



COMPARATIVE STUDY ON SHEAR VERSUS HAND PLUCKING OF UP-COUNTRY TEA

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A better-quality made tea relies on the plucking standard, and the aim of maintaining an optimum plucking standard is to obtain an economic yield, produce high-quality tea, and keep the tea bushes in good health. Currently, the Sri Lankan tea industry encounters low productivity, high production costs, and a declining workforce. The cost of harvesting bears a significant share of the total production cost. Therefore, the tea industry should be supported with cost-effective methods of harvesting. The purpose of this research was to investigate an alternative technique for tea harvesting that is suitable for use in the upcountry, rugged terrain. A comparative assessment was conducted in Fields 02 and 12B of Glentilt Estate, each covering 0.25 hectares and comprising approximately 3,125 KO145 tea bushes. Data collected over seven rounds of hand plucking and four rounds of shear plucking, focusing on plucking rate, plucking average, and leaf standard. An interviewer-administered survey was also conducted among pluckers, field officers, and manufacturing staff to capture perceptions of shear plucking. Results indicate no significant difference ($p < 0.05$) in leaf standard between the two methods. However, shear plucking demonstrated a significantly higher plucking rate (6.4 ± 0.3 kg/h) and plucking average (31.9 ± 1.6 kg/day) compared to hand plucking (4.2 ± 0.2 kg/h and 21.1 ± 0.8 kg/day, respectively). According to the survey, field officers, manufacturing staff, and hand pluckers prefer shear plucking due to its high efficiency, reduce refuse and higher made tea. Based on the findings, shear plucking can be suggested as a suitable alternative to conventional methods. However, further studies are recommended to validate these results and establish a more definitive recommendation.

Keywords: tea industry, hand plucking, shear plucking, plucking standard, leaf standard, plucking average, plucking rate

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INTRODUCTION

The tea industry in Sri Lanka is currently facing major challenges such as low productivity, rising production costs and a declining workforce (Bore, 2009). Among field operations, plucking plays a vital role in determining the quality and quantity of made tea. About 67% of the field workforce in tea plantations is involved in this activity (Shankar, 2003). Maintaining proper plucking standards is essential for achieving economic yields, ensuring high quality of tea and promoting bush health (Seneviratne, 2017). This study investigates an alternative tea harvesting technique suitable for the steep terrain of the up-country. The research compares a newly introduced selective shear method with traditional manual plucking by assessing leaf standard, plucking rate, and plucking average.

METHODOLOGY

Best field identification

Two fields were selected based on descending order rankings using yield book records from January to December 2022. The selection criteria included total crop harvested (kg), yield per hectare (kg/ha), and the number of plucking rounds conducted during the year. Based on the evaluation of these parameters, Fields 12B and 02 were identified as the most suitable for the study due to their superior performance.

Sampling and data collection

Field covered an area of 0.25 hectares and consisted of approximately 3,125 tea bushes. The tea plants were established through vegetative propagation and were in their second year of growth at the time of the study. The clone used for this experiment was KO145.

Evaluation of leaf standard

Five samples, each of hand-plucked and shear-plucked leaves, were collected at the weighing point, totalling 10 samples. Then, two bulk samples were prepared separately for hand-plucked and shear-plucked leaves. From each bulk sample, three sub-samples of 100g each were taken, resulting in six samples in total (three per plucking method). Each 100g sample was sorted into the following categories:

- **Best Leaf (BL):** Immature, undamaged leaves and tender shoot buds



- **Below Best Leaf (BBL):** Immature but physically damaged leaves and tender shoots
- **Poor Leaf (PL):** Mature, coarse leaves and single mature leaves

All samples were weighed using an electronic top-loading balance (TS 200, China), and the weights were recorded. The percentage of each leaf category was calculated and the average percentage of BL, BBL, and PL was recorded for both plucking methods.

Evaluation of plucking rate and plucking average

Fields No. 02 and 12B were divided for hand and shear plucking. Each section was harvested by 5 pluckers per method using a timer. Plucking was done for 1 hour and repeated three times to calculate the average plucking rate (kg/h) using the formula:

$$\text{Plucking Rate (kg/h)} = \text{Weight of Plucked Leaf} / \text{Time Duration}$$

Plucking average (kg/head) was calculated based on a 5-hour workday using:

$$\text{Plucking Average (kg/head)} = \text{Total Green Leaf Harvested} / \text{Number of Pluckers}$$

Data were collected over 7 hand plucking rounds and 4 shear plucking rounds.

Questionnaire survey

Four sets of self-administered questionnaires were distributed among shear pluckers, hand pluckers, field officers, and factory staff to gather their perceptions and feedback on various aspects related to the two plucking methods.

