplantings before the tree becomes unmanageable.

A matter in connection with leguminous plants, to which more attention might well be paid, is the question of soil inoculation.

We hear a lot on all sides that such and such a plant will not grow, but are our methods helpful and is not carelessness more often than not displayed? Many of us have seen short lengths of dadap cuttings stuck into the ground and this certainly does not lead to success.

The establishment of these plants is part of one's job and one must remember that, however unkindly, failure to do so may be looked on by one's employer as a tacit admission of one's failure as an agriculturist.

As far as soil inoculation is concerned no steps appear to be taken, but I would point out that much important work has been done with this at Home, and success is now being secured with certain bacterial cultures.

This however is not the popular method, the common ones employed being, as in the case of seed, by what is termed " Seed agglutination," that is to say by mixing seed, glue, and infected soil together, so that soil with the particular bacteria required adheres to the seed when dry, or else by soil transference, which is sowing soil of known infection over the areas where the farmer desires to establish his crop of legumes.

In this connection an excellent way to plant dadaps (in preference to cuttings) is from nursery grown stumps. Not only has the plant the advantage of a developed root system, but it also possesses the added advantage of conveying its own bacteria by means of the nodules on its roots. Nurseries are easily established on practically any soil, and a little cattle manure will give the incentive to the development of the bacteria.

The only drawback to this method that I have experienced or can conceive, is that whereas a cutting will grow true to type, a fairly large percentage of seedlings are thorny. I am afraid the

dadap possessed a thorny ancestry and that the laws of Mendel are now operative, but seed is cheap and if nurseries are carefully thinned, a sufficiently thornless type can be reserved and misgivings need not be held on this account.

Success with them is assured especially if hill tops are planted thickly, so that as the plants develop they will afford each other mutual protection from wind.

Perseverence is another asset and as the tilth improves and the soil becomes pregnant with life, every subsequent planting should spell a greater success. I would illustrate this by instancing an estate I am acquainted with, where after a complete planting failure with dadaps, a few cuttings were ultimately established round some lines. There is now such a smother of dadaps and the soil is so conditioned, that loppings take root where they fall, and are a source of anxiety to the Superintendent and a nuisance to weeding contractors.

And now, Gentlemen, I have not only kept you all quite long enough but I have come to the end of my remarks. I will close with an exhortation.

Mr. Renganathan on his retirement a short time ago, left a veiled farewell message—that we should look after our labour better—that it would pay us to do so.

That is true and it is equally true as regards the unseen workers in the soil. They are our tenants and with our labour constitute the life stream of the estate. But the difference is that their requirements are much simpler and that they pay rent if catered for.

They are in our soils now and no cash inducements are required in order to increase them. No Sarees for "Tee Vali," no rice @ 6/40 a bushel for them. Their only claim on you is housing in the shape of organic matter, and this we can offer them in the form of green manure.