

Erosion has become a world problem over vast areas. At the same time as we are bringing more and more land into the arable class, more and more land is passing from arable to waste since it has become sub-marginal for cultivation and such land is often in such a condition that it will never again carry a vegetative cover. This cannot go on for ever and the ultimate result can only be starvation.

Forestry and Agriculture are kindred subjects. Each has its place in the economy of a country. There is however a balance between the two and it is to the advantage of the pure agriculturist that this balance should be maintained.

To you agriculturists I say in closing that without wishing to deprecate in any way the ordinary anti-erosion methods which you are taught to adopt on your cultivated lands, you should remember that the forests are also your friends. Their effects are not spectacular, but they are none the less effective, and they are in themselves extremely important agents in checking the most pressing problem of modern times—erosion—the greatest enemy of the human race.

I congratulate the Madras Agricultural Students' Union on its selection of this subject for discussion. It is my fervent hope that the members of this Union who can visualise the dangers of soil erosion to the country, would strive hard at all times to keep the control of erosion as one of the most important objects of their lives.

## Prevention of Soil Erosion on Tea Estates in South India.\*

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**Introduction.** The object of my contribution to your discussions, is to describe, what steps have been and are being taken to prevent soil erosion on tea estates in S. India. In one way tea estates present a special problem, but what I have to say about anti-erosion measures, applies very largely to any form of hill cultivation.

Perhaps there are some of you not familiar with the tea industry in S. India, so I shall begin by saying that there are in Mysore, the Madras presidency and Travancore approximately 160,000 acres of tea. The chief districts in the Madras presidency are the Nilgiris, Wynad and Anamallais. In Travancore state tea is grown on the Kanan Devan Hills or High Ranges and in South and Central Travancore. Mysore and Cochin states have a comparatively small acreage.

Under an international scheme of restriction, practically no new areas are now being planted and the figure of 160,000 acres, remains very

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constant. The area hardly falls at all because, odd as it may seem, it does not pay to abandon tea—even the worst tea. Practically the whole of the large acreage is situated on the hill sides and mountain slopes of the Western ghats, and the plantations vary in elevation, from under 1000 feet to well over 7000 feet. Moreover, the tea is planted on land, sometimes very steep, which formerly carried medium to heavy jungle, though there is a certain amount of grass-land tea. Under virgin jungle or grass, the soil is so well protected that soil erosion hardly takes place. But as soon as such land is cleared for planting with a new crop, it immediately becomes liable to erosion, and from the very start the problem of erosion must be faced and tackled or else deterioration of land and crop takes place at a rapid pace. The problem is somewhat intensified because tea requires a fairly heavy rainfall, and in the tea districts we seldom have a rainfall of less than 50 inches per annum, and not unusually it goes to 200 inches and over. Most of this rain falls during the South West monsoon. You will appreciate then, that on hillsides and mountain slopes where there is a heavy rainfall, the prevention of erosion is a matter of the first importance, and particularly so, because tea is a perennial crop and with good treatment, we can expect the same plants to go on producing productive crop, for 70 years or more, provided they are well cared for.

**Kinds of erosion.** Under the conditions which I have mentioned, three forms of erosion can take place (i) erosion by wind; (ii) gully erosion and (iii) surface wash. The first of these is hardly a serious problem in tea estates; the second—gully erosion—is rather more serious, but chiefly we are concerned with erosion due to surface run-off. When this takes place, not only is the top soil gradually carried away, but with it the soil humus, the soluble nitrogen, the phosphates and potash. None of these valuable constituents we can afford to lose. In this short address, I shall confine myself very largely to erosion by surface run-off because as I have said, this is the type of erosion which presents the real problem.

**Surface wash.** This surface run-off, takes place chiefly, when the rate of rainfall is greater than the amount of water, that can be absorbed by the soil, at the time of fall. So, unless protective measures are taken, we find during heavy rain that all excess water which is not immediately absorbed by the soil, rush down the slopes and carry with it constituents which make up the top soil.

**Principles of Protective Measures** The greater the pace at which this water moves down the hill, over the surface, the larger is the quantity of soil that is washed away, so that, all efforts aimed at preventing erosion must be based on two chief principles. The first principle must be to render the soil as absorptive as possible so that it will rapidly absorb a large proportion of the water falling at any given time. The second step is to reduce to a minimum the rate at which any excess water can move over the soil surface. If a very large proportion of the rainfall is absorbed as it falls, and the excess can move but slowly, then erosion by surface run-off is

reduced to a minimum. That represents the ideal set of conditions we should aim at, and now the problem is how to achieve those ideal conditions.

