

SOME THOUGHTS ON FORKING

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There are many different ways of using a fork and it must therefore be made clear at the outset that the only type of forking which will be dealt with in this article is that generally known throughout Ceylon as "deep" forking. Neither "light" forking nor the type of forking adopted by most gardeners, in which clods of soil are actually turned over, will be considered.

The operation of deep forking is one in which a fork with three or four tines, 15 to 18 inches long, is forced into the ground at a nearly vertical angle as far as it will go, or can be pushed without undue effort by the labourer's foot. The handle is then pushed forward so as to open up a crack in the soil behind the tines. The fork is then either withdrawn, when the operation is called "plain" forking, or else something is pushed into the open crack with the foot prior to withdrawal of the fork. In this case the operation is called "envelope" forking and may be used in the application of mineral fertilisers or else to incorporate ground litter, green manure loppings and similar materials into the soil. Diagrams showing the correct and incorrect ways of doing deep forking are given on page 25 of the *Tea Quarterly* for March, 1950.

Having now defined what is meant by deep forking it will be helpful to try and assess what effects this operation is likely to have on the soil itself. Incorrect forking will undoubtedly also cause much damage to the roots of the tea bush, but if the operation is carried out correctly, according to Paterson's recommendations¹ there should be very little root damage and this effect will accordingly be disregarded in the ensuing discussion.

Now the first and most obvious effect of forking is to open up the soil. This will increase aeration down to the lowest levels penetrated by the fork tines and will also increase the absorption of surface water. Conversely, in periods of drought it will also greatly increase the rate of loss of soil moisture and so accelerate the drying out of the upper soil levels. Further, during showery weather the effects of alternate wetting and drying will be intensified. These effects are important, since, as pointed out by Tolhurst in another article in this issue² they lead to a remarkable acceleration in the rate of breakdown of soil organic matter.

Finally the mechanical disturbance caused by forking will tend to have a deleterious effect on the crumb structure of the soil, if it has any to start with. This in turn will, if not counteracted, lead in time to a greater tendency to pack down readily, impeded drainage and aeration and reduction in water holding capacity.

The effects of forking, either "plain" or "envelope", in which the addition of mineral fertilisers and/or organic materials produces still further complications, are thus seen to be most complex and even contradictory. This, however, should not cause undue surprise if, as is common practice nowadays, the soil itself is thought of as a complex organism in which physical, chemical and microbial activities are all interacting at one and the same time. From this viewpoint therefore it is easy to see that any disturbance of the existing dynamic equilibrium is likely to have far reaching and largely unpredictable effects. Furthermore, no two areas of soil, even though indistinguishable on physical or chemical grounds, can be expected to have the same microbial population and so may well react entirely differently to any disturbing factor such as deep forking.

Unless therefore a great deal is known about the soil conditions, the nature of the ground cover and the prevailing climatic conditions, it would seem to be practically impossible to forecast whether the deep forking of any particular area is likely to prove beneficial or harmful. No hard and fast rules as to when to fork and when not to fork can accordingly be laid down for the guidance of superintendents. The best that can be done is to quote a number of specific examples of different soil categories and to try and decide as to whether forking is advantageous or undesirable in each case.

Category 1.—Soils with a high level of fertility and good crumb structure.—These soils will have good drainage and aeration and a high level of microbial activity. Their content of relatively stable organic matter is also likely to be high.

Forking of this type of soil in showery weather, which is the only time when forking ought to be carried out at all, will enhance the effects of alternate wetting and drying, thus greatly stimulating the already intense microbial activity. This in turn will lead to a more rapid breakdown of the soil organic matter. The addition of green manure behind the fork will still further stimulate this activity leading to increased losses of organic matter and to the temporary locking up of mineral nutrients, which are thus rendered unavailable to the tea bushes. These effects are clearly undesirable.

Since the soil is already well drained and aerated, forking will bring about no improvement in these characteristics, while the mechanical disturbance will have a deleterious effect on the existing crumb structure. This will again deteriorate still further due to the loss of some of the organic matter binding the soil particles into crumbs which will occur as a consequence of the increased microbial activity referred to above.

