

Farm machinery: The economics of paddy harvesting

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Received : 27.09.2012; Accepted : 06.02.2013

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■ **ABSTRACT** : The present study assessed the potential of using paddy harvesters and its impact on timeliness, harvesting cost, crop yield, farm income and employment. The results indicated that mechanical harvester ensured rapid harvesting, reduced harvesting costs, minimised post harvest losses, raised income of farmers and assisted farmers in overcoming labour shortages during peak harvesting period. The machine replaced labour by about 90 per cent, reduced harvesting costs by Rs. 5500 per hectare and increased net return by around Rs. 35000/ha. Field conditions such as crop density, crop maturity, soil moisture condition, weed population, plot size, lodging and operators skills determines the efficiency of harvesting. Mechanical harvester harvested 10 acres per day. The mechanical harvester is impressive equipment, which reduced the cost of paddy production by about 25-30 per cent and reduced post harvest losses to a considerable extent. Negative effects are noticed on employment opportunities and also on the income of harvesting labourers. Although the mechanical harvester has gained greater acceptance among farmers, the price of the machine is around 15 lakhs; which tend to discourage them to invest on this technology. However, it is possible to popularize these machines in major rice producing areas by providing financial incentives to farmers and companies and by way of conducting appropriate training programmes.

■ **KEY WORDS** : Mechanical harvester, Employment

■ **HOW TO CITE THIS PAPER** : Basavarajappa, D.N., Chinnappa, B. and Sannathimmappa, H.G. (2013). Farm machinery: The economics of paddy harvesting. *Internat. J. Agric. Engg.*, **6**(1) : 240-243.

Harvesting, threshing and winnowing represent the final field operations in the paddy production process. It is at this particular point that the farmers and labourers receive their pay off through cultivation. Harvesting is traditionally carried out in Karnataka by using sickles. Four wheel tractors/low capacity mechanical threshers are generally used for threshing, winnowing is carried out by fan attached to tractor or through manual winnowing. The harvesting and threshing operations consume as much as 50 per cent of the total farm power requirement for paddy cultivation in Karnataka. Harvesting, threshing and winnowing are done separately and require a great deal of labour application, usually in the range of 10-15 labour days per ha depending on the condition of the crop and variety. Both men and women participate in these operations and the wage rate in cash or kind is substantially high as Rs. 200-250/day. Owing to the high level of labour requirements and the concurrent maturity of crops in many farmers fields, more often difficulties are encountered in mobilizing sufficient labour and harvesting is delayed beyond the optimum crop maturity conditions. The delay in harvesting result, reduction of the quality and quantity of paddy. This can be a costly practice if the harvesting takes

place during rainy season. Labour scarcity during the peak labour demanding period and the high wage rate involved are becoming a challenge for rice cultivation. The cost of labour is about 40-45 per cent of the total cost of production of paddy, out of which 50 per cent is used for harvesting, threshing and winnowing operations.

These constraints could be overcome through the introduction mechanical paddy harvesters. It will provide solutions scarcity of labour during peak harvesting season and also assist in achieving timeliness, minimizing drudgery, reducing crop losses and improving the quality of paddy. It has been reported that grain losses were below 3 per cent and grain damage was about 0.5 per cent when harvesting is done with paddy harvester in Japan. In this context an effort is made through this paper to achieve the following objective to evaluate the impact of using the mechanical harvester on timeliness, harvesting costs, crop yield, farm income and labour use.

■ METHODOLOGY

Field level data on use of harvester were collected through personal interview with the farmers. Data pertaining to *Kharif* 2011-12 were used for the analysis. 90 farmers were

interviewed at Jigali, Kumbalur, Kathalagere and Holesirigere of Davanagere district regarding use of paddy harvester. This survey was designed to identify the timeliness, harvesting cost, crop yield, farm income and labour use for different harvesting methods. This study attempted to investigate the performance of following harvesting and threshing methods.

- Manual harvesting and threshing with four wheel tractors.
- Manual harvesting and threshing with low capacity thresher.
- Mechanical harvester.

