Role of Mechanization in Effective Management of Time and Labour in *Ragi (Eleusinecoracana L.)* Cultivation

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ABSTRACT

Mechanization plays an important role in timely operation, reducing labour and drudgery in Indian agriculture. Front line demonstration on mechanization in Ragi from sowing to post harvest operation was conducted by KVK, Ramanagara during kharif 2013-14, 2014-15 and 2015-16 covering 17ha. Improved implements and machinery namely cultivator, tractor drawn seed cum fertilizer drill, cycle weeder, Ragi reaper and thresher were used for various farm operations from land preparation to harvesting. Awareness was also created through trainings, demonstrations and media coverage. The Results of the demonstration showed that mechanization reduced time of operation by 76 percent and the cost of cultivation by 58 percent per hectare with respect to conventional farming. The conventional farming included land preparation by bullock drawn harrow, sowing by bullock drawn seed drill, manual interculture and weeding, manual picking and harvesting of Ragi using khurpi. This also helped in timely operations which in turn helped to get higher yield. Farmers opined that usage of improved implements helped them to overcome drudgery involved in the field and also reduction in cost of operation. Field capacity of seed drill, cycle weeder and Ragi reaper was observed to be 0.34,0.05,0.32ha/h respectively.

Key words*: Mechanization, Cycle weeder, Ragi harvester, Field capacity, Field efficiency*

INTRODUCTION

Ragi or finger millet (*Eleusinecoracana L*.) is one of the common millets in several regions of India. It has been an important staple food in the parts of eastern, central Africa and India (FAO, 1995). Millets are important food in many under developed countries because of their ability to grow under adverse weather conditions like limited rainfall. In contrast, millet is the major source of energy and protein for millions of people in dry country. It has been reported that millet has many nutritious and medical functions (Obilana and Manyasa, 2002; Yang *et al*., 2012).

Ramanagara district is predominantly agriculture oriented district and *Ragi* or finger millet is one of the major crops grown in the district in an area of 62326 ha. Traditional farming is being practiced in Ramanagara district from land preparation to post-harvest operations, where too much drudgery is involved and also due to excess involvement of labour in different farm operations the cost of production is quite high. Non-availability of labour in peak period accounts for higher expenditure with less productivity. The timeliness of operations has assumed greater significant in obtaining optimal yields from different crops, which has been possible by way of mechanization (Joginder Singh, 2006). Human drudgery can be reduced by providing farmer-friendly farm tools and equipment which increase the productivity of worker with safety and comfort. KVK, Ramanagara has demonstrated improved implements and machinery in *Ragi* cultivation, from land preparation to threshing operation, to reduce drudgery and to compare traditional farming with mechanized farming among

farmers with the following objectives:

1. To evaluate the field performance of the improved implements and machinery over conventional farming, and
2. To compare the cost economics of *Ragi* cultivation with improved implements against traditional farming.

MATERIALS AND METHODS

Front line demonstration on mechanization in *Ragi* cultivation was carried out at 35 farmer's field in three villages, namely Dollenahalli, Gollaratti, Srigiripur, of Magadi Taluk of Ramanagara district covering 17 ha during 2013-14, 2014-15 and 2015-16. Land preparation, seed treatment, weeding, harvesting and threshing activities involving human labour were carefully studied. Tractor drawn 9 tyne cultivator was used for land preparation. Tractor drawn seed cum fertilizer drill with 9 rows was used for sowing of seeds. Weeding and Inter-cultivation was carried with the help of cycle weeder. Reaper cum harvester and thresher were hired from custom hiring centre and used. Data regarding time, cost of operation, hiring charges for bullocks and number of labourers required in each operation i.e. land preparation, sowing, weed management, harvesting and threshing was recorded. The performance of improved set of equipment was compared with conventional farming of ragi in the area. The conventional farming included land preparation by bullock drawn harrow, sowing by bullock drawn seed drill, manual interculture and weeding, manual picking and harvesting of Ragi using khurpi. The specifications of seed drill, cycle weeder and Ragi reaper are given in Table 1, 2 and 3, respectively.

Table 1: Specification of tractor drawn Seed cum fertilizer drill used for sowing of Ragi

Sl. No	Particulars	Specification
1	Type	Tractor mounted
2	No. of Hoppers	2
3	Capacity of hopper	Seeds-48 kg, Fertilizer-50 kg
4	No. of Rows	9
5	Power source	26.25 kW and above tractor
6	Aprox weight (kg)	300

Table 2: Specification of cycle weeder

Sl. No	Particulars	Specification
1	Width of cut (m)	0.15-0.20
2	Depth of Cut (cm)	2-2.5
3	No. of persons required for operation	1
4	Weight of implement (kg)	10
5	Length × Breadth × Height (m)	1.2 × 0.45 × 1.1

Table 3: Specification of Ragi reaper

Sl.No	Particulars	Specification
1	Width of cut (m)	1.0
2	Row spacing (m)	0.3
3	No. of blades	24
4	No. of persons required for operation	1
5	Forward Speed of travel (kms/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,3.75 kW

Field Evaluation

The field trials of improved implements like tractor drawn cultivator, seed drill, cycle weeder and *Ragi* reaper were conducted at field of 35 farmers in an area of 17 ha. For evaluating the following performance criteria were considered:

a. Field capacity of the machine
b. Field efficiency of the machine
c. Speed of travel
d. Harvesting losses

In comparison to conventional method of *Ragi* cultivation, savings in labour, time and cost of operation using improved technology was determined.

