Tea Bull. 17(1/2), 33-38, 2002

SCIENCE BEHIND PRACTICES IN PRUNING OF TEA

M A WIJERATNE
(Senior Research Officer, Agronomy Division,
Tea Research Institute of Sri Lanka, Low Country Station,
Ratnapura, Sri Lanka)

Introduction

Naturally tea plant grows into a small tree of about 10 m in height. However, growth of the plant is confined to a low grown bush of about 1 m by pruning in commercial exploitation. The removal of leaf bearing branches is called pruning. The main objectives of pruning tea are to.

1. reduce the height of the bush
2. stimulate vegetative growth for vigorous flushing and
3. maintain a healthy frame

Once the tea bush is pruned, a new secondary frame is formed and it remains economically productive for about 2-5 years depending on the jat or clone, environmental factors (tea growing region) and management practices. Pruning practices, which are recommended by the TRI have a scientific basis. Poor recovery and high casualties after pruning have become very common in tea lands due to adoption of inappropriate pruning policies. Lack of knowledge on the scientific basis of a pruning policy attributes to the adoption of such incorrect pruning practices by tea growers. Hence, some of the important aspects are discussed below.

Pruning and recovery

"*Pruning in tea science resembles a surgical operation in medical science*" (Gadd, 1931). This means that the success of this operation depends on the vigour of the tea bush at pruning, method followed and the comfort of the environment.

Pruning removes all or more of the canopy branches with foliage. Hence, it deprives the bush of its sole source of assimilates or food supply, on which the growth of the bush is totally dependent. Consequently, maintenance and regrowth or recovery of the bush after pruning, is dependent up on the food materials stored in the root system and remaining woody branches and the stem. These facts have been carefully taken into consideration in the selection of a proper pruning policy.

Height of pruning

Pruning acts as a stimulant to the growth of dormant buds on the woody branches. More commonly, tender portions of the branches are removed by pruning and therefore, the older dormant buds are stimulated for regrowth. As the viability and vigour of these senile dormant buds are comparatively poorer than younger dormant buds, special care should be taken, while pruning, to leave as many younger portions of branches as possible (Mwakha, 1997; Gadd, 1931; Tubbs, 1931). Tubbs (1947) warned the tea growers of bad consequences of hard pruning in his words *"It is possible that Ceylon will suffer from the effect of one of its periodic waves of heavy pruning unless the need for such treatment is critically examined by all responsible for a pruning policy"*. This shows that the severity or the height of pruning decides, to a greater extent, the time taken for recovery and the degree of debilitation or death of bushes after pruning. However, the selected pruning height should also ensure a satisfactory cleaning of the basal part of the frame and continuation of plucking for a longer period before the next prune. Under many circumstances, medium pruning proves to be ideal for tea. But when the frames are highly debilitated and having only a healthy collar region, a new frame can only be formed by a very low pruning (rejuvenation pruning). Therefore, correct height should be carefully selected depending on the health and vigour of the tea bush in order to achieve a successful recovery after pruning.

Time of pruning

Removal of a large number of tender shoots within a short period of time (cropping season) pave way for the exhaustion of starch reserves. When there is a boost of shoot growth, carbohydrates produced by the maintenance foliage is mostly diverted to top growth. Due to respiration and in the absence of starch diverted to roots, the amount of starch reserves in the root system depletes. Hence, pruning should not be carried out soon after a rush crop. Bushes passing through a stress (dry period, pest or disease attack etc.) also have low root reserves due to high rate of respiration owing to higher temperatures, and low rate of assimilation owing to stress and loss of foliage (Krishnapillai *et al.*, 1992). Therefore, such periods should not be selected for pruning tea bushes. Pruning tea at a time when the growth of cambium is high ensures a better callus formation. The best period is soon after the commencement of an active growth of the bush, i.e. with the onset of a rush crop (at the beginning of a cropping season) or some time after a stress period (dry spell). These periods are characterized with an active sap flow. Therefore, pruning into or during dry weather should be avoided (Gadd, 1929; 1931).

