



Performance of Mechanical Reaper for Ragi (*Eleusine coracana* L.) Harvesting

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ABSTRACT

A study on Front line demonstration of power tiller mounted mechanical reaper was conducted at farmers' field in Magadi taluk of Ramanagar district by Krishi Vigyan Kendra (KVK), Ramanagara. Demonstrations were carried out at 25 farmers field covering an area of 11 há during kharif 2013-14 and 2014-15 seasons. The Results of the study showed that harvesting of ragi using reaper had reduced time of operation by 72 per cent, total labour dependency by 92 per cent and cost of cultivation by 81 per cent as compared to manual operation. Field capacity of ragi reaper was found to be 0.23 ha/hr in comparison to manual operation. This demonstration helped the farmers in creating awareness and inculcating the knowledge of the mechanization, which in turn help them to get more returns. Farmer opined that mechanical reaper was easy to operate, can reduce drudgery and overcomes labour scarcity during crucial stage of operation.

Key words: Demonstration, Field capacity, Labour, Mechanization, Ragi reaper,

INTRODUCTION

Mechanization plays an important role to carry out timely operation, reducing labour and drudgery in agriculture. Ramanagara district is predominantly oriented with ragi (*Eleusine coracana* L.) crop covering an area of 62326 ha. One of the important operations in ragi cultivation is harvesting. This operation is carried using locally available sickle which is time consuming and needs more number of labours per unit area. Non-availability of labour during peak periods also accounts for more expenditure. Majority of the farmers come under small and marginal category. These fragmented lands have lower productivity due to the inadequate operation and merger use of the precise farm machineries (Srivastava, 2004). The timeliness of operations has assumed greater significant in obtaining optimal yields from different crops, which is possible by way of mechanization.

Reaper harvesters on the other hand are other alternative for harvesting purpose, provided straw is considered as economic by-product for animal feed and/or industrial applications. Therefore, KVK,

Ramanagara demonstrated use of ragi reaper with the objective to evaluate its field performance over conventional method of harvesting and compare the cost of operation.

MATERIALS AND METHODS

Front line demonstrations were carried out at 25 farmers' field covering 11 ha in villages namely Dhonehalli, Gollaratti, Srigiripur of Magadi taluk of Ramanagara district. Reaper cum harvester was hired from custom hiring centre and harvesting was carried out consecutively for two years 2013-14 and 2014-15. In addition to that, awareness about the importance of mechanization was also created through various extension activities like on campus and off campus training programmes, demonstrations, group discussions, literatures and other extension activities. Harvesting of ragi using labourers was studied in comparison to mechanized harvesting of ragi using ragi reaper. Data regarding time and cost of operation, labour charges and number of labourers required in harvesting were recorded.

Field evaluation

The specification of the mechanical reaper has been given in Table 1.

Table 1. Technical specifications of Ragi reaper.

Sr. No	Particular	Specification
1	Width of cut (m)	1.0
2	Row spacing (m)	0.3
3	Number of blades	24
4	No. of persons required for operation	1
5	Forward Speed of travel (km/hr)	2.20
6	Width of machine (m)	1.45
7	Length of machine (m)	2.40
8	Height of machine (m)	0.87
9	Weight of machine (kg)	120
10	Power source	Petrol engine, 5 H.P
11	Cost of the machine (Rs)	1,07,000/-

To evaluate the efficacy of the reaper, following performance criteria were considered.

- Field capacity of the machine
- Field efficiency of the machine
- Harvesting losses
- Savings in labour, time and cost of operation over conventional method of harvesting.

Actual Field capacity

Field capacity is the actual area covered by the machine or implement under actual time usually expressed in ha/hr. It is the quantum of work turned out by the machine. Field capacity should be the maximum with least effort for minimizing field losses.

$$\text{Actual Field capacity (ha/hr)} = \frac{\text{Actual area covered, ha}}{\text{Time taken, hr}}$$

Theoretical Field capacity

Theoretical field capacity was calculated based on the forwarded speed and the width of the equipment. It was calculated as

$$\text{Theoretical field capacity} = \frac{W \times S}{10}$$

Where, W = Width of the implement, m and S = Speed of operation (km/hr).