Data analysis and methods :

Data pertaining to three different harvesting and threshing methods were analysed. The following estimates were considered to evaluate the efficiency of these methods.

- Timeliness and labour requirements of three methods were compared by estimating average labour hours taken for harvesting one ha. paddy.
- Cost of harvesting of different methods was estimated by averaging all the costs involved in harvesting to drying one ha. paddy.
- Yield and income obtained from different methods were compared through analysing average yield and prices.
- Partial budgeting technique was used to evaluate the field level performance of mechanical harvester.

Partial budgeting :

Partial budgeting was used to estimate the changes in cost of reduction and income for both manual and mechanical harvester operations.

RESULTS AND DISCUSSION

The experimental findings obtained from the present

study have been discussed in following heads:

Timeliness of harvesting operations :

Paddy harvesting in major growing areas most of the state is delayed during summer season as a result of manual harvesting. Farmers have experienced further delay of harvesting during rainy season. Farmers gained improvement in the timeliness by using mechanical harvester for harvesting their crop at optimum conditions. While manual harvesting and threshing with four-wheel tractor consume about 25 labour days/ha, use of manual harvesting and low capacity thresher took about 15 labour days/ha.

The average labour requirement was reduced to about 02 hours per ha when using mechanical harvester (Table 1). All the mechanical harvester users expressed that it permitted faster, easier and timely operations in harvesting. However, the labour days requirement for mechanical harvester was relatively low in Bhadra Command area due to large plot size, low density planting soil conditions and less lodging nature of the paddy variety cultivation by the farmers.

Cost of harvesting, threshing and winnowing :

The estimated cost of manual harvesting and threshing by four-wheel tractor was about Rs. 7100/ha and with the low capacity thresher it was Rs. 6600/ha (Table 2). In contrast, the cost of mechanical harvester operations was around Rs. 4050/ha. The detailed breakdown of cost is given in Table 3. Paddy harvested using mechanical harvester requires drying before storage and this cost about Rs. 850/ha. Although cost of harvesting by mechanical harvester is estimated to be around Rs. 4050/ha (Table 2).

Changes in crop yield, farm income and unit cost of production

It reveals that average crop output obtained from the

| Table 1: Average labour hours requirement for harvesting, threshing and winnowing one ha of paddy | | | (hrs/ha) |
|---|---|--|----------------------|
| Operations | Manual harvesting and threshing with four-wheel tractor | Manual harvesting and threshing with low capacity thresher | Mechanical harvester |
| Cutting with sickle binding gathering and heaping | 20 | 25 | } 02 hrs |
| Threshing with 4 WT | 04 | 06 | |
| Threshing with low capacity thresher | - | 10 | |
| Winnowing and bagging | 10 | 10 | |
| Total | 39 | 51 | 02 hrs |

| Table 2: Average cost of harvesting, threshing and winnowing | | | (Rs/ha) |
|--|---|---|----------------------|
| Operations | Manual harvesting and threshing with 4-WT | Manual harvest and threshing with low capacity thresher | Mechanical harvester |
| Harvesting, gathering and heaping | 2600 | 2600 | } 3200 |
| Threshing | 1500 | 1400 | |
| Transport, winnowing and drying | 3000 | 2600 | 850 |
| Total | 7100 | 6600 | 4050 |

adoption of mechanical harvester was around 5820 kg/ha, whereas, average yield from manual harvesting-threshing with four-wheel tractor and manual harvesting with low capacity thresher was 5240 kg/ha and 5470 kg/ha, respectively (Table 5). Hence, mechanical harvester gave additional yield advantage of 200-250 kg/ha to farmers indicated that increase in average paddy yield was due to reduced post harvest losses, which is about 3 per cent of total crop output. Reasons cited for reduced losses were timely harvesting, complete coverage and cutting, manual post harvest losses during gathering, threshing and winnowing (Table 5). High field losses were reported in manual harvesting and threshing especially when harvesting delayed due to rains and the engagement of inefficient and dishonest labourers. Farmers were able to obtain an additional income of Rs. 4500-7500/ha (price of paddy=1350/q.) as a result of reduced crop losses.

