Brewing Innovations
1925 | TRI | 2025

How well mechanized harvesting fits into the present-day context

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Present-Day Context

Worker shortage

Trying out different approaches to overcome worker shortages

Impact to yield

high cost of production

Mechanized Harvesting (MH)as an option

What would be the leaf standard

Demand for awareness and training on MH

Plantations community reaction

Background of the research context

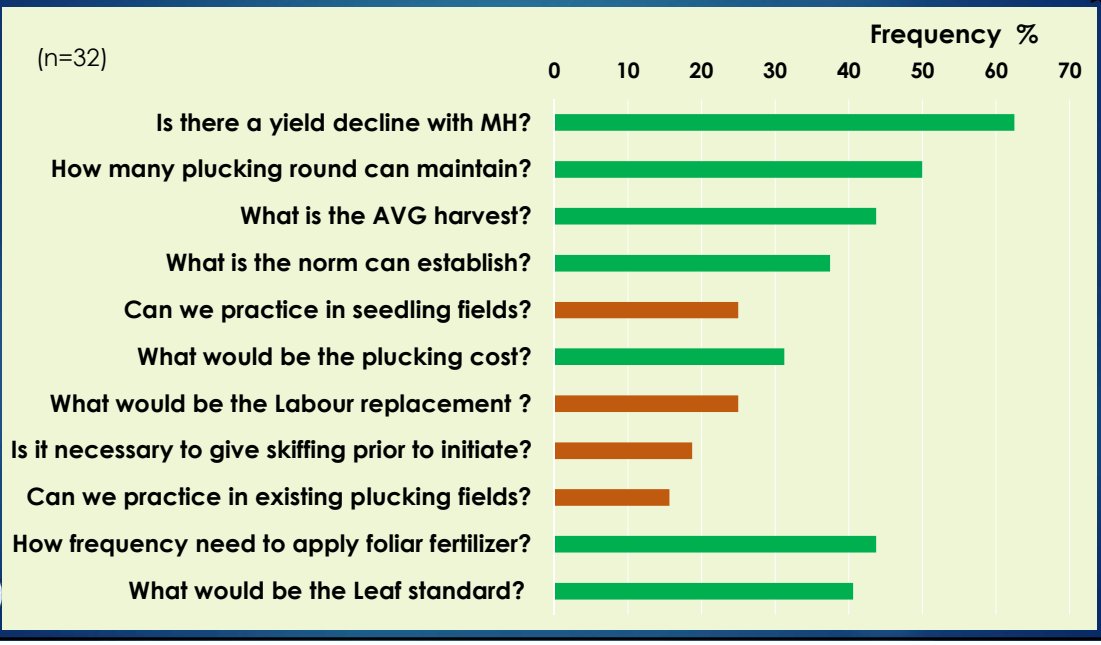
Growing demand for training and evaluation on mechanized harvesting in the tea sector

Questions arising at trainings

Identifying the area for research



Questions came out in trainings



Aim of the Research

To explore

- unclear area of MH
- How fit MH under the present context
- Appropriate methods for better practice of MH

- Research method: Cross-sectional multiple case study
- Type of data collected: Quantitative, qualitative data, and secondary data
- Population: MH users of the corporate sector Tea plantations
- Data analysis: Descriptive and content analysis

Tool used:
Semi-structured Interview guide
Collecting Secondary data
Field observations

- AVG plucking round
- Norm
- AVG harvest
- Yield
- plucking cost
- Leaf standard
- Foliar fertilizer application

Managers', field officers', and operators' views.

Basic information of plantations

	Plantation A	Plantation B	Plantation C	Plantation D	Plantation E
Location	Upcountry	Upcountry	Uva	Up country	Up country
Extent/ha	230	408	364	319	377
VP	230	204	182	171	311
Seedling	-	204	182	148	66
Machine type used	Fuel powered	Battery powered	Fuel powered	battery powered	Battery powered
Mechanized extent (motorized)	24%	45%	7%	18%	65%

Types of harvesting machine used in the tea sector

Battery powered machines

Blade length 12 inches

Clip-on type and Backpack battery

Brushless motors







(n=3)

Fuel-powered machines

Blade length 24 inches and 46 inches

Two-stroke petrol engines





(n=2)