Resting before pruning

Starch reserves in the root system and remnant branches after pruning are the only sources of food for growing buds after pruning. Of these two stores (sink), the most important one is the root system as the amount of starch reserves in branches of tea bushes in plucking is negligible i.e. less than 10% (Gadd, 1929, Krishnapillai, *et al.*, 1992). Majority of root reserves is lost by root respiration. Hence, the size of the root system and rate of respiration of live tissues determine the availability of reserves for recovery after pruning. Tubbs (1934) has reported that the recovery is affected when the starch reserves are below 12%. Recovery of tea bushes after pruning can be extremely poor when the root reserves are less than 5% (Krishnapillai *et al.*, 1992). Due to vagaries of weather and poor pruning practices adopted in tea plantations, the starch reserves of our tea bushes at pruning are usually below this critical level (12%). Such incidents are very common in the low country tea plantations where the root reserves are less than that in the up country owing to climatic (temperature) variations (Tubbs, 1934). Therefore, resting of tea bushes prior to pruning is essential in order to boost root reserves and recovery after pruning (Anon, 1999; Tubbs 1947; 1934). However, it must be emphasized that resting tea bushes for a few weeks i.e. less than a month will not suffice for replenishing the starch reserves but to further decline the amount due to free growth of shoots (Anon 1996).

Method of pruning

More than 60% of the dry matter produced by the bush is lost by respiration (Barua, 1987). As a result, a significant loss of food reserves can occur even after pruning due to the respiration of remnant live tissues of the frame and roots. Hence, while pruning, few branches having about 200-300 leaves can be left intact for supplying food for the maintenance of the bush. These branches are best known as lungs. They also dilute any harmful root metabolites, which arise from dead feeder roots and cause rim-blight symptoms on newly expanding leaves (Roberts, *et al.*, 1976). Moreover, retention of lungs promotes growth and activity of feeder roots and assists the development of new shoots (Kandiah, *et al.*, 1984).

Pruning cut is a wound through which wood-rotting organisms can enter into the plant body and invade live tissues. Hence, it is very necessary to get the wound healed soon, in order to protect the tissues from any infection. When a branch is cut, a mass of tissues is formed around the cut surface. This newly growing tissues are known as callus. The ring of callus originated from the cambium grows into the centre of the cut surface and covers the wound. Generally, callus formation is faster when the pruning cut is located near an actively growing region. This ensures an adequate supply of food materials to the callus forming

tissues. The pruning cut should, therefore, be located along the path of food supply in order to ensure a better callus formation. Hence, when a branch is to be completely removed, it should be cut from its base or main stem leaving no stub for drying and die back. If a branch is to be shortened, the cut should be made just above a dormant bud (eye) (Gadd 1931; 1929).

Post pruning practices

Pruning suddenly exposes the base of branches shaded over a longer period to direct sunlight, which can increase the bark temperature to more than 10°C above the ambience (Kulasegaram, 1986). This can lead to desiccation, scorching and death of dormant buds. Therefore, frame should be covered by spreading the prunings over the frame soon after pruning. This prevents the desiccation of the pruning cuts and the damage due to sun scorch. These prunings kept over the frame should be removed about three days after pruning. The late removal can lead to poor recovery and also physical damage to growing shoots.

The application of fungicidal dressing or a water resistant paint on the pruning cut facilitates better callus formation as it prevents the invasion of wood rotting organisms and desiccation of live tissues (Gadd 1931). "Mossing and Ferning" (removal of moss and ferns) attached to the frame and near the collar region exposes hidden dormant buds to the external environment and stimulate bud break. Spraying of hydrated lime on pruned frames also checks the growth of moss and lichens, soften bark, reduces sun scorch and enhances bud break (Sivapalan, 1998).

Removal of lungs and dead snags

At the time of lung removal, presence of adequate foliage in the recovering bushes is very essential, in order to take up the job of lungs. The lungs should therefore, be removed when the majority of recovering shoots has more than 3-4 fully expanded leaves. Due to the variation in the rate of recovery after pruning, removal of lungs may have to be done selectively in a few steps. Early or late removal would either leads to poor recovery or loss of crop. The lung branches should be cut to the younger wood few centimeters above the pruning level in such a way that recovering shoots are not damaged. It activates growth of dormant buds on the lung branches promptly and assists their recovering shoots to reach the plucking table early. This also minimizes the die back of lung branches after pruning (Kulasegaram, 1986; Tubbs, 1937; Tubbs, 1934).

