Impact of farm mechanization on rice cultivation of Bargarh District

Upasana Mohapatra*, Pujarani Mishra, Raj Kishore Mishra and Tapas Ranjan Sahoo

Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

*Corresponding author e-mail: umohapatra02@gmail.com

ABSTRACT

The study was conducted to analyze the impact of farm mechanization on rice cultivation in Bargarh district of Odisha. Personal interview method was used to collect primary data using pre-tested structured interview schedules from 120 sample farmers. Multistage sampling technique was followed for selection of sample farmers. Farm budgeting and Garrett ranking techniques were used to analyze the collected data. The study revealed that, in case of manual cultivation of rice in the study area, a total of 35.65 man days of man labour, 22.84 days of woman labour and 2.96 pair days of bullock labour and 3.57 hours of machine labour were utilized. The need of human labour is more in traditional farming the semi-mechanical farming. The average yield per acre of manual and semi-mechanical cultivation was found to be 23.50 quintals and 24.75 quintals, respectively. The net returns per acre for rice cultivation for traditional rice growers and adopters of mechanical harvesting was found to be Rs. 13190.45 and Rs. 17613.91 leading to returns to cost ratios of 1.70 and 2.07, respectively. The major constraints faced by the owners of machines in semi- mechanical cultivation of Rice were high cost of the machines, non-availability of financial support and fluctuations in area under the crop.

Key words: Constraints, cost, labour scarcity, mechanization, semi-mechanized farming

INTRODUCTION

Agricultural mechanization, one of the great achievements of the 20th century, was enabled by technologies that created value in agricultural production practices through the more efficient use of labour, the timeliness of operations, and more efficient input management with a focus on sustainable, high-productivity systems. Mechanized farming is the replacement of manual implements of labour in sectors of material production or in labour processes with machines and mechanisms using various types of power for their operation. Farm mechanization is the main plank of modern agriculture.

Rice in Odisha is now grown on an area of 4.4 million hectares, which accounts for 91 per cent of the area under cereals and contributes about 94 per cent of total cereal production in the state (www.dacnet.nic.in). The traditional method of cultivation of rice demands considerable amount of labour, drudgery, time and cost to harvest, which reflects on total production cost of the crop. It was estimated that manual method of cultivation consumes about 35 to 40 per cent of total labour requirement of the rice crop production system (Dange and Thakare, 2010). The shortage of labour during season and vagaries of weather causes high loss to farmers. The timely harvest of crop is vital to reduce the yield loss and increase quality of produce. The shortage of labour can be bridged by mechanized cultivation.

Mechanical cultivation of rice is getting popular among large as well as medium scale farmers in view of farmers facing acute shortage of labour and time. But, delay in harvesting of rice will result in loss of grain on field leading to huge loss of crop yield to farmers. In recent years, introduction of various schemes in general and MGNREGA in particular, majority of farmers are facing labour problem in taking up crucial agricultural operations. In view of labour scarcity, farmers are looking for alternative methods

of cultivation of agricultural commodities. This study evaluated various implications of machines used for cultivation of rice in the selected major rice growing district of Western Odisha, Bargarh with the specific objectives to estimate the cost and returns associated with semi-mechanized in comparison with non-mechanized rice cultivation in the study area and to document the constraints in semi-mechanical cultivation of rice in the selected region.

MATERIALS AND METHODS

The present study was based on both primary and secondary data. Personal interview method was used to collect primary data using pre-tested structured interview schedules. Secondary data on area, production and yield of rice were collected from the Directorate of Economics and Statistics, Govt of Odisha. A two stage random sampling procedure was followed. One block of Bargarh district namely Barpali was selected purposively as the block has more numbers of power tiller, combined harvester and thresher and also have maximum area under rice cultivation. Randomly four villages namely Remta, KrushakPalli, Barangpali and Kumhari were selected from partial mechanized and non-mechanized categories respectively. 120 rice growers were selected, of which, sixty were manual cultivators and other sixty were adopters of semi-mechanical method of cultivation.

Tabular analysis / Budgeting technique

Budgeting technique was followed for estimating the cost and returns in the production of rice and to assess the economics of major methods of puddling of field by power tiller, transplanting, harvesting and threshing of rice.