The organic matter content of this type of soil can probably be only built up by addition of organic material in an already highly stabilised form. Such material is normally only produced in conditions where a good mulch has been built up on the surface of the soil, either as the result of thatching with Guatemala grass or similar loppings or from natural leaf-fall under a complete cover of tea and overhead shade. An occasional deep forking, such as once in a cycle, might thus be of some value in bringing some of the stabilised organic matter formed in the surface mulch down into the deeper soil levels.

With a good surface mulch most of the feeding root activity will be concentrated in the upper soil levels. Application of mineral fertiliser by deep envelope forking will therefore tend to put it into soil levels which are below the zone of maximum feeding root activity and should be avoided. Broadcasting or scuffling in of fertiliser is clearly preferable.

The above discussion would appear to fully support the opinion expressed at the 1953 Conference to the effect that "*under a good cover of tea and probably only under a good cover of tea with a certain amount of mulch under the bushes, too much deep forking is not only unnecessary but definitely harmful*"³ since, in old tea, it is only where, the italicised conditions exist that the soil is likely to exhibit a high level of fertility.

Category 2. Soils with a medium level of fertility and poor crumb structure.—This is a type of soil likely to be found in parts of Uva and the mid-country especially. It may tend to pack down on the surface, with consequent heavy run-off of surface water. The cover of the tea may be incomplete, leading to soil exposure and there will be no surface mulch. Both the organic matter content, and the level of microbial activity are unlikely to be high.

Forking of this type of soil in showery weather will break up the hard surface and greatly improve both the aeration and water absorbing capacity. This latter effect is of considerable importance in districts such as Uva, which are subject to prolonged periods of drought. Furthermore since it may well be desirable to raise both the organic matter content and the level of microbial activity the forking in of undecomposed green material may prove beneficial. However, since the resultant increase in microbial activity will also cause a temporary locking up of available mineral nutrients, it would be sound practice only to fork in green material at the same time as mineral fertiliser is applied. Both can be safely applied by envelope forking, since it can be reasonably expected that the zone of maximum feeding root activity will be at a deeper level than in the case of category 1 soils.

Mechanical disturbance from forking will, of course, tend to destroy the existing crumb structure, but this effect is likely to be more than offset by the improvement brought about by raising the organic matter level. In general therefore the regular deep forking of this type of soil would appear to be beneficial.

Category 3. Deteriorated soils with low fertility and little or no crumb structure.—These soils are likely to be found where there is a very poor cover of low yielding tea and where there is much exposure of bare soil. The organic matter content will be low and there will be little or no microbial activity; in fact the more exposed areas are likely to be sterile as the result of insolation. The soil will tend to pack down hard to a considerable depth and both aeration and drainage will be very poor, leading to much run-off and erosion.

In such soils regular deep forking in showery weather with the incorporation of as much organic material as possible behind the fork can obviously do nothing but good, since all the desirable characters of the soil will tend to be improved thereby. However, much more than forking needs to be done if any permanent improvement is to be effected, but such recommendations are outside the scope of this article.

To sum up therefore it would seem that in soils with a high level of fertility deep forking does more harm than good, but that in soils with a lower level of fertility, in areas where there has been packing of the surface, and in areas subject to prolonged droughts, deep forking when wisely carried out, is likely to be beneficial. The category into which any particular estate field happens to fall must, however, be left to the judgment of the individual superintendent, since it would clearly be quite impossible for the Institute to attempt to assess soil conditions throughout Ceylon's whole tea area. As a guide it is probably safe to assume that no old field which does not develop a complete cover of tea during the course of the pruning cycle, and which is incapable of giving yields in excess of 1,000 pounds per acre per annum, can be expected to have a highly fertile soil entitling it to be placed in category 1.

Deep forking either during or just before a period of drought is expected must always be considered harmful in all types of soils.

REFERENCES

- (1) Paterson, H. C. (1950)—Root disturbance with special reference to tea cultivation. *Tea Quarterly*, 21 (1), pp. 23-27.
- (2) Tolhurst, J. A. H. (1956)—Ideas on the experimental replanting of tea. *Tea Quarterly*, 27 (3), pp. 60-66.
- (3) Portsmouth, G. B. (1953)—The principles of bush management. *Tea Quarterly*, 24 (1 and 2), p. 19.