THE CULTIVATION OF TEA*

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When I accepted the invitation to address your Association I was told by your Chairman that the abnormal weather conditions of the last two seasons had brought into prominence the question of cultivation, using the term in its restricted sense of the mechanical working of the soil. I have accordingly chosen to speak this afternoon on that subject; but soil cultivation has so many implications relating to other aspects of tea culture that I shall offer no apology for commenting, as occasion arises, on other aspects which appear to me to be relevant to the main question.

If I were to ask you now to give me your views as to why cultivation is regarded by agriculturists as a fundamental necessity, you would most probably combine in answering to the effect that it ensures adequate soil aeration. Here we find ourselves right at the heart of our problem, for it has to be admitted that experiments have shown no very striking direct effects; but rather that aeration and water movement are closely linked.

I think I can help you to appreciate this basic difficulty if I place the emphasis rather differently. The first reason for cultivation is to maintain the soil in a porous condition. For healthy plant growth the air in the minute pores and channels of the soil has to be constantly

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renewed. Now the most effective way to keep air renewed is to ensure that those pore spaces are not blocked by water; the vital necessity therefore is drainage. Moreover, rain-water itself contains appreciable quantities of air dissolved in it, and by free water movement this air is made to contribute to the soil atmosphere. Aeration therefore is an indirect effect of cultivation working through the factor of water movement. Provided this movement is free, there seems for the purposes of aeration to be no need for excessive commination of the soil particles. Our ideas are apt to be coloured by the parallel of conditions ruling in systems of temperate agriculture where the necessity of a seed-bed tilth for small seeds is paramount. Those conditions do not apply to the culture of a perennial bush such as tea. Nevertheless, some form of cultivation is necessary, for the maintenance of porosity is really important particularly on land such as ours subject as it is to soil erosion. The more rain we can absorb and pass through the soil, and the less rain that is carried away as run-off, the sounder will be our agricultural practice. I will therefore recommend moderate cultivation with a view to breaking the hard cap of the soil as an important check on run-off and soil erosion, and will couple with it the breaking of the shallow pans that are frequently found in our up-country tea soils particularly.

The second reason for cultivation is to suppress weeds and help root development. As far as weeds are concerned the problem is not important under the prevailing system of clean weeding, but there seems to be a reliable concensus of opinion that tea is not very efficient in thrusting its roots through resistant soils.

Thirdly, cultivation is to be recommended as a means of ensuring that the application of manures is deep-seated. There are so many facets to this problem that I shall not deal with them now, but reserve them for a fuller discussion later. Porosity, root expansion and manurial applications thus provide reasonable justification for cultivation, but before expanding these points it may be as well to clear away some misconceptions.

Of late there has been much discussion in the rubber industry about a system of management described as the "Forestry" method of rearing that crop. Cultivation as we know it has no place in this

system, and the question that arises is whether anything of the sort is applicable to tea. Can we afford to forego cultivation without loss? The answer is, I feel, entirely negative. Forestry methods imply a very careful economy of soil resources, it is true, and the protection of the soil that is achieved in the process safeguards the porosity side of the question, but it is not suitable for a quick growing crop where leaf is the first consideration. If we are to remove the chemical laboratory of the tea plant in part, it is essential that its renewal should be adequately rapid, and anything approaching forestry methods will not achieve that.

There is another set of facts that touches us much more closely. Experiments in N. E. India have shown that severe cultivation retards the growth and cropping capacity of tea. Had I been speaking to you some two months later I could have given you some first-hand comments on these trials, for I set out on a tour of Assam in a week's time. But although I have not at present this advantage, I have had the opportunity of discussing at length with Mr. H. R. Cooper of the Tocklai Experimental Station this aspect of their work.

The Tocklai findings are that cultivation in excess of that required to suppress weeds does no good and may do harm. In this connection it is interesting that even on farm crops at home summer cultivation, *i.e.*, during the growth of the crop, produces the same effect according to recent experiments at the Rothamsted Experimental Station. How then are we to relate these findings to our own conditions? In the first place we must understand that soil erosion and run-off do not trouble cultivators in Assam and England, and that they can afford to discount losses of soil or manure if cultivation is restricted. But also there is a difference in degree. Cultivation during the crop production months in Assam is described by the euphemistic title of "hoeing", but it actually involves the slicing away and turning over of weed sod with a long handled mammoty some six or seven times a year. It is not surprising that root damage sufficient to cause loss of crop is liable to occur if this process is overdone. In a similar fashion, as everyone knows, the use of a sharp-cutting hoe at home can play havoc with shallow-rooted crops. Compared with these drastic operations envelope-forking is a very mild expedient.

These experiments therefore warn us against over-cultivation but they do not discredit the milder and less frequent forms common in Ceylon which are employed for quite different and cogent reasons. I propose now therefore to consider in more detail the kind of cultivation prevalent in Ceylon and to describe both its advantages and disadvantages.

CULTIVATION IN RELATION TO DRY WEATHER.