Field efficiency

The field efficiency of the machine indicates the efficacy of the machine and operator, in reducing the time taken in turning and stoppage for adjustments.

$$\text{Field efficiency (\%)} = \frac{\text{Actual field capacity (ha/hr)}}{\text{Theoretical field capacity (ha/hr)}} \times 100$$

A rectangular type of field helps in achieving higher field efficiency. Higher field efficiency reduces the cost of operation.

Speed of travel (Forward speed)

For measuring forward speed of reaper while harvesting of crop, the distance reaper travelled in 15 seconds was measured and speed of travel was recorded in terms of km/hr (Alizadeh *et al*, 2007)

Harvesting losses

In order to estimate harvesting losses in manual and reaper harvesting, the losses that occurred before harvesting (pre-harvest) must be measured. To do this, in four parts of each plot with the use of wooden frame with 1m×1m dimensions, all grains fallen within the frame are collected and weighed and the mean of the four measured values are recorded. Harvesting losses include shattering and uncut losses and were determined by the following equation (Pradhan *et al*, 1998)

$$W_{gt} = W_{g1} + W_{g2} + W_{g3}$$

Where, Wgt = Total losses (g/m²),
Wg₁ = Pre harvest losses (g/ m²)

Wg² = Shattering losses (g/ m²) Wg³ = Uncut losses (g/ m²)

After measuring the amount of losses at different stages, the percentage of harvest losses were determined by the following equation

$$H = \frac{W_{gt} - W_{g1}}{Y_g} \times 100$$

Where,

H = Percentage of harvest losses (%)

Wg₁ = Pre-harvest losses (g/m²)

Wgt = Total harvesting losses (g/m²)

Yg = Grain yield (g/m²)

Stubbles left in the field was also measured using scale and expressed in metric unit.

Performance of Mechanical Reaper

Table 2. Comparative economics of operations between Ragi reaper and manual harvesting.

Operation	Total time taken(hr/ha)			Total number of labours /ha			Total cost of cultivation (Rs/ha)		
	Mechanization	Manual	Efficiency over Manual (%)	Mechanization	Manual	Efficiency over Manual (%)	Mechanization	Manual	Efficiency over Manual (%)
Harvesting	5	18	72	2	25	92	3000	15625	81

RESULTS AND DISCUSSION

The results (Table 3) revealed that overall time taken for harvesting of ragi by reaper was reduced by 72 per cent compared to manual harvesting. Similar results were found by Shelke (2011). Labour dependency to harvest one hectare area of ragi using mechanical reaper was reduced by 92 per cent while cost of cultivation was reduced by 81 per cent over manual operations, Thus there was a saving an amount of Rs.12, 625/ha.

The effective width of reaper was 1.0 m and forward speed of machine was 2.20 km/hr for. The cost of the fuel was included to work out the cost of cultivation. The average fuel consumption recorded was 1.2 l/hr.

The Actual field capacity of the reaper was found to be 0.23 ha/hr whereas, theoretical field capacity was recorded 0.31 ha/hr, but these values differ with crop condition, labourers ability and climate conditions. Field efficiency was found to be 74.1 per cent (Table 2).

The measured values of pre harvest losses were found to be 3.54 per cent whereas post harvest losses under manual and ragi reaper conditions were 4.21 and 5.30 per cent, respectively.

The harvesting losses were more than pre-harvest and manual harvesting but were in acceptable limit (Kumar, *et al*). This may be due to mechanical action of harvester and physiological maturity of crop. The stubble height left over in the field after harvesting was 130 mm and in manual harvested plots, it was 55mm. the cost of cultivation under ragi reaper was found to be Rs. 3000/-ha against

Rs. 15,625/-ha under manual harvesting. Therefore, it was evident that harvesting with ragi reaper was the most economical.

CONCLUSION

Scarcity of manual labours and drudgery to carry out field operation calls for different power sources. Time and labour are crucial resources in cultivation of field crops. Adoption of mechanization in cultural operations not only reduces drudgery but also saves time considerably resulting in lower cost of cultivation and increased returns. Farmers opined that adoption of mechanization not only reduces the drudgery, reduces cost of cultivation but also increases more returns per unit time and area.

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