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MANAGEMENT COMMITMENT TO TECHNOLOGY ADOPTION: A SUCCESS STORY ON INNOVATIVE TEA HARVESTING SYSTEM[1]

M. A. Wijeratne[1] , H. W. Shyamalie[2] and Hemantha Kahatapitiya[3]

Abstract

The worker shortage has been one of the causes for low productivity and quality of made tea. Plucking is the most commonly affected field practice due to worker shortage. Plucking rounds are extended and many fields are under-plucked when adequate number of pluckers is not available. Stripping and leaf damages are also common due to poor plucking practices as a result of worker shortage. All these factors can lead to high refuse tea content, poor quality of end product and narrow down the profit margin of estates. In order to reverse this situation it is essential to improve productivity (efficiency) of available workforce and improve quality of harvested leaf.

Appropriate mechanization of harvesting practices has been shown to be a viable solution to shortage of pluckers. The TRI Selective Tea Harvester and Innovative Tea Plucking Basket can be advantageously used for improving plucker productivity and minimize leaf damage during harvesting. The analysis of data collected from the Alton estate at Maskeliya region that uses more than 250 harvesters for about two years has proven the advantages of introducing the new harvesting system with appropriate management interventions.

The data showed that use of the TRI Selective Tea Harvester and Innovative Tea Plucking Basket has reduced below norm pluckers and improved plucking averages (intakes) thereby reducing plucking cost without affecting estate tea yield. The pay-back period of the harvester is worked out to be less than 20 days. Moreover, introduction of such an innovative tea harvesting system has increased monthly income of the estate workers and created a better working environment and recognition to the workers. This case study demonstrated that dedication of all concerned and management intervention are essential to implement new technologies successfully.

Introduction

Tea cultivation is a highly labour intensive operation. Plucking is known to be the most labour intensive field practice in mature tea that accounts for about 70% of the total labour use in the field. Therefore, worker shortage in the corporate sector tea plantations has been identified to be one of the main causes for low productivity and poor quality of the end product. Additionally, estates are also facing problems

[1]*Officer-in-Charge, TRI, Ratnapura Sub Station*
[2]*Head, Agric Economics Division, TRI*
[3]*Senior Manager, Alton Estate*

of poor plucking intakes (low labour productivity), under plucking (leaving pluckable shoots without being properly harvested), stripping and removal of "*arimbus*"(i.e. very small shoots to be taken at next rounds), physical leaf damages, high coarse leaf and high refuse tea contents. Such a scenario leads to high cost of production and poor prices either narrowing the profitability of tea estates or causing remarkable losses. Therefore, implementation of appropriate technologies that improve worker productivity and quality of the end product is need of the hour. However, introduction of new technologies to a workforce that has got used to a routine practice over many years in plantation agriculture such as pluckers is reported to be not a very easy task. The success of implementation of such technologies greatly depends on the skill, knowledge and attitudes of the workforce as well as the commitment of the supervisory and managerial staff.

Innovative tea harvesting system

The innovative tea harvesting system under consideration in this study includes TRI selective tea harvester and innovative plucking basket. The TRI selective tea harvester and innovative tea plucking basket have been introduced to the tea growers by the TRI with the objective of increasing worker productivity and quality of harvested leaf. The TRI selective tea harvester weighs about 325g and hence, is found to be very lighter in weight than the tea harvesting shears used in other tea growing countries weighing 1-1.5kg. The selective harvester is more maneuverable than the ordinary shears in any type of terrains as the former is lighter than the latter and the former has no prominent (long) handles. The selective harvester gives a better control to the user to move it over the plucking surface and pick shoots selectively without taking coarse leaf and *arimbus*. The plucker's hands are very close to the tea shoots, when the selective harvesters are used, and one hand always touches the plucking surface. As plucker feels the level of plucking surface, it helps maintaining the plucking table by preventing the shoots being plucked below the surface leaving *arimbus*. Use of shears avoids physical damage due to crushing and bruising by hands especially, when succulent shoots are stripped (*stripping*) and large number of shoots is held by hand before throwing to basket whilst manual plucking.

Use of shears is more efficient when a proper basket is used for shoot collection. Although, it was a routine practice in the past to use bamboo/cane baskets while plucking, it has now become extinct or rare. Lack of availability, less durability and some difficulties faced by pluckers to move in tea fields carrying such heavy and bulky baskets have been attributable to poor usage of such baskets. Taking these factors into consideration, the TRI has introduced a novel tea plucking basket with a cap that weighs about 600g. This basket is made with a PVC frame and a cloth sack. It has an impressive appearance and does not entangle with tea bushes. The plucker can wear the basket and put the harvested shoots into it very conveniently. It also last longer than conventional bamboo baskets.