Data analysis

Data were analyzed using a statistical analysis software (SAS/Excel).

RESULTS AND DISCUSSION

Analysis of self-administered questionnaire

Summary of positive responses to the questionnaire survey is shown in Figure 1. According to that, there is a multifaceted perspective on plucking methods among different stakeholders. While hand pluckers expressed comfort with the traditional hand plucking method, many also showed interest in adopting shear plucking. Field officers, representing both managerial and processing perspectives, reported satisfaction with the quality of leaves harvested through shear plucking and viewed it as a more efficient approach overall.

Factory workers involved in tea processing also acknowledged the advantages of shear plucking. They noted a reduction in the quantity of refused tea and an increase in the percentage of tea made, indicating improvements in both quality and efficiency.

Shear pluckers themselves, despite recognizing some ergonomic challenges associated with the method, generally preferred shear plucking due to its efficiency. However, they expressed dissatisfaction with the extended interval between



successive plucking rounds, which they felt negatively affected their workflow and satisfaction.

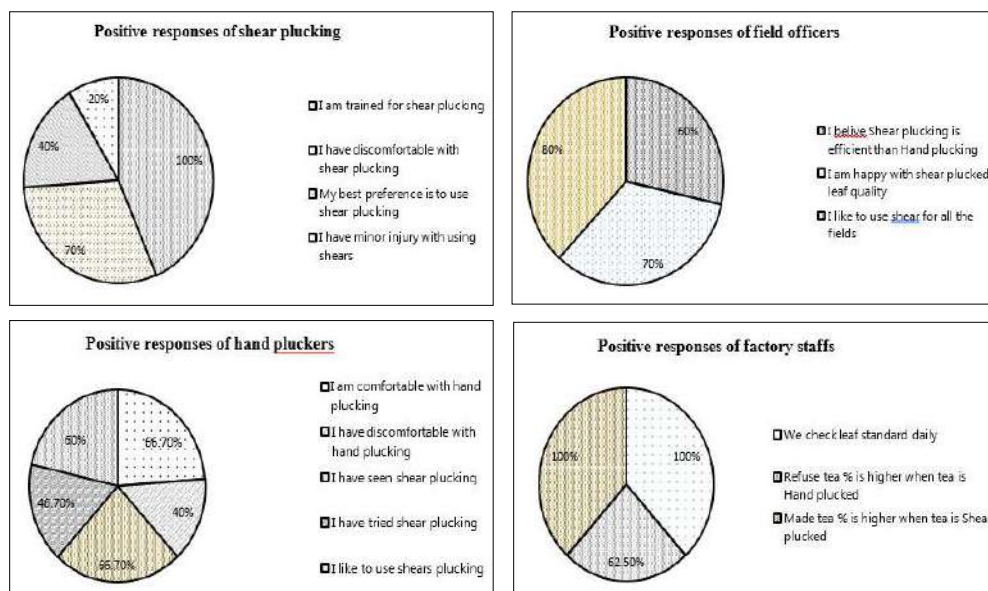


Figure 1: Summary of positive responses of questionnaire survey

Evaluation of leaf standard

Leaf standard, a key determinant of made tea quality was assessed under three categories: Best Leaf (BL), Below Best Leaf (BBL), and Poor Leaf (PL). Figure 2 illustrates the percentage distribution of these categories for both hand and shear plucking in Field No.02 and 12B. Statistical analysis revealed no significant difference ($P < 0.05$) in leaf standard between the two plucking methods. As the quality remains consistent, shear plucking is considered a viable and preferable alternative especially in challenging terrain.