Partial budgeting was carried out to examine the outcome of mechanical harvester by computing additional costs incurred and additional returns obtained. The analysis has shown that farmers can benefit with additional foodgrains of 5.8 qtls. Worth Rs. 7540 which farmers would have foregone with traditional method of harvesting paddy. Besides, the

farmers could save Rs. 2250 on account of savings in labour use for harvesting. The net gain due to adoption of this technology is economically viable. This is an important message to be disseminated to farming community by extension agencies for harnessing the potential benefits of this technology (Table 4).

Labour use :

Mechanical harvester operation and manual cutting of farmers requires about two average labour days/ha. In contrast manual harvesting and threshing and winnowing with 4-WT need about 10-0 average labour days per ha. This indicated a gross labour displacement of 8 average labour days/ha due to use of mechanical harvesters. It represents a straight forward substitution of capital for labour and that under the labour supply circumstances existent in most sub-continent countries. All the respondent expressed that manual harvesting and threshing methods are labourers and becoming unattractive for the present generation particularly youths. Youths are moving away from farming as educated youths are looking for more productive and less labourers employment. Mechanical harvesters are capable of providing such opportunities to meet the present demand of younger generation.

Table 3: Average cost of mechanical harvester operations

| Item | Average cost (Rs. /ha) |
|--------------------------------|------------------------|
| Operators wage | 350 |
| Labour | 355 |
| Transport of machine | 500 |
| Diesel and lubricants | 1000 |
| Depreciation cost | 250 |
| Interest | 250 |
| Maintenance cost and operation | 200 |
| Miscellaneous cost | 300 |

Table 4: Partial budgeting

| Debit (Added costs and reduced returns) | Value Rs. | Credit (Added returns and reduced costs) | Value Rs. |
|---|-----------|--|-----------|
| Cost of the machine | 15 lakhs | Increase in returns | 7540 |
| Diesel (12 lit/ha) | 600/- | Increase in yield | 7450 |
| Depreciation | 1.5 lakh | Labour cost saving 15 labours at Rs. 150/day | 2250 |
| Interest on capital | 0.9 lakh | Other input material saved | 2000 |
| Wages of the operator/day | 350/- | Decrease in fuel and repair cost | 2500 |

Table 5: Average output of different harvesting and threshing methods

| Sr.No. | Methods | Average output (kg/ha) |
|--------|--|------------------------|
| 1. | Manual harvesting and threshing with 4 WT | 5240 |
| 2. | Manual harvesting and threshing with low capacity thresher | 5470 |
| 3. | Mechanical harvester | 5820 |

Constraints :

The Mechanical harvester has its limitations and technical problems.

- Consumes more time and did not operate effectively in small, wet, weedy and muddy fields.
- The paddy harvested need drying before storage and requires drying facilities especially during summer season.
- Operational costs are high and require the services of skilled machine operator.
- Trained operators and mechanics are a scarcity at present and the conduction of appropriate training programme is needed in this field.

Reconditioned machines that were imported by farmers at lower prices ranging from Rs.10-15 lakhs were not durable and the quality of output found to be below the anticipated standards.

Conclusion :

The mechanical harvester which has gained rapid acceptance from the farmers when first introduced during late 90's has both advantages and the disadvantages compared to manual reaping. Advantages included faster harvesting, less labour requirement, reduced cost, minimized grain loss, quicker handling, faster and easier threshing and increased income to farmers. Disadvantages of the mechanical harvester include labour displacement and reduction of income of labours with limited alternative income opportunities. The present analysis implies a positive impact through the use of

mechanical harvester. Although the machine had an adverse impact on employment opportunities and the income of harvesting labourers, it was found to be an attractive investment for owners and did certainly reduce production costs. Mechanization of paddy harvesting could be a key to overcome labour shortage and timely availability that presently hinder the increased cropping intensity, which in turn will permit labour to be absorbed at other related operations during the production cycle. Adoption of this technology in paddy sector provides a powerful incentive to famers. This form of mechanization acts as a shifter variable n the factor market (labour) and in the supply response (yield gain) as well.

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