The Case study

The Alton estate, Upcot has been using the TRI selective tea harvesters and innovative tea plucking baskets for more than two years since 2009. The tea extent being shear harvested was 233.9ha comprising of 59.9ha of VP tea and 76.25ha of seedling tea which accounts for 58% of the total tea extent of the estate. The shear harvesting was first introduced in the latter part of 2009 with 15 harvesters and the estate workers were trained by the TRI staff for proper use of shears. The estate supplied new baskets to the workers and special incentives were offered during early stages of introduction of the new plucking system. With proper supervision of the field staff, it was able to improve labour productivity and leaf standard of workers using the harvesters. Seeing the benefits of using harvesters, other workers also volunteered for shear harvesting and as a result the number of workers using shears increased to about 270 by 2011. Later, the workers were also given overall/jackets and some were using hand gloves too. Productivity (land & labour), labour use, cost and tea prices were extracted from estate records from 2009-2011 for seedling and VP tea separately for the purpose of comparison in this study.

Benefits of adopting innovative harvesting system

a). Reduction of below-norm pluckers

A high % of below-norm pluckers (workers bringing less quantity of leaf than stipulated quantity or norm) has been identified to be one of the main causes for high cost of plucking of an estate. Table 1 shows the impact of below-norm pluckers on the cost of plucking. Accordingly, requirement of pluckers and cost of plucking can be remarkable reduced by reducing the percentage of below-norm pluckers in an estate.

The data collected from the Alton estate (Table 2a & b) have shown that the % of pluckers with very poor plucking averages has been largely reduced with the introduction of shears to the tea fields. In contrast, the % of pluckers bringing high plucking intake has been remarkably increased.

Table 1: Impact of below-norm pluckers on cost of plucking

Below-norm pluckers	**Pluckers (No/ha/yr)**	**Plucking Cost (Rs/kg, Made tea)**	**Saving (Rs/kg)**
With 30% below-norm pluckers	517	163.81	-
Reduce below-norm pluckers by 10 %	511	162.09	1.72
Reduce below-norm pluckers by 20 %	506	160.66	3.15
Reduce below-norm pluckers by 30 %	502	159.52	4.29
Reduce below-norm pluckers by 40 %	497	158.09	5.72

Table 2a: Percentage of pluckers at various productivity (intake) levels-Seedling tea

Year	Above 16 kg	14-16kg	11-13kg	Below 10kg
2011 (Up to August)	50.38	39.55	3.92	6.14
2010	16.78	22.11	16.24	44.87
2009	17.12	17.33	15.77	49.78
2008	18.48	19.79	13.29	48.44
2007	15.92	10.57	11.84	61.67
2006	18.72	9.76	15.84	55.68

Table 2b: Percentage of pluckers at various productivity (intake) levels-VP tea

Year	Above 16 kg	14-16kg	11-13kg	Below 10kg
2011 (Up to August)	59.83	33.52	4.19	2.46
2010	28.90	26.18	15.87	29.05
2009	23.23	20.31	16.10	40.36
2008	31.74	19.24	14.04	34.97
2007	35.94	12.97	13.43	37.65
2006	39.71	11.05	16.81	32.43

b). Increase in plucking intake

The average productivity of workers using selective harvesters is about 20-26 kg/day for VP tea compared with 16-20 kg/day for manual plucking. In the case of seedling tea, the output of the harvester has been in the range of 15-18 kg/day. It is clear with the data presented in the Table 3 that increase in plucking intake reduces the cost of plucking by an appreciable amount. Increase in plucking intake by about 5 kg/manday reduces plucking cost by about 15 Rs/kg in high yielding VP tea and by 29 Rs/kg in low yielding seedling tea where the intakes are usually low. Estate records showed that estate average plucking intake has gone up from 13.8kg/ manday to 17.3 kg/manday after introducing selective tea harvesters.

Table 3: Impact of plucking intake on cost of plucking (difference between the plucking cost at present intake and improved intake are given in parenthesis as Rs/kg)

	Plucking cost (Rs/kg MT)							
Type	**Present Plucker Intake kg/day**	**At Present intake**	**Intake increase by 0.5kg**	**Intake increase by 1kg**	**Intake increase by 2kg**	**Intake increase by 3kg**	**Intake increase by 4kg**	**Intake increase by 5kg**
VP	**18**	**164**	**162 (2)**	**160 (4)**	**157 (7)**	**154 (10)**	**151 (13)**	**149 (15)**
Seedling	**14**	**222**	**218 (4)**	**214 (8)**	**208 (14)**	**202 (20)**	**197 (25)**	**193 (29)**

c). Labour requirement for plucking

The labour requirement for plucking is low with selective tea harvesters compared with manual plucking. Plucking round vary from field to field depending on plucking technique, field conditions and whether they are planted with seedling or VP tea. Hence, monthly labour use for plucking was compared. The estate data have shown that labour requirement for shear harvesting in VP tea fields varied from 32-36 workers/ha/month as against 42-46 workers/ha//month for manual plucking. In the case of seedling tea fields, it varied from 18-32 workers/ha/month (all seedling tea fields were under shear harvesting and hence, no comparison was possible between manual & shear harvesting).