Findings related to first objective

A Operators Average harvest

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
55kg	44kg	52kg	48kg	55kg
Average : Approximately **49 kg** **(Site B, D & E)**				





49 kgs (Maximum 90kg & minimum 35kg)

110 kgs (55x2) (Sampath & Mahinda, 2024)

B Average Norm

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
40 kg	40kg	40kg	30kg	35kg
Average: Approximately **35kg** **(Site B, D & E)**				

35 kg

80 kg (40x2) (Sampath & Mahinda, 2024)

Findings related to first objective

C Average plucking rounds

Results of secondary data				
Site A	Site B	Site C	Sit D	Site E
2	2.5	1.5 - 2	2 -2.5	2.5
Average: **2** - **2.5** rounds/month (B, D & E)				



02 -2.5 rounds/month



1.5 -2 rounds
(Sampath & Mahinda, 2024)

D Can we practice MH in seedling tea?

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
-	✓	-	✓	✓

- Managers' response: 60% (Yes)

Achievable plucking round = **2**
(confirmed by secondary data)

E What would be the plucking cost?

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
Rs230	Rs 180	Rs 190	Rs 250	223
Rs **214**				

▶ Rs **214** (Range: Rs 180- 250)
(for a one kg of made tea)

F What would be the Labour replacement with MH?

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
2	2	2	2	2
Average: **2:1**				

▶ 100% increase of Labour Efficiency
(When set norm as 40 kgs)

G Is it necessary to do skiffing(trimming) prior to initiating?

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
-	×	-	×	×
(BP machine users: B, D & E)				

- Managers response: 60% (Not necessarily)

(Not necessarily for a battery-powered machine)

H Can we practice in existing plucking fields while doing manual harvesting?

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
✓	✓	-	✓	✓

- Managers' response: 80% (Yes)
- Possible to practice MH in existing plucking fields
- **Researchers observation**: Ability to minimize the removal of *arimbu* through smoothly handling machine

I How frequent to apply foliar fertilizer?

Results of secondary data				
Site A	Site B	Site C	Site D	Site E
1-2	1	1	1	1
(one round per month)				

Managers response: 100%

(one round per month)

J Possibility of maintaining Leaf standard

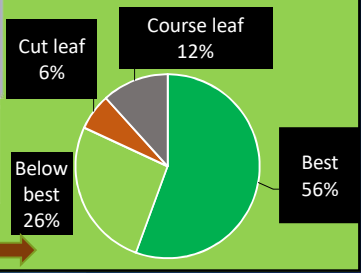
Results of secondary data				
Site A	Site B	Site C	Site D	Site E
✓	✓	-	✓	✓
Managers response : 80% (Yes)				



Leaf standard: Over 60%



Leaf standard: 45- 55%

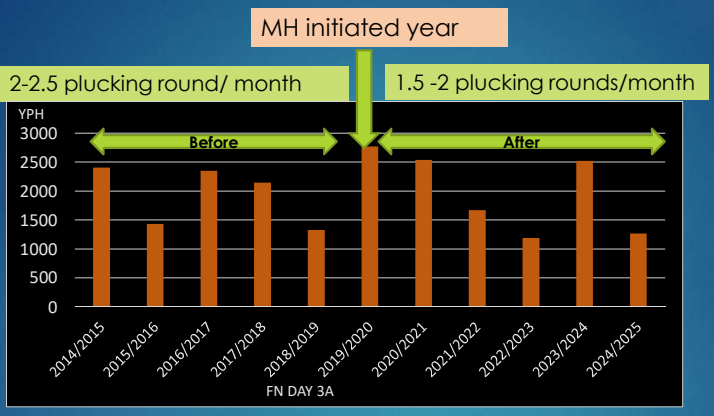


Results of Leaf standard assessment done in up country (2026)

Is there a yield decline with MH ?