*Increasing the absorptive capacity of the soil.* I shall first deal with the absorptive power of the soil. It is not possible immediately to change the type of soil but we must see that the soil is kept in good physical condition, has no hard pan either on or near the surface and is well drained. Its power of absorbing water should thus be raised to the maximum capacity. The periodical addition of organic matter, materially helps in increasing the power of absorption. Attention is paid to all these points on tea estates and by adopting them it has been possible to ensure that a large proportion of the heavy rainfall penetrates into the soil. But such methods, which after all are only good farming practices, are insufficient in themselves because during the time of heaviest rains and continual rainfall there is a certain amount of excess rainfall, and it is the steps, taken to deal with this latter mass of water (1" of rain = 110 tons of water per acre) which finally decides how much erosion does take place.

There are several methods which decrease the speed of movement of excess water and thereby decrease the rate at which the surface soil can be moved. Moreover, the slower the movement of excess water over the soil surface, the more time there is for the soil to absorb this water.

**Protective measures.** The methods resorted to on tea estates are:—

(i). *Terracing.* I expect you all will have seen terracing done at some time or other, and in any case it is adequately dealt with in many text books. Terracing is most effective when it is so supported as to be permanent, and its main feature is, that it tends to convert a hill-side into a series of flats and thereby reduces the rate of surface run-off. It is effective, especially if done on contour, but it is an expensive method. Since we have other methods which are as good and somewhat less expensive, terracing is not an universal feature of South Indian tea estates.

(ii). *Maintaining surface drains.* There are various systems of surface drainage and great use is made of such drainage systems in South Indian tea estates. One usually thinks of drains as being a means of carrying away water as quickly as possible, but for purposes of control of erosion their use has been modified so that the anti-erosion drains have come to mean drains which collect excess surface water, and move it off as slowly as possible. These drains really are very effective, and especially so, if they are not too far apart and are well designed so that water cannot travel far, over the soil surface before it reaches a drain, and when it does reach a drain the slope is so gradual that its rate of movement in the drains is reduced as far as possible. In many cases it is the custom to have ordinary surface drains well placed, gradually leading the water away, but more often than not, modifications have been made in the drains themselves to reduce still further the rate of water movement. One of these modifications entails digging "silt pits" in the drains every few yards. This reduces the rate of

movement, and facilitates deposition of silt in the pits. Later, the soil so collected, can be spread back, on the land from which it has come—always on the upper side of the drain. A second modification is what is known as a "lock and step" drain. This is no more than an ordinary drain with a series of steps and locks whose purpose is to reduce the speed of water movement thereby allowing the soil carried by the water, to settle in the drains, eventually to be replaced on the land. There are still more modifications of this method but suffice now to say that these drainage systems are effective methods of preventing soil wash.

(iii). *Raising shade trees and cover crops.* Finally, I want to mention what I consider to be the most effective method of controlling erosion. It amounts to no more than seeing that the soil is never bare and exposed. An exposed soil, subject to the heavy beating effect of rain, is most liable to erosion. Now it has become almost a fetish on tea estates to keep the land covered and this is done by growing shade trees—which break the fall of rain—and also by growing cover crops between the rows of tea or allowing soft weeds to grow. When by such practices the soil is completely covered on the surface and fully occupied by the root systems of plants, erosion is reduced to a minimum, and it is perhaps the only real way, how the problem can be tackled effectively. I know it sounds all wrong and looks untidy to have a cover of weeds growing amidst tea, and we do know that their presence reduces yield by 5 to 10 per cent. But so much importance is placed on preventing any kind of erosion, that most planters are prepared to sacrifice this loss of yield, to keep their soil intact. Eventually, of course, it pays a handsome dividend to do so. Unlike the annual crops, tea is a crop which can stand a certain amount of weed growth and cover crop, provided always that the weeds are never allowed get out of control and that any harmful weeds are always removed.

**Conclusion.** It is by a combination of these methods that the problem of soil erosion is being tackled on tea estates in S. India today, and I think I can truly claim for the planters that not only do they realise their responsibility in this direction, but that they have studied the problem intelligently and are putting into practice the most effective measures. After all it amounts to nothing less than that—and it is the message which I should like to leave with you today—there are two ways of managing land, viz. either you can (a) *mine* it—take from it all it will give and take no care for the future; or you can (b) *farm* it—treat it intelligently as a living and lasting thing and realise that the land and yourself have a future to think of. Be always suspicious of erosion—it goes on much more rapidly than one would believe by appearances. Regard it as a major problem.