

MECHANICAL HARVESTING

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Under Sri Lankan conditions, harvesting of tea is entirely by hand. In recent times, several estates have been strained to their utmost to find enough labour for plucking. This problem is aggravated especially during the heavy cropping periods; it is further complicated when plantations bordering villages have to depend partly on village labour who may not turn up for work regularly as they have to attend to other work in their own paddy or vegetable holdings. This causes problems to the management to maintain regular plucking rounds.

Plucking is the most labour intensive operation in the production of tea. About 640 labour days are required annually per hectare for harvesting clonal tea, while the labour used for all other field operations amount to 130 labour days per year. Mechanisation of plucking should therefore lead to a tremendous saving in labour on a plantation.

Mechanical harvesting was first tried out in Sri Lanka as far back as 1948 at Dickwella Estate, Hali-ela. The machine used was a "Tarpen Cropper" powered by a motor. In this trial, while no major yield differences were evident, a lower cost per pound of leaf was noted with the machine during a high cropping month but a higher cost in a low cropping month and no difference in the tasters' valuation of the made tea, except in appearance where hand plucked tea was superior.

In the 1960s shears and plucking machines were used in trials at Aislaby Estate, Bandarawela and at the TRI (St Coombs, Talawakele). In the St Coombs trial, the mower-type Ochai Tea Cutter gave an unsatisfactory harvest of leaf on high jat seed tea. Coarse leaf, stalk and cut leaves were included in the harvest, but when shears were used the standard of leaf was considerably improved though unwanted leaf was still present. The

increased yields obtained was due to the unwanted leaves and more time was spent in sorting out the leaves. It was concluded that made teas from machine and shear-harvested leaf were valued considerably less than hand-picked leaf. Following these trials both shears and plucking machines have been used on a limited scale on one or two estates. However, they have still not been adopted for use on a commercial scale in Sri Lanka. Due to the increasing labour wages and the scarcity of labour for harvesting leaf specially during heavy cropping seasons, interest in mechanical harvesting has been revived. Since 1979 we have been testing machines as well as shears at the Low-country Station, and at Hapugastenne and Noragalla State Plantations.

Plucking Machines

Plucking machines are capable of producing a very high output of leaf per unit time per labourer with a low requirement of labourers per hectare. In some countries e.g. Japan, USSR, the entire harvesting is mechanised.

The types of machines that were used in our experiments are described below:

<u>Model</u>	<u>Cutting width</u>	<u>Number of labourers</u>	<u>Power source</u>	<u>Cutting action</u>
1	30 cm	2	Portable Generator	Reciprocating teeth-(Hair clipper type)
2	30 cm	2	Portable Generator	Cylindrically arranged blades
3	30 cm	2	Engine(Knapsack)	Reciprocating teeth-(Hair clipper type)

4	100 cm	2	Engine(Knapsack)	Reciproca -ting teeth (Hair Clipper type)
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They are all of Japanese manufacture. Models 1 and 2 did not give a satisfactory performance.

With the large machine (Model 4), the outputs varied from 30 - 60 kg in different months, with an average output of 48.0 kg green leaf per hour. This is equivalent to an output of 16.0 kg/hr per labour, compared to 5.8 kg/plucker/hr for hand plucking i.e. the machine gave $2\frac{1}{2}$ - 3 times the output/labourer obtained with hand plucking. The coarse leaf content of machine harvested leaf was 20% by weight. This "coarse leaf" includes stalk, mature leaf pieces and coarse portions of overgrown shoots.

With regard to labour usage, it was found that the labour required per kg for harvesting with the machine was less than half the labour required for hand plucking. When the labour required for picking out coarse leaf was included, the labour requirement was 81% of the labour for hand plucking. The labour requirement would be further reduced with the plucking machine, as a result of the extended plucking rounds. This is due to removal of immature shoots or "arimbus" unselectively by the machine. In our trials the round was extended to 2 weeks compared with weekly hand plucking.

When the total cost of machine harvesting i.e. fixed cost, running cost (labour, fuel and maintenance) and cost of labour for picking out coarse leaf, was computed the cost per kg MT was only 62% of the cost of hand plucking. It must be noted that the effective wage for hand plucking used in this calculation, was much higher than the rate of Rs.30/= used for machine harvesting. This is due to the additional "overkilos" incentive payment for hand plucking.

Thus, machine harvesting would seem to be worthwhile both in terms of labour efficiency as well as cost.

However, there are several important limitations to the use of plucking machines. Firstly, the quality of harvested leaf is quite different to hand plucked leaf. Machine harvested leaf has 30% of cut pieces and 20% coarse leaf. If the coarse leaf is not properly separated out it will lead to a high percentage of refuse tea and off grades. Even if the coarse leaf is sorted out prior to manufacture, the presence of cut pieces could alter the grades obtained. Since the quality of teas is a primary consideration as far as Sri Lanka teas are concerned, the use of machines may pose a serious limitation.

Secondly, it will not be feasible to use the machine on very steep lands. Machines may be used successfully only on lands up to 25% slope. The presence of shade trees particularly dense low shade will also restrict the movement of the machine and operators.

Thirdly, we have observed that when machines are used there is a loss of crop of about 30%. This is due to both, harvesting of immature shoots as well as the deterioration of the efficiency of maintenance foliage as a result of damaging i.e. cutting, the mother leaves by the machine. This is a serious limitation, and needs further investigation. Continuous machine harvesting leads to the reduction in maintenance foliage, weakening of the bush and reduction in yield. Such bushes have a poorer appearance and do not recover well after pruning.

Thus, it is clear that plucking machines cannot completely replace the present system of hand plucking but they do have a potential within the limitations imposed by the terrain. By employing machine harvesting an increased output with the attendant benefit of ensuring timeliness is possible, and it is likely that the use of machines will be economically and practically feasible on the gently sloping and flat lands.

Hand Shears

Shears have the advantage that they could be used in any type of terrain. There is however an inverse relationship between the output, which depends on the speed of harvesting, and the quality of leaf. Where leaf with about 10% coarse leaf by weight was obtained, we found that the output/hour was generally lower than hand plucking. Over a period of 10 months, only in one month did the output/plucker exceed hand plucking.

Another problem with the shears is that there is a tendency to pluck hard, so that, after 6 - 9 months of shearing there was little maintenance foliage and flush production was reduced. In some cases the bushes had to be rested to bring back the plucking table to a normal condition.

Generally, there has been a loss in crop compared to hand plucking, and the losses ranged from 5% - 40% over a 6-month period in different experiments.

Although shears have not given good results in trials in the low country, it is being used (on a limited scale) in countries like India during the heavy cropping months. It is claimed that 2 - 3 times the normal outputs are obtained. However, continuous shear harvesting like continuous hard plucking will depress crop and affect bush health.

We would like to encourage plantations to use shears on their estates on a trial basis and assess their performance. Shears should be used only during the high cropping months — not continuously. Best results will be obtained on tea with a full cover, and tea with a high density of plucking points. It is important that whenever shears are used it should be done so as to enable meaningful comparisons with hand plucking.