Yield after MH- VP fields

Site A



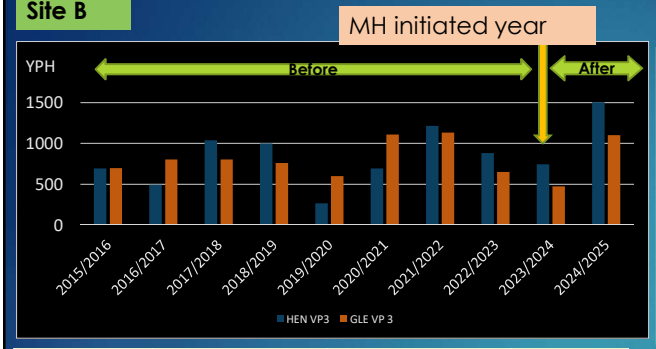
	Pre-mechanized mean (YPH)	Post-mechanized mean (YPH)	Difference
Field N3A	1930.0	1990	60

Location: Upcountry
Machine type used: Fuel powered machine
Average plucking round: 1.5- 02 / month
Duration of MH practice: 5 years

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Yield after MH- VP fields

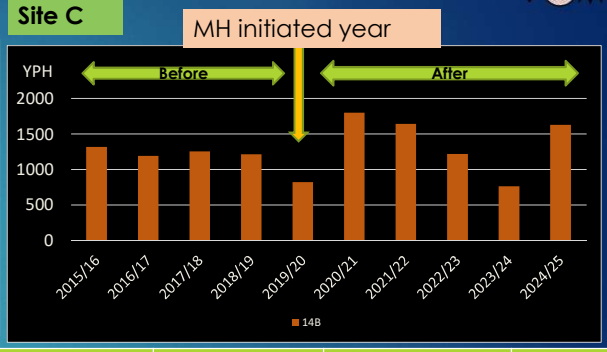
Site B



Field No	Pre-mechanized mean (YPH)	Post-mechanized mean (YPH)	Difference
HEN VP 3A	781	1185	404
GLE VP 3	817	882	65

Location: Upcountry -VP
Machine type used: Battery-powered machine
Average plucking round: 02/ month
Duration of MH practice: 1 ½ years

Site C



Field No	Pre-mechanized mean (YPH)	Post-mechanized mean (YPH)	Difference
HAP N3A	1240	1407	167

Location: UVA- VP
Machine type used: Fuel powered machine (2 operators +1 helper)
Average plucking round: 1.5 - 02/ month
Duration of MH practice: 6 years

Exploring an appropriate method for better practice of MH



Skill develop.....



Common methods of operating machines - new users (at red wood level)

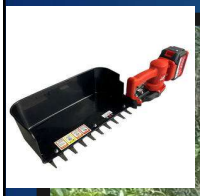


Careful operation of machines at green wood level



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Operating the machine in a somewhat selective manner

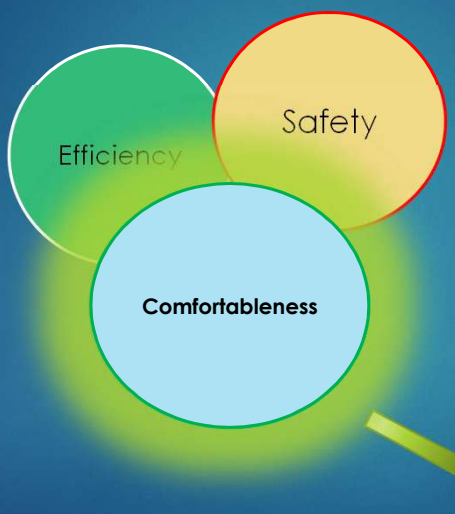




Adaptability of MH under the present-day context

- Adaptability to Management → Findings confirmed ability to address WS
- Technological Adaptability → Findings confirmed user friendliness of BPM
- Adaptability to Crop → Findings confirmed that ability to practice MH concerning bush health
- Adaptability to terrains → Observations confirmed the ability operate BPM even in different terrains
- Adaptability to Employees → Workers are able to achieve satisfactory monthly income (favorable attitude)

Ergonomics of Mechanized Tea Harvesting



Issues related to machine operators

Operators concern - Ergonomic aspects of machine operation

Item	Response of the randomly selected operators (n=23)
Pain: Shoulder, arm strain, Back pain	72%
Weight of the Blade assembly too much	21%
Difficulty in operating the right-hand machine by left-handed people	9%
Noise	-
Researchers Observations	**Justifications**
Necessity of emergency Stop (power cut)switches	For the safety concern
Frequent power cable disconnection	Affecting to operation
Variation of weight of the blade assembly depend on the models	Variation: 1.1- 2.2 kg
Variation of Weight of the battery depend on the models	Backpack battery: 2.2 kg - 4 kg Clip-on type battery : less than 850g
Necessity of convenient handle to grip	To reduce slipping action

