

*ASPHYXIATION OF TEA ROOTS IN CLAYEY SOILS

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Numerous cases of retarded growth of mature tea (both seedling and vegetatively-propagated tea) as well as young plants in new clearings have been recorded from all tea districts in Ceylon at all elevations. In the cases under consideration in this article, there have been no pathogens present on the leaves, stems or roots of these bushes. The reasons for the decline of the plants, and remedial measures for revitalizing them are given below.

Symptoms

Aerial symptoms

The foliage of the affected bushes are thin as a result of defoliation and the failure of new leaves to develop rapidly (Figures 1 & 2). Flowering and fruiting is profuse, and so is the tendency for banji formation. The leaves sometimes tend to show slight chlorosis but this is not universal. In advanced cases, complete defoliation takes place. In affected areas non-recovery from pruning is common. No pathogens are present, but in areas where the Shot-hole Borer is present, it may seem that the intensity of shot-hole borer damage is more severe in affected patches. In general, therefore, the appearance of the tea is poor.

Subterranean symptoms

Mature seedling tea

The main root system seems satisfactory on cursory examination with apparently strong, stout, main roots which may, however, show a purple or bluish coloration on the wood. The development of the feeder root system, however, is typically poor, and is confined to the soil nearest the surface. If uprooting is done during wet weather, the feeder roots appear slender and translucent, and do not develop as thick mats but as loose flaccid strands. If uprooting is done in dry weather it will be evident that many of the feeder roots lying close to the ground have been desiccated and would, therefore, be dead. No root pathogens are present.

Clonal tea

The root systems of VP plants growing in affected areas seem to show lateral rather than downward development. Even the larger roots seem to spread sideways, parallel to the ground, but do not penetrate deep down. The development of the feeding roots are similar to those described for seedling tea above. In both seedling and VP tea, the feeder roots will be present close to the surface of the soil and do not seem to penetrate deeper than one foot. In many cases, root penetration is often less than this.

Cause

It is evident that conditions are not ideal for root growth. In every case it has been found that the subsoil is a heavy clay which has a high water-holding capacity, or that it contains well-compacted layers of stone, rock or gravel, interspersed with such clay. The layer of good topsoil is very shallow. The result is that water does

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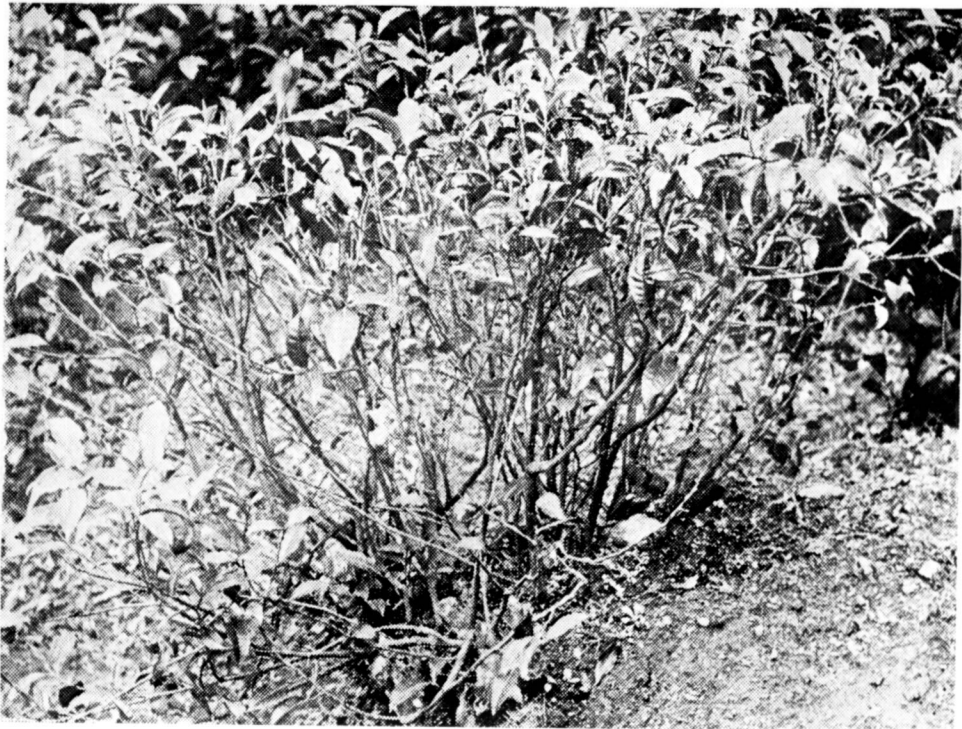


FIGURE 1 — *A typical tea bush growing in clayey soil*



FIGURE 2 — *The plucking table of a tea bush growing in clayey soil*

not seep down into soil but collects at the point where the clay is present. It would seem that lateral movement of water is too slow for satisfactory drainage. During wet weather the water is unable to drain away because of the clay or other impediments, and the water table consequently rises, displacing the air in the soil, and often inundating the fibrous roots which require air for good growth. As a result of this asphyxiation, the feeder roots tend to die, and those that remain alive would, naturally, be nearer the soil surface.

During dry weather, the roots nearest the surface become desiccated first, and as the moisture level in the soil recedes, feeder roots tend to make their way down into the soil, but this is accompanied by a certain amount of drying out of the roots nearer the surface. With the onset of the wet weather, the process is reversed, and the feeder roots lying deeper down in the soil get inundated again and new feeder roots begin to form nearer the soil surface as before.

Discussion

In cultivation practice, the tea bush loses some of its young foliage at each plucking round, apparently without a loss of vigour. The effect of the bush losing its feeder roots seems much more serious. A progressive weakening of the bush sets in, and in this state it is liable to die when it is pruned. Neither very wet weather nor very dry weather are favourable to these bushes. The weak and debilitated state of the bushes is, therefore, striking. When bushes are weak, their susceptibility to attack by pests and diseases generally increases.

Corrective measures

In all cases where this condition occurs, it is found that the layer of soil satisfactory for root growth is shallow. The bottom of this soil layer is subject to inundation and the top to desiccation in wet and dry weather respectively. In correcting the trouble, therefore, it is necessary to thicken the layer of good soil as far as possible. This can be achieved by carrying out the following measures :

- 1—Thatching the soil surface with mana or guatemala loppings will minimize soil erosion in wet weather and the desiccation of feeder roots during unusually dry weather.
- 2—The addition of mulch will enrich the soil with organic matter and improve its aeration as well as its fertility.
- 3—Deep-forking of the soil to the maximum possible depth will help aerate the poorer clay soil and make it satisfactory for root growth. Forking must not, however, be done just before or just after pruning because it may tend to damage feeder roots at this critical time. Three to six months after recovery would perhaps be most suitable.
- 4—In steep areas, terraces would be necessary to minimize soil erosion.
- 5—The addition of compost would enrich the soil and enhance root growth.
- 6—Pruning should be carried out cautiously, avoiding very hard pruning and preferably leaving lungs.
- 7—In badly water-logged areas, cutting deep drains would help remove excess water from the soil.

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