Bringing tea into plucking

The removal of top growth of the recovering shoots to a level is called tipping. This is done by removing top portions of shoots to an even height leaving 4-6 leaves at the base of shoots. In order to carry out a successful tipping in many clones, the majority of recovering shoots should have formed a brown stem just at the base. It is very necessary to leave sufficient leaves to the bush after tipping as the formation of a new frame depends largely on the vigour of the tipped branches and the productivity of the foliage left after tipping. Further they are the branches to be pruned at the next pruning season and therefore, they should be allowed for adequate thickening. Hence, tipping should be done at the proper time when recovering shoots are ready to support the top growth forming the plucking table. As expanding leaves partly depend on imported food (assimilate) for their growth (Marimuthu *et al.*, 1994), only the fully expanded leaves which export assimilates to the needy tissues must be left after tipping.

Tea bushes after pruning can be brought into plucking without knife tipping which is called plucking-in. In this method recovering shoots are plucked leaving 2-3 leaves when they are having about 5-6 leaves. Although this method would reduce the unproductive period after pruning by few weeks, it deprive the new branches to be adequately grown before they support the top growth of shoots forming the plucking table. Further, the growth of a new generation of shoots after plucking-in, greatly depends on the stored food reserves as remaining foliage is not mature enough to supply food. This may also lead to the deterioration of the vigour of tea bushes.

Hence, timely tipping results in an even growth of shoots and the formation of a vigorous frame with sturdy branches contributing to high yield (Anon, 2000).

Conclusions

When the scientific basis behind the recommended pruning practices is considered, it is clear that change of pruning height according to the vigour and health of the bush, timely pruning with the onset of monsoons and before a rush crop, resting before pruning, leaving healthy lungs and removal of lungs when the bushes have adequately refoliated, cleaning of frames, application of wound dressings and lime washing of frames and timely tipping leaving adequate foliage to the bush ensure a better and a faster recovery of tea bushes after pruning minimizing casualties.

REFERENCES

Anon. 1996 Agronomy Division, Ann. Rep. Tea Research Institute of Sri Lanka-1996, 25-46.

Anon. (1999 Agronomy Division, Ann. Rep. Tea Research Institute of Sri Lanka-1999, 23-50.

Anon 2000Agronomy Division, Ann. Rep. Tea Research Institute of Sri Lanka-2000, 28-55.

Barua D N 1987 Net and gross productivity in tea. *In*: Tree crop physiology. Eds. Sethuraj, M.R. Rhagavendra, A.S. pp 224-246. Elsevier, Amsterdam

Gadd C H 1929 Pruning in relation to wood rot of tea. Tea Quart. 2, 10-16.

Gadd C H 1931. Pruning in relation to diseases. Tea Quart. 4, 45-53.

Kandiah S, Wettasinghe D T and Wadasinghe G 1984. Root influence on shoot development in tea (*Camellia sinensis (L.) O. Kuntz*) following shoot pruning. J. Hort. Sci. 59, 581-587.

Krisnapillai S, Pallemulla D and Navaratne S 1992. Studies on tea and drought 1. Some observations on drought effects on physiology of tea. S.L.J.Tea Sci. 61 (2), 59-67.

Kulasegaram S 1986. Pruning. *In* Hand book on tea. Eds. Sivapalan P Kulasegaram S and Kathiravetpillai A pp 82-87Tea Research Institute of Sri Lanka, Talawakelle, Sri Lanka.

Marimuthu S, Raj Kumar and Manivel L1994 Factors affecting partitioning of assimilates in tea. J. Nuclear Agr. Biol. 23, 219-223.

Mwakha E 1997. Tea pruning for yield improvement. Tea. 18 (2), 144-148.

Robberts G R, De Silva U L L and Wettasinghe D T 1976. The Effects of cultural operations on composition of the xylem sap of tea plant recovering from pruning. Ann. Bot. 40, 825-831.

Sivapalan P 1998 Liming of tea fields. A critical need. Tea Bull. 8 (1), 3-22.

Tubbs F R 1931. Some physiological aspects of pruning. Tea Quart. 4, 40-44.

Tubbs F R 1934 Pruning in relation to estate profits. Tea Quart. 7, 4-10.

Tubbs F R 1937 The length of the pruning cycle. Tea Quart. 10, 21-45.

Tubbs F R1947 Pruning today. Tea Quart. 18 (4), 112-114.