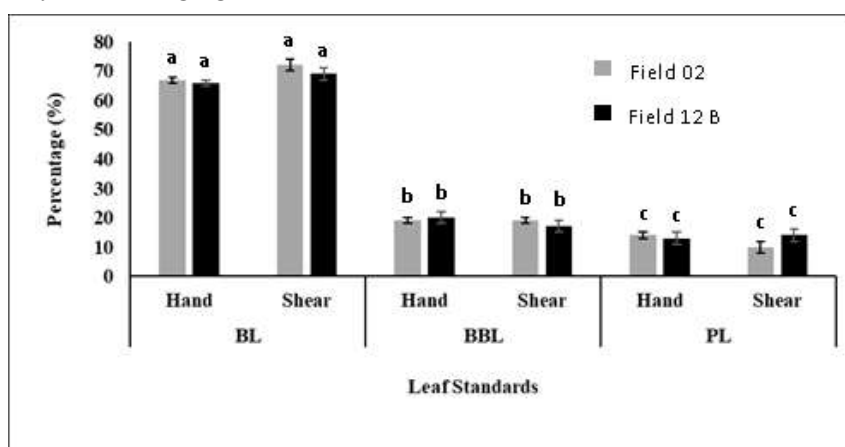


Figure 2: Leaf standard



Comparison of plucking rate

A significant difference ($P < 0.05$) was observed between hand plucking (4.2 ± 0.2 kg/h) and shear plucking (6.4 ± 0.3 kg/h) in both Field No. 02 and 12B, as shown in the Figure 3. Shear plucking consistently demonstrated higher plucking rates, indicating improved productivity. This enhanced efficiency suggests potential labour cost savings, which is particularly important for labour-intensive sectors like tea cultivation, where harvesting practices directly influence economic sustainability.

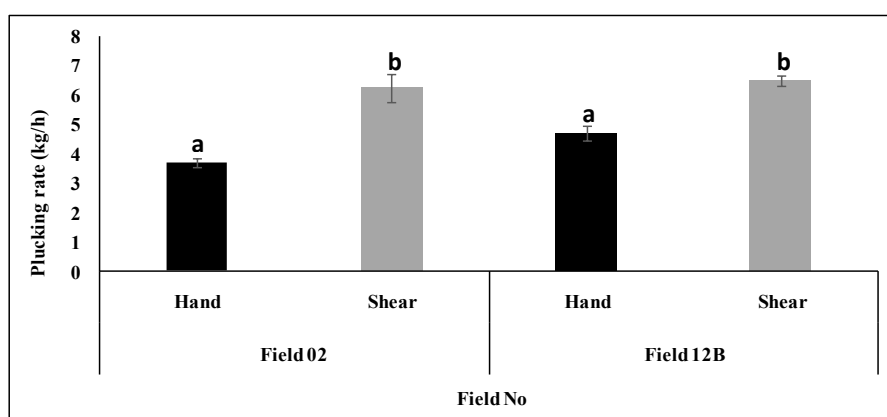


Figure 3: Plucking rate

Comparison of plucking average per worker

The evaluation of the plucking average per worker, calculated based on the daily total of harvested tea leaves revealed a significant difference ($P < 0.05$) between hand plucking and shear plucking methods in both Field No. 02 and 12B (Figure 4). Workers using plucking shears recorded a significantly higher average (31.9 ± 1.6 kg/day) compared to those using hand plucking (21.1 ± 0.8 kg/day). This clearly highlights the efficiency and productivity benefits of shear plucking.

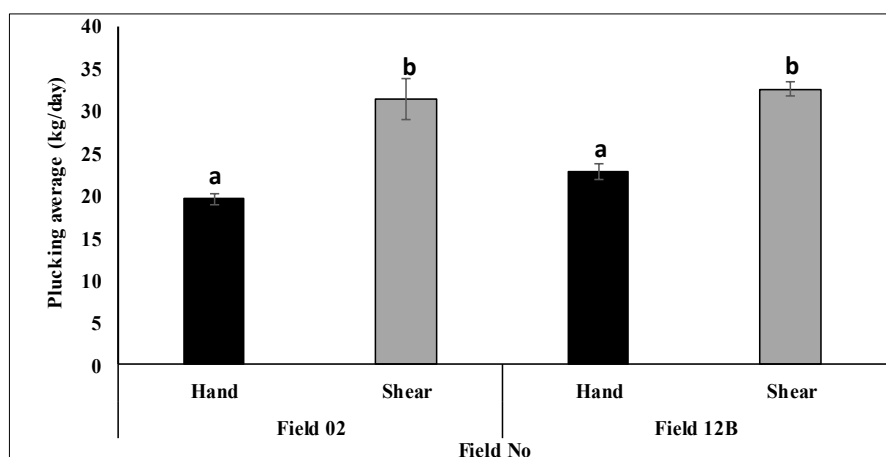


Figure 4: Plucking average



CONCLUSIONS/RECOMMENDATIONS

The comparative analysis of hand plucking and shear plucking revealed several significant findings. While the leaf standard of shear-plucked tea was not significantly different ($P < 0.05$) from that of hand-plucked tea, the plucking rate was markedly higher with shears (6.4 ± 0.3 kg/h) compared to hand plucking (4.2 ± 0.2 kg/h). Similarly, a significant difference was observed in the daily plucking average, with shear pluckers harvesting 31.9 ± 1.6 kg/day versus 21.1 ± 0.8 kg/day for hand pluckers. These results support the promoted adoption of shear plucking, particularly in upcountry regions with difficult terrain where labour efficiency is essential.

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