

TECHNICAL PAPER 3 - PLUCKING / HARVESTING OF TEA

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Plucking, Picking or Harvesting are all synonyms with tea harvesting as the marketable product of tea is manufactured from young or tender tea shoots which are picked at specific intervals depending on the rate of growth which also differs due to weather, temperature, elevation etc. The policies germane to harvesting of tea involve numerous aspects such as [a] Plucking method [b] Plucking standard, [c] Plucking severity and [d] Plucking frequency. It is this writer's personal experience over three and a half decades in the Tea Planting Industry that effective harvesting policies in a tea estate has a direct effect on the productivity and indeed viability of tea plantations. Accordingly, the carrying out of proper plucking policies, contrary to misguided and erroneous beliefs, paradoxically reduces the cost of plucking, increases the Yield per Hectare [YPH] and improves the quality of the required leaf standards [end-product] and significantly maintains the sustainable growth of tea bushes, period!

During the period the writer was managing the largest commercial tea plantations in Sri Lanka, he monitored the Cost of Plucking [COP] on a daily basis in each division as Plucking alone constitutes some 40% of the total Cost of Production spectrum as manual plucking is not only a skilled job but is highly labour intensive; it is usual also to engage approximately 65% to 70% of the available workers on harvesting leaf on an estate. Although the worker needs for manual plucking varies with productivity of a tea field, under average conditions in Sri Lanka, it amounts to around 10 – 12 workers per ha.

The writer of this technical paper had not only established the highest YPH in major plantations he managed such as Pettiagalla, Hapugastenne [SL's biggest tea plantation] Gartmore, Diyagama West [Up Country's largest plantation] he also secured the highest tea prices by record high Nett Sale Averages – I could categorically state that both these vital pillars of excellence were achieved primarily due to constant care and attention being personally paid in all aspects of PLUCKING after all the quality of made tea is greatly influenced by the chemical constituents of the tea leaf, fibre content, physical condition of leaf from point of harvesting, transport, handling with avoidance of contamination etc.

QUALITY PARAMETERS OF TEA LEAF: The best quality tea can be produced from tender shoots having a bud and 2 – 3 leaves that are free of physical / mechanical damage and contamination. Therefore proper Plucking Policies must be implemented so as to ensure that tender shoots [bud and 2-3 leaves] are harvested and not exposed to harsh / direct sunlight post-harvesting and also transported carefully and swiftly to processing plants [tea factories] to minimize damage and delay. I reiterate that adopting of effective and proper Plucking Polices is absolutely vital to generate high yields while enhancing worker productivity without adversely affecting the growth of the tea bush.

SHOOT GENERATIONS & SHOOT GROWTH: The physical act of Plucking removes the tender apices of shoots which are photo synthetically active green tissues and the apical dominance exerted by them suppresses the growth of the axillary bud beneath the harvested shoot; soon after the apical

dominance is removed, the axillary bud below the point of plucking starts swelling and initially unfurls its two outer covers named 'Scale Leaves' – these two scale leaves, which are usually very small, have a short lifetime and generally falls off within a few days after opening. The next leaf appendage to unfurl is the 'fish leaf' which is oval shaped. Some buds produce two fish leaves. When growth progresses, the terminal bud produces normal leaves; interestingly after producing several leaves, the terminal bud 'ceases' leaf production and emerges as a dormant '*banji*' bud. This '*banji*' is a tiny bud usually covered by leaf hairs. After the dormant period lapses, which could extend to several weeks or months, depending on various ecological and genetic factors, the dormant apical bud reactivates itself and opens as a set of similar leaf appendages. Thus, a free-growing tea shoot passes thru an active and dormant phase of growth that occurs alternatively. This phenomenon is known as the periodic growth of tea.

During the writer's long experience in managing tea estates, whilst he paid much close and sustained attention to plucking standards, one specific area in plucking operations was to ensure that all immature dormant buds or '*banjies*' are picked and included into the leaf being plucked and to remove and discard all other mature '*banjies*' – to ensure a '*banjie-free*' plucking surface at any time, especially vital just before attending to 'Foliar Spraying' of Urea, Zinc Sulphate & Epsom Salts. The aim is to break the 'dormant-cycle' and to encourage more plucking points towards enhancing productivity of tea bush.

