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Mechanization of harvesting in tea: A classic case of Science and Technology interfacce with Management

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ABSTRACT: This article presents that tea industry in south India has benefited immensely by technological and watershed interventions that boosted the productivity of south Indian tea. Considering "Harvesting" as a key operation of tea industry, this article highlights the following four critical parameters: crop yield; cost of production; leaf quality and price realization. Furthermore, Leaf Expansion Time (LET) is taken as the basis while planning harvesting schedules In 1989, actual scientific studies on "phyllochron concept" based on accumulated day degrees were carried out as per recommendations made by R.S.R. Murthy and V.S. Sharma. Furthermore keeping "multiplication factor" and LET in view, a Harvesting Interval Equation is also formed and discussed. Finally based on the science and technology interface, this article stresses on the importance of the "art of plucking", which has become a "science of harvesting", and is gaining wider consideration particularly in the context of acute shortage of workers and ever-spiraling wage-bills.

Keywords: Harvesting; south Indian tea; Leaf expansion time, LET; Harvesting interval

Introduction

Tea Industry in south India has benefited immensely by technological intervention, by way of improved plant nutrition through both soil and foliar applications, infilling, rejuvenation pruning, effective management of weeds, diseases and insect–pests, and of course, plant improvement. All of these have become watershed interventions that boosted the productivity of south Indian tea.

Harvesting is a key operation in tea cultivation as it influences to a great extent the four basic parameters that determine the bottom line of the industry which are as follows:

1. Crop Yield,
2. Cost of Production,
3. Leaf Quality and
4. Price Realization.

In order to bring improvement in these parameters, it is to be ensured that harvesting of the crop is done at the optimum interval when the target shoots attain the maximum weight but before turning coarse.

A simple technological understanding in reformulating the method of tea harvesting in an era, wherein semi-mechanization has become a necessary evil, is discussed here.

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Shift from Selective to Non-selective Harvesting

In traditional hand-plucking, shoots of the optimum size are selectively harvested at each round of plucking. However, in today's context of acute shortage and high cost of labour, one is compelled to resort to mechanization, partially or fully. Hand-operated topiarist's shears fitted with a collection-tray lend themselves admirably in mechanizing harvesting, partially. The challenge, however, is in using these hand-held shears without significant crop loss, in absence of the crop shoot selectivity. The way out lies in ensuring maximum "clustering" of crop shoots of uniform growth and size, prior to harvesting.

Harvesting, hence, needs to be done with an understanding of growth rhythm and physiology of the bush. However, appropriate plantation management practices need to be adopted for ensuring the clustering of the shoots.

Leaf Expansion Time (LET)

While planning harvesting schedules under a semi-mechanical regime, Leaf Expansion Time (LET) is taken as the basis. In simple terms, LET is the number of days taken for one leaf & a bud to unfurl another leaf and become two leaf & a bud or from two leaf & a bud to three leaf & a bud. LET is a parallel term for "leaf period" or "phyllochron" which refers to the time interval in days between unfolding of two successive leaf appendages. LET, of course, depends on the rate of growth, as dictated by weather conditions, chiefly the prevailing

temperature regime. Day degrees accumulated in the system regulate the expansion and growth of the shoots.

In 1989, actual scientific studies on "phyllochron concept" based on accumulated day degrees were carried out as per recommendations made by Murthy and Sharma.[1]

Monitoring LET

Tagging of shoots (one leaf & a bud) and observations on unfurling of leaf are carried out on each estate by trained people/staff on a daily basis and records are kept on LET values. LET, in general, ranges between 8 and 9 days during the high cropping season and 10 and 11 days during the lean season in the south Indian conditions.

Target Shoots comprising majority of succulent three leaves & a bud, large two leaves & a bud, one leaf and two-leaves banjis are harvested. Considering the overall economy in terms of yield, quality and cost of plucking, target shoots in the harvest should be up to 80%. The immature buds and soft cut leaf should be within 10%.

Standardization of Harvesting Interval

The two operational levers, *i.e.* "harvesting interval" and "size of unplucked shoots left on the bush" are important factors in standardization of harvesting practices. In order to harvest 80% target leaves, Harvesting Interval gains importance and significance. Harvesting interval is derived by multiplying LET (in days) with the factor '2' since three leaves & a bud is the target shoot. In other words, for one leaf & a bud to become the target shoot, the interval will be 2 – LET. The number of days taken for one leaf & a bud to become two leaves & a bud is taken as 1 – LET and then, that from two leaves & a bud to three leaves & a bud as 2 – LET.

Here, '2' is the "mupliplication factor". Therefore, LET in days multiplied by the multiplication factor gives the harvesting interval. For example, if LET is 9 days, then $9 \times 2 = 18$, so harvesting should be done at 18-day interval.

However, multiplication factor depends on the size of shoots *Left behind On the Bush* (*LOB*), following *Non-selective Level Shearing*. Harvesting is done gliding the shears on the bush-surface to ensure the retention of uniform, small one leaf & a bud on the plucking table. "Maintenance Foliage" will also get added by default, in the process. In case the maintenance foliage happens to be sparse or inadequate (less than a depth of 15–20 cm), deliberate addition of foliage by switching over to either hand-plucking or addition of foliage by shears is resorted to.

Equation for Harvesting Interval

Leaving behind the correct generation of shoots on the bush by applying correct LET with the desired multiplication factor, the optimum harvesting interval can be arrived at, that determines the yield and the quality of shoots that are to be harvested.

The above discussed method can be formulated into an equation, thus:

$$LOB + HI = TS$$

Here, *LOB* stands for "Size of shoot left on the bush", *HI* is "Harvest Interval" and *TS* is "Target shoot".

Similarly,

$$HI = LET \times Mf$$

Here, again *HI* stands for "Harvest interval" whereas *LET* is "Leaf Expansion Time" and *Mf* stands for "Multiplication factor".

The "Art of Plucking" thus becomes "Science of Harvesting". This concept of "level-harvesting" adopted in some estates is gaining wider consideration particularly in the context of acute shortage of workers and ever-spiraling wage-bills. An important fact that is to be kept in mind is that there is a likelihood of certain amount of loss in yield, *say* up to 5%, during the adoption of level shear-harvesting; however, the loss is compensated to a great extent by increased plucking average (up to 40%) and reduced plucker-rquirement (up to 40%).

Reference

1. Murty RSR & Sharma VS. 1989. Rationalization of plucking intervals in tea. *UPASI Tea Sci Dept Bull* 43: 6–15.