Right-handed to left-handed ratio: 9:1



Converted machine (Modified machine)

Machines maintenance

Brushless (BLDC-type) machine:

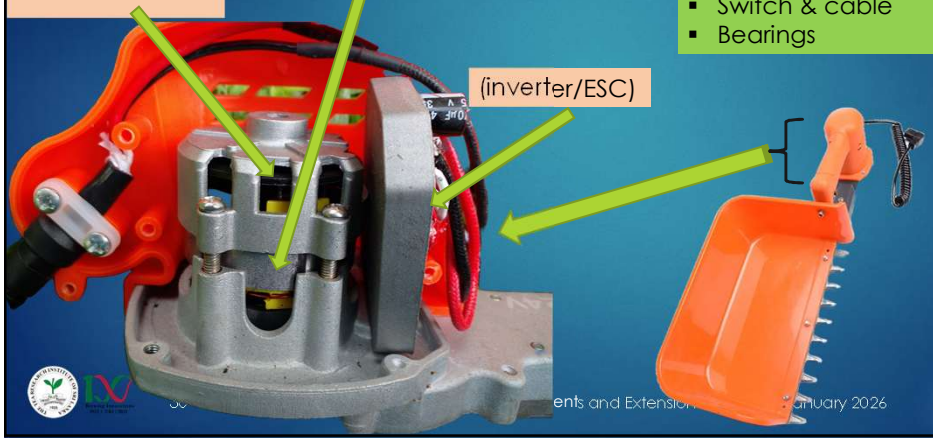
- no brushes to wear out
- Very Less maintenance
- Higher efficiency / energy saving
- Less heat-up
- Balanced weight distribution

Rotor: Rotating part

Stator: Fixed part of the motor.

(inverter/ESC)

Frequently defective parts
- Switch & cable
- Bearings

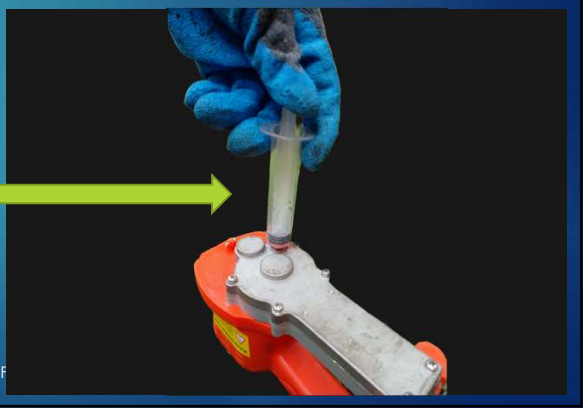


Machines maintenance

Contd.

- Timely lubricating (Gear box and blade assembly)
- Operating the machine in heavy rain may cause damage
- Properly charging the battery even not in use

lubricating



Summary of findings

Items	Results
Average plucking round with battery powered machines	2 -2.5 rounds /month
Average norm with battery powered machines	35 kg
Average harvest with battery powered machines	49kg
Majority use machine	Battery powered machines
Harvesting Cost (for one kg of made tea)	Rs 214
Labour replacement with MH	2:1
Skiffing prior to initiate MH with battery powered machines	Not necessarily
Ability to manage WS	Double norm
Ability to practice MH with manual harvesting	Alternate manner
Foliar application	One round per month
Leaf standard	Acceptable range (over 60%)
Yield decline compare to extended manual harvesting	No detected
User-friendliness	Weight of the blade assembly is not user-friendly
Ergonomic context	Shoulder pain

Conclusions

- Battery-powered machines (BPM) appear as user-friendly (Green technology)
- An acceptable leaf standard can be achieved through proper handling machines
- The necessity of operators' skill development for better practice (with the certification system-NVQSL)
- The necessity of timely monitoring of operators by field staff
- Ability to operators to gain benefits through MH
- Necessity of timely ground and foliar fertilization
- BPM can effectively practice comparably with manual Harvesting with Extended rounds
- Ability to maintain the revenue extent
- Ability to reduce the cost of harvesting
- With heavy machines severe impact to the tea bush
- MH can be used to manage revenue while prioritizing manual harvesting in high-yielding fields

Take-home message

MH could be used to manage revenue while giving priority for manual harvesting in high-yielding fields

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