Tea Bull. 10 (1), 15-22, 1990

SOME OBSERVATIONS ON PRACTICES TO BE ADOPTED IN MINIMISING DROUGHT EFFECTS IN NEW CLEARINGS OF TEA PLANTATIONS

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INTRODUCTION

Plants exhibit moisture stress when the soil moisture becomes limiting to such an extent that plant roots fail to absorb sufficient amounts to compensate the loss due to transpiration. Water is the medium for all important biological activity in the plant, the most important amongst which is photosynthesis - the process of synthesising plant food with the aid of solar energy. Hence moisture stress in plants will retard growth causing stunting of plants, wilting, defoliation and in extreme cases even death.

On account of the high plant density in tea fields, the number of plant casualties per unit area due to any adverse conditions, such as moisture stress during dry periods, is fairly high when compared with other plantation crops such as rubber and coconut. Loss of young tea plants would lead to the following consequences.

1. Added expenditure on infilling vacancies;
2. Delay in the early establishment and harvest;
3. Increased soil erosion as a consequence of exposed vacant patches.

The exposed vacant patches could become extended further due to the weakening of plants at the perimeter as a result of soil erosion and profuse weed growth in the vacant areas. This clearly indicates the importance of adopting appropriate measures to protect the young tea plants from the vagaries of weather, especially during dry weather and possible prolonged droughts.

In order to avoid such losses, the right strategy needs to be adopted from the very beginning, from proper land selection, the correct choice of a basket of clones, to the adoption of appropriate cultural practices at the correct times. The choice of clones is of critical importance since the degree of drought damage depends to a considerable extent on the ability of the respective clone to withstand and tolerate moisture stress. Any lapse in the choice of the clone will be irreparable after field establishment. Therefore, appropriate attention must be given to drought tolerance when selecting clones especially for drought-prone areas. Some of the drought resistant characters are:

1. Deep and extensive root system
2. Thick layer of cutin on leaves
3. Low density of stomata on the leaf surface and which close promptly under moisture stress
4. High root to shoot ratio.

In order to minimise drought effects, it is necessary to take every possible effort to conserve soil moisture during land preparation, planting and after care operations. The soil moisture conservation could be achieved by adopting proper cultural practices at the correct time with due understanding of the soil type and weather pattern of the region.

Drought effects and casualties in new clearings in respect to some of the cultural practices adopted in the low country during past drought periods, will be discussed here.

Planting (Planting density)

The number of plants per unit area of land refers to density which determines the land area occupied by one plant. The land area could be modified to increase the plant population without causing competition between plants until canopies of adjacent plants meet. Any further increase in plant population will lead to competition for water, nutrients and light, resulting in weaker plants with poor growth. Competition for moisture could be very serious during periods of drought resulting in high mortality rates. The currently recommended spacing of 12 x 6 m (4 ft. x 2 ft.) theoretically accommodates 13,600 plants per ha but in practice the number of plants are always below this figure due to roads, footpaths and drains in the land. However some plantations and small holders adopt closer spacing in the expectation of getting good cover and higher yields. Closer planting is rather costly as it involves additional expenditure on plants and fertilizer and may prove disastrous by producing weaker plants which may die off for the slightest moisture stress.

The results of an experiment with different spacing and their performance during drought showed the following casualties:

Spacing	% Drought casualties
Hedge planting 0.46 sq.m/ plant (5 sq.ft/plant)	40
Recommended 0.74 sq.m/ plant (8 sq.ft/plant)	24
Triangular planting 1.2 sq.m/ plant (13 sq.ft/plant)	18

The highest casualty rate of 40% was found to be in hedge planting where the plant population (21,500/ha) was high. It was reduced to 24% with the recommended spacing (13,600/ha) and further reduced to 18% with a lower plant population (8275/ha) with triangular planting. This shows that closer planting can cause a greater loss of young tea plants, during a dry spell.

Weed Management

Weeds thrive well in new clearings of tea due to unrestricted light and as a result they deprive the tea of moisture and nutrients. Most of the weed species are able to withstand long dry spells compared to vegetatively propagated tea plants. The well established root systems of most of the weed species is mainly restricted to the top layer of the undisturbed soil. The surface layer of soil usually gets slightly wet or moist following early morning mist and fog that generally accompanies dry spells. Weeds are able to use this moisture but the tea plants are unable to utilise it due to the nature of the root system in tea; moreover, this moisture is hardly sufficient for a plant like tea to pull through the drought. As a result of this, weeds are able to survive and grow satisfactorily even during a drought.