The top of the tea bush is trained to usually have a flat surface [or dome shape] for easy harvesting and enhance shoot production. This bush surface is known as the 'Plucking Table'. During manual plucking operations, a level plucking table is usually maintained by keeping a 2m long straight stick horizontally on the bush and harvesting shoots to the level of the stick. Once the tender portion of overgrown shoots are harvested, the shoot butts containing mature leaves and internodes above the level need to be removed to maintain the level of the plucking table – known as 'breaking back' [and removal of *banjies*]

The 'Plucking Table' consists of a large number of shoots at different stages of growth ranging from growing axillary buds to harvestable shoots with few leaves. Each of these groups of shoots identified by the number of leaves at same stage of growth is called a 'generation'. These generations are created by frequent harvesting and the variation of the rate of shoot growth. Usually the number of generations is around 6 when bushes are plucked at short intervals or 'Rounds' but less with extended plucking rounds and under mechanical harvesting systems. When the number of generations is more, a higher degree of selectivity is required to harvest standard shoots. Of these generations, the older one or two are generally harvested as 'flush shoots', leaving the younger generations for successive plucking rounds. Actively growing shoots with more than 2 leaves and dormant shoots are called 'harvestable [plucking] shoots while the other younger generations are known as 'buds' or '*Arimbus*' – should not be removed!

MANUAL PLUCKING

With selective plucking [harvesting] one or two older generations of shoots with 2-3 leaves are removed. However younger generation of shoots [immature buds or '*Arimbus*'] are left un-plucked to enhance the 'sink' capacity of the bush and also to pluck them as 'heavier units' at a subsequent

plucking round. Selective plucking not only gives high and sustainable yields, it also ensures optimum utilization of shoot growth as well as production of good quality made tea.

However in non-selective harvesting, it is possible to harvest many generations of shoots, sans any selection. This results in no immature shoots being left on the bush and the plucking table would have only 'mother leaves' that are dark green in colour and aptly named: '*Black Plucking*'. This is a practice that should be avoided at all costs as it not only adversely affects the source: sink relationship of the bush, but also extends the time taken for regeneration of shoots due to release of immature buds for re-growth. Although non-selective plucking can give a spurt in yields initially, for perhaps a few months, there will be marked decline in yield at the latter part of the pruning cycle due to effects on dry matter assimilation and shoot production. Significantly, the crop gathered through non-selective harvesting has shoots with various degrees of maturity and therefore leads to the production of poor quality teas.

This unacceptable practice also known as 'Severe Hard Plucking' negatively impacts the health and vigour of the tea bush and reduces its life span. Further adverse consequences of non-selective harvesting are the production of small shoots and formation of '*mudichchi*' [Crow's feet condition], i.e. a clump of shoots and stalks. These unsightly clumps are formed due to production of multiple shoots on a single shoot butt and inadequate space among shoots, especially when the shoots are repeatedly plucked right down to the 'fish leaf' – sadly much evidence of 'hard plucking' was seen by the writer on his recent VA visits as recently as November 2016!

LEAF STANDARD & STANDARD OF PLUCKING: With aim of producing good quality tea, harvested shoots should have only 2-3 tender leaves that are free of physical/mechanical damage/leaf afflicted with disease such as Blister Blight spores and of course single 'hard' mature and coarse leaf. To reiterate Good quality tea leaves for manufacture should have only 2-3 tender leaves including immature '*banjies*' or dormant buds that are acceptable for tea processing. On the other hand tea shoots with mature [coarse] leaves and stalks, including damaged shoots and leaf that has been contaminated with foreign matter such sand, dirt, grime etc are sub-standard or simply 'bad leaf' for processing. Usually the presence of more than 75 to 80% of 'Good Leaf' ensures a better quality of the end product.

