

DROUGHT

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This article was first published as a circular in July of this year and is reproduced again here as a result of numerous requests from planters.

The very severe drought experienced early in the year caused widespread concern among tea planters, and prompted the Board of Control to instruct the Tea Research Institute to publish its views and recommendations for the prevention or alleviation of the severe effects of drought.

In issuing this circular it is emphasised that little research work has been carried out on droughts, and in making the following recommendations reliance has had to be placed on general principles rather than on experimental data.

Tea plants, like most other plants, lose water through evaporation mainly through their leaves. The amount lost in this way is enormous; under normal conditions of growth, provided the tea can continue to obtain all the water needed, this loss has been estimated to be equivalent to 3-4 inches of rain per month. This process of evaporation is known as "transpiration". Transpiration is necessary for the plant and causes normally no injury, but when there is a lack of water in the soil and the atmosphere is dry a continual loss may result in a set-back of a temporary or permanent nature to the tea.

How much water a plant will lose through transpiration will depend on its leaf area and prevailing atmospheric conditions such as light, temperature and wind.

If transpiration is reduced or enhanced by some factor the amount of water required by the roots will also be decreased or increased. In the latter case, if water is not obtainable to the roots in sufficient quantities, the tea will begin to wilt. Accordingly, the problem of successfully weathering a drought is one of finding a balance so that the loss of water through transpiration or directly from the soil is reduced to a minimum.

The tea bush in its natural habitat grows under shade. It is a shade-loving plant and its leaves are not provided with any special mechanism, like e.g. the xerophytes, to restrict water loss during a spell of dry weather. Thus, removal of overhead shade during drought would very markedly increase transpiration both due to the increased light intensity and to the increased temperature of the leaves. The temperature of the leaves exposed to direct sunshine may increase as much as 10°C above that of the surrounding air, resulting in sun scorch. Last but not least a considerable reduction in the existing shade would also lead to more wind, which factor alone may greatly increase the transpiration rate of the tea bushes. Consequently, it can be assumed that the reduction in water loss, as brought about by the presence of sufficient overhead shade, will far outweigh the amount of water lost by competition from the shade. Naturally, much will depend on soil depth, number, size and type of shade trees employed. A shallow soil and the presence of shade trees which have no adaptability against drought conditions like dadaps and Gliricidias, will be detrimental to the tea plants during a dry period. On the other hand, on a soil which allows deep rooting and which is planted with shade trees able to

withstand drought, e.g. species of *Albizzia*, competition for water may be much less to be feared, since the shade trees are likely to draw their requirements from levels inaccessible to tea roots.

The general outlines given above may be interpreted into the following short term measures against drought:—

(1) **Prevention of Direct Evaporation of Water from the Soil Surface.**—This is of special importance in all cases where the tea bushes themselves do not provide a sufficient soil cover.

(i) Thatching with Guatemala or Mana grass, or any other material available, will give a good soil cover. Thatching will also considerably reduce any direct heating of the soil. Every 30 rows or so, about six rows must be left unthatched to serve as fire breaks.

(ii) No cultivation of any sort should be undertaken at the beginning of or during, a dry period; it will only increase the rate of evaporation of water from the soil.

(2) **Reduction of the Competition for Water with Bush Manures and Shade Trees.**—(i) Bush green manures like *Crotalaria*, *Tephrosia* and ground covers like *Stylosanthes*, etc. are likely to compete for water in the same soil levels. Accordingly, these should be cut back at the very commencement of a drought, and the loppings used as a thatch.

(ii) It is also strongly advisable to partially remove the foliage of the shade trees by lopping, e.g. the alternating branches, this should be done particularly if the medium shade consists of *dadaps* or *Glicicidias*. In general one should reduce the transpiration surface of the shade to such an extent that still enough cover is left to protect the tea from direct sunshine (see (3) (i)).

(3) **Reduction of Transpiration of the Tea itself.**—(i) This can be done indirectly by keeping as much shade as is essential to prevent exposure of the tea to the sun (see (2) (ii)). In this way extra water loss due to increased temperature and light intensity will be avoided.

(ii) Water loss by the tea bushes can be also directly reduced by reducing its own leaf area. Therefore, if a drought sets in, plucking should be continued in order to remove any flush produced. Eventually, should the drought persevere, as a last resort pruning might be undertaken if the general health of the bushes is good and starch reserves adequate. This may afford an effective, though drastic, means of enabling the bushes to survive a water shortage. The removal of about 50 per cent. of the leaf area should be the aim. Young plants must be stripped of their leaves, or cut back, in any case.

The following long term measures to reduce the consequences of drought must be considered:—

(1) **Shade Trees.**—It is important that high and medium shade trees be planted on a rotational system, (see *Tea Quarterly*, Vol. XXIV, Part 3, September 1953, pages 90-93), in order to ensure that fields will not be exposed by the removal of trees which have survived their period of usefulness. They should not be allowed to grow too big. Preferably trees should be chosen which can adapt themselves to dry conditions, such as *Grevillea* and species of *Acacia* and *Albizzia*.

(2) **Drainage.**—Good drainage is an additional help in retaining soil moisture (and in preventing soil erosion). Every effort should be made to adopt a system

that will be able to trap the maximum amount of rain water. Lateral drains should be spaced at a distance of about 20 to 25 feet and aligned at a gradient of about 1 in 120. Reverse slope drains appear to be the most suitable as the water holding capacity of such drains is much more than that of silt pits.

(3) **Organic Matter.**—An increase in the organic matter content of the soil should be aimed at by thatching or by spreading of compost, tea refuse, cattle manure or green material on the surface. Soil should not be disturbed by forking during, or just before a drought may be expected. Organic matter improves the texture of the soil and its water capacity and indirectly increases the soil depth in which feeding roots can develop.

(4) **New Planting.**—When new planting of tea is carried out, wide holes or trenches at least 18 inches deep should be cut before putting out plants in clearings, or as supplies. Such holes or trenches will give the plants a better chance of developing extensive root systems. Such plants would be better able to survive a drought.

(5) **Wind Belts.**—The planting of wind belts in order to reduce the effect of hot winds is highly advisable. In order to be really effective wind belts should be planted on a district scale, especially in those areas where large areas of patna exist.

(6) **Selection for Drought Resistance.**—In areas where droughts occur it is important to look for plants that appear to withstand dry conditions well.