In many plantations and small holdings weeding rounds are sometimes delayed due to various problems that are associated with lack of funds and shortage of labour. Under these circumstances there is profuse weed growth and as a result new clearings easily become prone to severe moisture stress early in the dry period.

Some observations on the effects of weeds on tea during periods of drought are as follows: New clearings heavily infested with the weeds have shown 30% casualties following a drought when compared to 20% casualties in the adjacent area maintained free of weeds. This was observed in young tea without any mulching but similar results have been observed with mulching. It is generally considered that mulching acts as a physical barrier and smothers the weeds but observations have indicated that weeds thrive well once the mulch breaks down due to the resultant good fertility (addition of organic matter and nutrients following partial and complete decomposition of mulching materials). As a result of profuse weed growth in new clearings where the mulch has decomposed it is necessary to check the weed growth before weeds compete with tea for moisture. If weeding rounds are delayed drought effects and casualties could be higher in mulched areas compared to unmulched weed free areas. Observation of tea plants in new clearings where the mulch has decomposed and consequently weed infested, showed drought casualties of 53% compared to 24% in a weed free new clearing without mulching. This serves to emphasize the need to maintain the mulch by re-supplying once it has broken down. Therefore to minimize drought effects it is very important that weeding rounds should not be delayed specially before the onset of dry periods.

It is common knowledge that use of any implement for weed control in tea is banned but it is still not uncommon to see scrapers and mammoties being used for weed control in plantations and small-holdings. Surface soil disturbance not only makes the land liable for erosion but it also depletes its soil moisture due to enhanced evaporation from the disturbed soil surface. Hence any sort of mechanical weeding which disturbs the soil surface should be avoided at any cost during a drought or prior to a drought. Manual weeding or resorting to chemical weed control with utmost care in the choice of the herbicide, rate and application at an early stage of a drought could be considered ideal.

Mulching and Cover Cropping

Mulching is an important agricultural practice that has several advantages such as conservation of soil moisture, improvement in soil fertility by supplying organic matter and nutrients and weed control. Mulching is a most effective cultural practice that minimises the adverse effects of moisture stress during dry periods. In a study where different mulching materials were compared with no mulching, soil moisture, soil temperature and visual assessments on wilting of young plants were monitored during drought. The results indicated that soil moisture at a depth of 0-15 cm (0-6 inches) in mulched plots was 6.9% compared to 5.0% in unmulched plots while the soil temperature was 34.5^{o}C in unmulched plots. With respect to visual assessments on wilting, mulched plots had only 15% young tea wilting compared to 56% wilting in unmulched plots.

The higher moisture content and lower soil temperature resulted in lesser wilting of plants in mulched plots and this contributed to minimise the drought effects to a considerable extent. Therefore mulching is a very important practice in order to protect new clearings from drought hazards.

The establishment of cover crops is considered as an alternative for mulching with respect to soil conservation rather than moisture conservation. Therefore it is necessary to manage the cover crops to reduce their competition for moisture with tea during dry periods. In an experiment, leguminous cover crop species viz. *Desmodium ovalifolium* and *Stylosanthes gracilis* were established between tea rows and these were compared with young tea that was mulched. The cover crops were restricted to a 60 cm (24 inch) strip between tea rows to minimise their competitive effect and to facilitate other cultural operations. The cover crops were slashed down to ground level periodically. Mulching was repeated at 3 month intervals in the young tea.

Observations on drought effects indicated that casualties of young tea in the *Desmodium* and *Stylosanthes* plots were 43% and 64% respectively while in the mulched plots it was only 26%. Accordingly the number of plants lost in the cover crop plots amounts to twice to that lost in the mulched plots. Further, soil moisture measurements at a depth of 0-15 cm (0-6 inches) was 4.35% in cover crop plots compared to 6.35% in mulched plots. The high casualty rate in cover crop plots could be attributed to depleted soil moisture in these plots compared to mulched plots.

The high casualty rate in cover crop plots could be attributed to depleted soil moisture in these plots compared to mulched plots. It was also observed that growth of cover crops was profuse in spite of slashing periodically. This could be due to the extensive root system of cover crops and their adaptability to adverse weather conditions. Hence the behaviour of cover crops to some extent is similar to that of weeds and their effects on young tea during dry periods.

Considering the above facts it is clear that in order to minimise drought effects in new clearings it is important that more attention should be paid to proper selection of land, selection of appropriate clones, ideal plant population, timely weed management and maintenance of mulch. This could be harnessed by proper integration of cultural and management practices.