The following procedures were adopted for evaluating machine performance

Theoretical field capacity: It is the rate of field coverage of the implement based on 100 percent of time at the rated speed and covering 100 percent of its rated width

$$\text{Theoritical field capacity } (ha/h) = \frac{\text{Width (m)X Speed (m/h)}}{10000}$$

Effective field capacity: Field capacity is the actual area covered by the machine or implement usually expressed in ha/h. It is the quantum of work turned out by the machine. Field capacity should be the maximum with least effort for minimizing field losses. It was calculated by following equation:

$$\text{Effective field capacity } (ha/h) = \frac{\text{Width (m)X Speed (m/h)}}{10{,}000} \text{ X Effeciency}$$

Field efficiency: The field efficiency of the machine indicated the efficacy of the machine and operator, in reducing the time taken in turning and stoppage for adjustments. It was calculated by following equation:

$$\text{Field effeciency } (\%) = \frac{\text{Effective field capacity}}{\text{Theoritical field capacity}} X\ 100$$

Higher field efficiency indicated faster fields coverage in lesser time and hence reduced the cost of operation.

Speed of travel of harvester: For measuring forward speed of reaper/harvester while harvesting of crop, the distance travelled by the machine in 15 seconds was measured and speed of travel was recorded in terms of km/h.

Harvesting losses: In order to estimate harvesting losses in manual and reaper harvesting, first the losses that occurred before harvesting (pre-harvest) was measured. To do this, a wooden frame of 1m×1m dimension was used. It was randomly thrown in the field. All the grains fallen within the frame were collected and weighed. Four replications were taken and the mean of these values were determined. Same procedure was repeated after harvesting. Harvesting losses included shattering and uncut losses and were determined by the following equation:

$W_{gt} = W_{g_1} + W_{g_2} + W_{g_3}$

Where,

W_{gt} = Total losses (g/m^2),

W_{g_1} = Pre- harvest losses (g/ m^2)

W_{g_2} = Shattering losses (g/ m^2)

W_{g_3} = Uncut losses (g/ m^2)

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 (%)

W_{g_1} = Preharvest losses (g/m^2)

W_{gt} = Total harvesting losses (g/m^2)

Yg = Grain yield (g/m^2)

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

RESULTS AND DISCUSSION

The result of the demonstration on 35 farmers' fields in an area of 17 ha is given in Table 1.

It was observed that overall time taken for carrying all the field operations with improved equipment

Table 4: Comparative analysis of economics of different operations

Operation	Total time taken (h/ha)			Total labours/ha (No)			Total cost of cultivation, (Rs/ha)		
	Improved equipment	Conventional	% change	Improved equipment	Conventional	% change	Improved equipment	Conventional	% change
Cultivation	5	45	-89	-	3	-	3750	5625	-33
Sowing	5	13	-61	5	15	-67	3750	7125	-47
Weeding	15	20	-25	5	38	-87	750	5625	-87
Harvesting	5	18	-72	2	25	-92	3000	15625	-81
Threshing	3	40	-93	10	25	-60	6250	7500	-17
Total	33	136	-76	22	106	-79	17500	41500	-58

was reduced by 76% in comparison to conventional farming. Similar results were found by PP shelke in 2011. In comparison to conventional farming by using improved set of equipment labour dependency and cost of cultivation was reduced by 79% and 58% respectively. The effective field capacity of improved seed drill, cycle weeder and *Ragi* harvester was found to be 0.34, 0.05, 0.32 ha/h respectively, but these values differed with crop condition, labour ability and climate condition (Table 5).

The performance of reaper is determined by the rate and quality at which the operations are accomplished. The effective width of reaper was 1.0 metre and forward speed of machine was 2.20 km/h. The cost of the fuel was included to work out the cost of cultivation. The average fuel consumption recorded was 1.2 l/h.

The measured values of pre and post-harvest losses in manual and *Ragi* reaper are shown in Table 3. Harvest losses were more than pre-harvest and manual harvesting but it is in acceptable limit (Kumar, *et al.* 2006).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 as and manually harvested plots was 55 mm

Extension activities created much awareness about the technology and many farmers showed satisfaction over the performance of implements which helped them in reducing drudgery in field operations (Table 7). A view of demonstration of reaper is shown in Fig. 1.

CONCLUSIONS

Time and labour are crucial resources in cultivation of field crops. Adoption of mechanization in cultural operations not only reduced drudgery but also saved time resulting in low cost of cultivation and increased returns. Farmers opined that adoption of mechanization not only reduced the drudgery and cost of cultivation but also gave higher return per unit time and area. It is also important to note

Table 5: Field capacity and field efficiency of improved equipment

Type of equipment	Field capacity (ha/h)			Field efficiency (%)
	Improved equipment		Conventional	
	AFC	TFC		
Seed drill	0.34	0.42	0.15	80.9
Cycle weeder	0.05	0.06	0.02	83.3
Reaper/harvester	0.32	0.44	0.23	72.2

Table 6: Pre and Post-harvest losses

Pre-harvesting losses (%)	Post-Harvest losses (%)	
	Manual harvesting	*Ragi* reaper
3.54	4.21	5.30

Table 7: Extension activities conducted

Activity	2013-14	2014-15	2015-16
On-Campus training programmes	1	1	2
Off-Campus training programmes	4	3	4
Demonstrations	15	14	12
Group discussions	10	15	11
Radio talk	1	1	-
Publications	2	1	2
Total	33	35	31

Fig. 1: Demonstration of *Ragi* reaper

that harvesting of *Ragi* using harvester left much of stubble in the field which resulted in low fodder availability. It needs to be rectified in future course of refinement and modification.

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