A REVERSE SLOPE DRAINING SYSTEM—II.

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The following notes in amplification of the article previously published (*Tea Quarterly*, 1930, **3**, 73). may perhaps be of interest.

Inspection of the drains after heavy rain shows clearly the wide variation in the capacity of the soil to absorb water, some sections holding up water very much longer than sections adjacent to them. It has been noticed, however, that as the sub-soil becomes more thoroughly aerated by the use of these drains, water has been absorbed at a quicker rate. The amount of water held up is, of course, very considerable. Considering 18 in. wide drains with a 12 in. water level, 100 feet of drain will contain 75 cubic feet of water. Assuming there are 1,500 feet of drains to the acre, since 1 c.f. water equals 6·23 gallons, then approximately 70,087 gallons of water per acre are held up to be absorbed at the cessation of rain, if the drains have been overflowing. This water contains dissolved air and plant food derived from the surface soil and must find its way through the sub-soil which is thereby definitely improved in condition.

The reverse slope drains in question have now been cut over some 90 acres of pruned tea and have been available for more detailed observation. During the four months of pruning and manuring these fields only 10 inches of rain was recorded but this comparatively dry period was followed by 11·5 inches in a fortnight.

Due to the long spell of dry weather there was a considerable amount of silt brought down into the drains with the first onset of heavy rain and, with the continual daily rain, the drains were not capable of absorbing the water with sufficient speed to prevent them overflowing. Nevertheless, a very considerable amount of silt and loam, rich in the artificial manures recently applied, was collected on the sections along the drains and it was observed, in fact, during the heaviest rain when the sections were spilling, that most of the silt was so retained, little passing over the spills.

The amount of silt so far collected is not sufficient to impair the working efficiency of the drains since, although at first it is inclined to form a heap where it has fallen from the bank above the drain, with the action of the running water it becomes more evenly spread out over the surface of the reverse slope and, until the latter becomes levelled out by reason of the quantity of silt collected, no appreciable quantity of silt is pushed over the edge of the section. The silt so accumulated is, of course, available for return as a top dressing either above or below the drain.

Another advantage observed in the pruned field is that although a certain number of prunings fall into the drains, their presence does not cause these drains to become blocked since the flow of water in them is not powerful enough to carry the prunings along. Hence, the drains, except for the periodical cleaning out of the collected silt, require less attention than drains with a continuous gradient.

On the other hand, further observation has shewn that if any unchecked flow of water is allowed to enter these drains, so causing a more rapid stream to flow over the spills, there is then a certain amount of erosion caused on the top of each section. In such cases, therefore, it is not suggested that these drains will be of a permanent nature unless the lip is reinforced with stone. By the side of a cart road or path, for instance, such drains are useful in collecting the gravel or surface that washes off the roads, which can easily be replaced from the drain, but the excess amount of water arriving from the hard surface of the road is apt to cause these drains to overflow at a quicker rate than they do when cut in the field and hence internal erosion is set up. The importance, however, of holding up as much silt as possible is clearly shewn from the following figures which illustrate the amount of soil lost with ordinary drains.

In a field where the ordinary drains were in existence, a silt-pit 5 ft. × 5 ft. × 5 ft., *i.e.*, of 125 cubic feet capacity, was cut at the botton of each of four leading drains. After three inches of rain had fallen in five days these pits were all filled with silt which had emptied into and out of these leading drains. In other words some 500 cubic feet of soil had been lost in five days from about five acres of land.

Construction of reverse slope drains.—In practice it is not found necessary to find the level of each section separately, but the length of the sections, if made at a 6 in. level, will be half the reading of the gradient of the main drain, *i.e.*, a gradient of 1 in 15 will make the sections 7½ ft. long. If, however, the gradient is less than 1 in 30, the optimum length of 15 feet should not be exceeded, in other words for any gradient less than 1 in 30 use a 15 ft. section. By so doing the height of the water level will, of course, vary with the gradient and the level taken will be less than the original 6 in.

New clearings. Assuming in a new clearing the drains are already cut with a gradient of 1 in 60, then by cutting 15 ft. sections there will be a drop level of only 3 in., but the height of the water level has been increased to 1 ft. 3 in., thereby increasing the water-holding capacity.

When cutting completely new drains in a new clearing, a gradient of 1 in 120 might be used. Then by cutting 15 ft. sections there will be a drop level of only 1½ in. but the height of the water level will be raised to 1 ft. 4½ in. The water-holding capacity will thereby be increased to 101 c.f. per 100 ft. of drain and without cutting to any greater depth than the original 1 ft. 6 in., or say 2 ft. allowing for a bund of 6 in. to the drain. Having then a spill of only 1½ in. there is a smaller surface at the edge of each section to be worn away. Although the flow of water may not receive such a check by reason of the shorter fall, the gradient being less steep will help to diminish any rapid flow.

In conclusion, it has been observed that with drains of the type described, even with such a steep gradient as 1 in 10 and with sections only 5 ft. long, during the period the drains are overflowing nearly the whole of the silt is deposited and but little passes over into the adjacent section. This is doubtless due to the fact that the bulk of the silt tends to sink to the bottom of the drain and as this bottom surface has a reverse slope, this acts as a brake on any movement of the deposited silt. Moreover, as the water which passes over the spills is only in a shallow layer, it has less force to push over any solid matter.