Overall performance of the estate

Collected data highlighted that overall estate yield has been increased after introducing the selective harvesters. In VP tea fields, the average yield increased from 1715 kg/ha/yr to 1910 kg/ha/yr and that in seedling tea fields increased from 1096 kg/ha/yr to 1151 kg/ha/yr within a period of one year. This shows that introduction of appropriate mechanical harvesting method such as use of selective tea harvesters does not adversely affect tea yields, but gives an opportunity to improve the estate crop. The ability for timely harvesting of all tea fields without undue extension of plucking rounds could be the main reason for high yield with the new plucking system. Data analysis revealed that the cost of plucking in 2010 has gone up by 40% as compared with that in 2009 in other estates in the region due to revision of labour wages. However, the Alton estate has been able to control plucking cost with an increase of 21% only for the same period due to shear harvesting. The cost of production has been reduced from 372 Rs/kg to 345 Rs/kg after introducing selective tea harvesters when other estates in the region have recorded an increase of cost of production during the same period (from 2009 & 2010). Similarly, the Alton estate have recorded a higher NSA (Net Sale Average) after introducing shears (i.e. 366.71 Rs/kg and 374.31 Rs/kg before and after introducing tea harvesters) when other estates in the region have recorded a decline in the NSA over the same period under consideration. This could be attributable to improved leaf standard under shear harvesting. Further, the estate has been able to improve worker productivity from 381 kg/worker/yr to 426 kg/worker/yr within a period of one year after introduction of selective harvesters. These overall benefits have turned a loss making property into profits. The analysis given below shows that the pay-back period of the selective harvester was less than 20 days.

Plucking average	-	VP (manual)	=	18 kg/worker
		(shears)	=	23 kg/worker
Cost including over kilos		(manual)	=	Rs. 610
		(shears)	=	Rs. 705

Rs/kg green leaf	(manual)	=	Rs. 33.88
	(shears)	=	Rs. 30.65
Savings with shears		=	Rs. 3.23 /kg GL

Amount of GL required to cover cost of shear = 421kg

No. of days required to pluck 421 kg = 18 days

Pay-back period = 18 days

Comparing the probable plucking cost (i.e without harvesters being used & 40% increase in plucking cost in 2010 in comparison with that in 2009 as observed in other estates in the region), i.e 202.88 Rs/kg with actual plucking cost in 2010 i.e. 176.29 Rs/kg, it was estimated that the estate has been able to save 26.59 Rs/kg of made tea only from plucking. (Plucking cost of Alton estate in 2009 was 144.92 Rs/kg). When the total estate production was considered the savings from plucking has been estimated to be about Rs.10 million/yr while the cost of introducing innovative harvesting system (selective harvester, baskets, overalls/jackets etc) was about Rs. one million.

Management commitment

The introduction of a new harvesting system needs greater commitment by all involved in the estate system. Contribution of the managerial as well as field staff is essential for successful continuation of the new programme. Such a dedication is necessary to change attitude of workers, training of workers, allow adequate time for training, select suitable fields, provision of required equipments and other ancillary needs (overalls/jackets etc) without a delay. effect repairs to equipments as necessary and give benefits to the users of harvesters. The workers should be frequently educated about benefits that they can enjoy once the system is successfully implemented, such as greater earnings leading to better living standards, improved working environment, social recognition and job satisfaction. Such steps are very essential at the beginning of the introduction of new technologies. Record keeping and periodic review of the progress are also necessary for strategic planning of further improvement and rectification of any failures in the field. The selective tea harvester is manually operated and hence, its output largely depends on the skill and efficiency of the user. Additionally, terrain, yield potential, level of inputs such as fertilizers, cultivar and stage in the pruning cycle (height of the bush) can also pose some limitations for high output. Therefore, output and the benefits may vary from field to field and from estate to estate. Depending on the *in situ* experience, one can select best techniques, fields, workers, seasons etc for shear harvesting. One should also understand that such technologies may take some time to produce expected results. The tangible benefits are usually seen when a fair extent of tea fields (> 25%) are harvested using selective harvesters as proven by the Alton estate. In order to harness the full benefits of the innovating tea harvesting system, it is also necessary to transport tea leaf harvested by selective harvesters to the factory carefully without physical damages during transport.

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