At the Tea Research Institute's Conference held earlier this year we had an interesting exchange of opinion regarding drought problems. I think that the question of cultivation in relation to drought is sufficiently important to deal with this point again, even to the extent of repeating some of the arguments I used there. There is nothing good to be said for cultivation in dry weather in the conditions we have to face on the generality of estates in Ceylon. The breaking up of the soil at this time does not provide the protection of a dust mulch, as ordinarily understood in systems of dry farming, because this system only applies to cases where the water-table is relatively near at hand, *i.e.*, within some 6-10 feet. These conditions are not found on land with contours such as ours. The net effect of cultivation in drought in Ceylon is to expose a greater area of soil to the drying action of wind and sun, and to do root damage at a time when it is most dangerous, *i.e.*, when root regeneration is bound to be poor. Difficult as it may be at times, every effort should be made to transfer as much of the cultivation programme as possible to other times of the year. This plan has also advantages in the sphere of artificial manuring because manuring at this time will frequently accentuate drought deficiency. The reason for this is that the moisture that is left in the soil under these circumstances becomes highly concentrated with manurial salts and these high concentrations withhold the few remaining dregs of moisture from the plant.

CULTIVATION IN RELATION TO GREEN MANURING

For similar reasons, the forking-in of prunings and green manures during drought is to be deprecated. The amount of moisture they supply to the soil is quite small; they dry rapidly themselves, and they open up the soil even more than a straightforward plain forking.

Farmers at home are quite familiar with the phrase "letting the drought into soil" by injudicious cultivation, and the parallel holds quite well under Ceylon conditions.

Unless therefore this vegetable matter is composted it is better left as a leaf mulch. By protecting the soil from direct sunlight this mulch will preserve moisture in the upper layers of the soil in a much more efficient manner than our poor attempts at a dust mulch. It is not a highly efficient method of using green manures, but it is more expedient to lose some of the nutrient value of leaf-fall than to risk drought dangers. Where the mulch so formed is supplemented by a really good layer of Grevillea droppings, it plays a very important part in soil protection. In addition, it is a very fine protection from erosion when the later rains arrive. I would go so far as to say that, if you have easily accessible supplies of manna grass, the proposal to lay down a manna grass mulch in dry areas is worth considering. We have tried it at St. Coombs though not with all the paraphernalia of experiment. Its moisture retaining qualities are plainly to be seen, and recent work on coffee in Uganda suggests that its employment is coupled with definite benefits to plant growth and crop. When eventually it is forked in, it should be dressed with an ordinary artificial manure mixture, or, at any rate, with a nitrogenous dressing, in order to ensure its proper decomposition in the soil.

CULTIVATION IN RELATION TO ARTIFICIAL MANURING

It is perhaps as an adjunct to good manuring that cultivation plays its most important part. I have hinted at the disadvantages of manuring in dry weather, and one way of preventing undue nutrient concentration at the surface of the soil is to distribute the manure as uniformly as possible through a reasonable depth of soil. From a symposium I have recently read on cultivation of crops in dry areas in many parts of the world, it appears that the general experience is that shallow manurial applications are fraught with danger in places subject to dry periods.

There are other arguments on this point that are equally cogent. The fine feeding roots of tea are concentrated very largely in the cultivated and manured depths, so that, apart from any other considerations, a policy of shallow manuring tends to encourage unduly

root development in the soil depths that feel the effects of drought first. Moreover, phosphate and potash manures have not the mobility in the soil that nitrogen has, so that anything but deep forking localises the supplies of these nutrients.

Phosphates deserve a special word. In time, all forms of phosphatic manures revert in the soil to a type of compound that is only sparingly soluble. It is necessary therefore to distribute phosphates in those parts of the soil where the solvent action of soil moisture is reliably steady. Nothing could be more wasteful than the scratching in for a few inches of an insoluble manure like rock phosphate, (the saphos and safaga of commerce).

Lastly, in this connection shallow cultivation is not a good anti-soil erosion method, and with the loss of soil, loss of added manures goes hand in hand. These are to me convincing reasons for a reasonable policy of cultivation.

Now let us turn to the attendant disadvantages. In one form or another they culminate in root damage. I hope shortly to investigate this point in a joint experiment with the Tocklai Station and we shall try to make the results decisive. But provided the precautions regarding dry weather are borne in mind, I am not unduly perturbed by root disturbance from envelope forking. Roots like leaves, grow, work, become inefficient and die, and like leaves are stimulated to fresh growth by wound reactions. It is not very consistent to insist too much on root damage effects, when day by day a similar operation is going on, by means of plucking, in connection with the above ground portion of the bush. I have still to see in Ceylon an authentic instance of setback due to root damage. Some temporary check may possibly occur, but as in the case of tortrix attacks on leaves, the total effect over a period seems negligible.

I cannot see that alternate line forking every six months according to seasonal requirements constitutes a danger to root development, but rather, that for the reasons I have indicated, it is essential on estates which wish to maintain a reasonable standard of production.