The standard of plucking influences the quality of the end product and cost of manufacture. There are three 'plucking standards', namely: **Fine, Medium and Coarse**. When only shoots with two leaves and a bud are harvested, it is referred to as 'Fine Plucking'. If the harvested shoots consist of three leaves, it is considered as 'Medium Plucking'. Conversely 'Coarse Plucking' as the name suggests implies the removal of shoots with more than three leaves and inclusion of coarse/'stalky'/ damaged leaves.

Continuous Fine Plucking gives a low yield due to plucking of smaller shoots, leading to extension of the shoot replacement cycle. Apart from being costly, it does not make business sense to maintain a fine plucking standard as the productivity of workers too is negatively impacted, raising costs. However, Medium Plucking provides an acceptable leaf standard with twin objectives of producing better quality teas at a low cost. Obviously, one must avoid 'Coarse Plucking' at all times! [Source: TRI Handbook on Tea]

FREQUENCY OF PLUCKING [PLUCKING ROUNDS] The frequency of harvesting refers to the number of days between successive harvests. A plucking round is defined as the time taken by the majority of shoots remaining after the previous round is ready to be harvested. Usually the plucking round is determined by on-the-spot inspections. Under normal growing conditions the leaf period of common tea clones [cultivars] in Sri Lanka is about 6 to 7 days at high elevations and 5 to 6 days at low elevations. However this could be high as eight days under dry weather conditions at low elevations. Therefore plucking rounds are generally shorter during wet and sunny weather and longer during dry weather. Overall in a proper harvesting policy one should have a logical balance between plucking round and plucking standard in order to secure a higher yield and good quality of the final tea product.

MANAGEMENT OF RUSH CROPS: Tea yield varies with the change in weather conditions, with wet weather associated with high crop and dry periods with depressed yields. The axillary buds remain dormant or display very slow growth rate during dry months. Conversely with the rains, following a dry period would stimulate bud break. This large scale bud break and rapid shoot growth in backdrop of favourable weather conditions increases the shoot density and forms a peak in crop, known as the 'Rush Crop'. During the peak cropping months, worker needs for harvesting spikes due to plentiful harvestable shoots on offer. This is a period when tea growers face difficulties in deploying sufficient workers for harvesting. Furthermore, tea processing in the factories also get affected due to receipt of unmanageable leaf quantities over and above the factory capacity. Thus rush crops must be well managed by effective planning and resource deployment.

Strategies for 'rush crop management' include, the reduction of plucking fields, extension of plucking rounds, increase in plucker productivity along with resting of tea fields due for pruning [this enhances the starch reserves of the bushes to be pruned], pruning before the rush crop and proper tipping after pruning helps to mitigate some of the 'rush crop' issues. Some of these practices not only help in managing rush crop, but also improve the health and vigour of the bush due to enhanced recovery after pruning. Rush crop can also be managed to a greater extent by increasing the productivity of workers by resorting to mechanical harvesters, payment of attractive over-kilo rates, deploying workers on 'cash plucking' outside normal working hours and granting of attractive incentives based on attendance etc.

MECHANICAL HARVESTING: Manual plucking of tea requires a large number of workers and therefore some of the plucking fields are temporarily abandoned or permanently diversified due to shortage of workers. Although, incentive based plucking policies have enhanced labour productivity to an extent, it has not been a permanent solution to combat absenteeism of workers and declining work force due to outward migration from plantations to cities that seemingly lure them due to the 'bright lights', albeit harsher living standards in mostly crammed and unhygienic lodgings in cities compared to mostly healthy living on plantations, where drinking water is pure and free and one breaths clean, fresh air!

In view of above dire situation tea growers are compelled to seek alternatives to manual harvesting in order to ensure that the entire tea extent is harvested in time. Accordingly mechanical harvesting is being seriously considered for the tea industry as it needs to be socially and economically acceptable giving high output per worker, low plucking costs, harvesting of shoots with acceptable quality,

preservation of health and vigour of the bush with enhanced worker comfort with minimum impact on the environment – sounds utopian! Yet the TRI Selective Tea Harvester is just that!

Shears, **notably TRI Selective Tea Harvester**: This machine introduced by the Tea Research Institute of Sri Lanka has the potential to double the output of manual workers; the use of these shears prevent physical damage to shoots and preserve the quality of the harvested shoots. Shears are more suitable for high yielding tea fields and to manage the periods of rush crop where worker needs for plucking is high. Shear harvesting favours cultivars with high shoot density, less number of dormant shoots and those with long internodes. However, shear harvesting should be minimized during the early stages of bringing young tea into bearing and tipping after pruning, due to the open nature of the potential plucking table and lack of maintenance foliage. [Ref attached: Mechanised Harvesting / TRI Shear]

HARVESTING POLICIES

Harvesting policies include method, standard, severity and frequency of harvesting. These policies can vary from one field to another depending on the months after pruning, age of bush, and cultivar or '*jat*'. They also differ from one estate to another depending on the availability of resources and the type of tea produced; harvesting policies could also vary from one region to another depending on weather and climatic conditions. However the best harvesting policy is the one that gives the highest productivity at a low cost, ensuring the quality of the end product and vigour of the tea bush. Plucking operations and the Yield per Ha are inter-woven. For instance closer plucking rounds / generation plucking / removing all *banjies* at each and every plucking round / preserving buds [*arambus*] for next round / monitoring the quantum of leaf at each completed round and ensuring there are no unusual variances, directly improve productivity or **yield per ha** whilst lowering costs. The writer is a strong advocate of such practices!

YEILD PER HA [YPH] – A MUCH ABUSED AND MISQUOTED TERM!

Before working out the Yield per Hectare one must consider and question the following significant factors germane to YPH: the barometer of the health and standing of a commercial tea estate.

[1] 'Stand' per ha [No of bushes in each ha]; is 'census' taken of bushes at each pruning? Bush stand 20 years ago may be significantly reduced today, if no infilling done! How can we term a 'tea acre / ha' thus if its bush population is only 3000 / 7500 per acre/ ha?

[2] Mixed stand or exclusively seedlings – if so 'Old Seedlings [prior to WW11] or New Seedlings or 'Clonal Seedling' seed taken from cloned mother buses. OS were planted on the 'Up & Down' system and not planted on the contour. Hence its Bush Stand much lower than if planted on contour.

[3] Pure VP Block – if so mixed cultivars or separated into Clonal blocks. VP tea could yield at least 3 times more than OS tea; certain cultivars such as TRI 3000 & 4000 series are higher yielding and would thus produce more than some of the say, darker pigmented clones.

[4] The vibrancy / health of bushes overall – here soil moisture / shading [or lack of it] NPK inputs – ground / foliar; then degree / harshness of tipping / plucking impact on bush growth/yields. Today some estates have secured 3000 YPH mark; some languish at a paltry 700 kg/ha!

[5] In a typical 4-year pruning cycle did one attain the ‘Maximum Spreading Potential’ [MSP] of the bush by its 18 month post-pruning? Each bush must spread to its maximum spread within 18 months after pruning. This can be ensured by trained pluckers and close monitoring. In short – better the spread higher the number of potential plucking points on plucking table and thereby translates to higher yields. Dynamic & close supervision needed.

[6] Are all bushes ‘pluckable’ – here there are possible constraints – e.g. height, bushes tables covered with creepers, bushes located on too steep a terrain, bushes skiffed at ‘last plucking round’ to counter excess height etc. Unattainable heights mean un-plucked tea bushes. Period! Harvesting must be elevated to A1 priority in field supervision, always.

MONITORING OF QUANTUM PER PICK PER ROUND

There are countless areas of bush management, to say the least! However one glaring factor that supervisors miss out is to monitor the quantum per pick at each plucking round. The ‘totals’ of each round should not vary more that 5 to 8% plus or minus. If there are high variations per pick one could safely assume that only a part of the field is plucked but shown as totally plucked or some leaf is robbed by people of adjoining estates or worse illegal plucking under moon-light where such leaf is siphoned off to shady Green Leaf Collectors! Or simply ‘false’ plucking rounds! Plantations that display dramatic YPH drops display [or even attempt to hide!] these issues. ***Dyan Seneviratne***