Garrett Ranking Technique

To know the perceptions of farmers and document the constraints in semi- mechanical cultivation of Rice, Garrett's ranking technique was used (Garrett and Woodworth, 1969). Basically it gives the change of orders of constraints and advantages into numerical scores. The major advantage of this technique as compared to simple frequency distribution is that the constraints and advantages are arranged based on their importance from the point of view of respondents. Hence the same number of respondents on two or more

constraints may have been given different rank. Garrett's formula for converting ranks into per cent was given by

$$\text{Per cent position} = 100 * (R_{ij} - 0.5) / N_j$$

Where, R_{ij} = Rank given for i^{th} factor by j^{th} individual

N_j = Number of factors ranked by j^{th} individual

The per cent position of each rank then converted into scores referring to the Garrett table. For each factor, the scores of individual respondents were added together and divided by the total number of the respondents for whom scores were added. These mean scores for all the factors were arranged in descending order, ranks were given and most important factors were identified.

RESULTS AND DISCUSSION

Labour utilization pattern in rice cultivation

Data pertaining to labour utilization pattern in various operations (ploughing, transportation and spreading of FYM, transplanting, inter cultivation, weeding, fertilizer application, PPC application, irrigation, harvesting, threshing, drying / winnowing / bagging) in manual and semi-mechanized rice cultivation are presented in Table 1 and 2, respectively.

In case of manual cultivation of rice in the study area, a total of 35.65 man days of man labour, 22.84 days of woman labour and 2.96 pair days of bullock labour and 3.57 hours of machine labour were utilized.

In case of semi-mechanized cultivation of rice the labour utilization pattern was of two type: In case of harvesting by combine harvester a total of 25.94 man days of man labour and 14.80 hours of machine labour were utilized for per acre rice cultivation. In case of harvesting by manual method a total of 28.66 man days of man labour 5.85 days of woman labour and 14.83 hours of machine labour were utilized.

Similar results were seen by Sharma (2006) while studying the comparative statistics of labour input per hectare.

Cost structure in rice cultivation

Table 1. Labour utilization pattern in manual rice cultivation (per acre).

Sl. No.	Operations	Manual operated farms			
		Men labour (man days)	Women labour (days)	Bullock pair (pair days)	Machine labour (hours)
1	Ploughing	3.14	0.00	2.96	0.00
2	Transportation of FYM	1.05	0.00	0.00	1.71
3	Spreading of FYM	1.40	0.00	0.00	0.00
4	Transplanting	3.55	7.72	0.00	0.00
5	Inter cultivation	3.75	0.00	0.00	0.00
6	Weeding	3.65	5.90	0.00	0.00
7	Fertilizer application	3.75	0.00	0.00	0.00
8	PPC application	3.05	0.00	0.00	0.00
9	Irrigation	0.00	0.00	0.00	0.00
10	Harvesting	4.07	6.77	0.00	0.00
11	Threshing	5.37	2.45	0.00	1.86
12	Drying/Winnowing/Bagging	2.16	0.00	0.00	0.00
	Total	35.65	22.84	2.96	3.57

Table 2. Labour utilization pattern in semi-mechanized rice cultivation (per acre).

Sl. No.	Operations	Mechanical harvesting and threshing				Manual harvesting and mechanical threshing			
		HL (man days)	WL(days)	BL (pair days)	ML (hours)	HL (man days)	WL(days)	BL (pair days)	ML (hours)
1	Ploughing	1.00	0.00	0.00	4.50	1.00	0.00	0.00	4.50
2	Transportation of FYM	1.05	0.00	0.00	2.14	1.52	0.00	0.00	2.14
3	Spreading of FYM	1.40	0.00	0.00	0.00	1.64	0.00	0.00	0.00
4	Transplanting	2.61	0.00	0.00	3.45	2.61	0.00	0.00	3.45
5	Inter cultivation	3.19	0.00	0.00	0.00	3.19	0.00	0.00	0.00
6	Weeding	3.63	0.00	0.00	3.50	3.63	0.00	0.00	3.50
7	Fertilizer application	3.50	0.00	0.00	0.00	3.51	0.00	0.00	0.00
8	PPC application	3.00	0.00	0.00	0.00	3.12	0.00	0.00	0.50
9	Irrigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Harvesting	3.43	0.00	0.00	1.21	4.13	6.85	0.00	0.00
11	Threshing	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.74
12	Drying/Winnowing/	4.00	0.00	0.00	0.00	4.02	0.00	0.00	0.00
	Total	25.94	0.00	0.00	14.80	28.66	5.85	0.00	14.83

HL:Human Labour, WL: Women Labour, BL: Bullock labour, ML: Machine Labour

The cost structure in rice cultivation (per acre) for both traditional farmers and semi-mechanized operated farms is presented in Table 3. It could be observed from the table that per acre cost of cultivation was more in case of manual rice cultivators as compared to the adopters of semi-mechanical rice cultivation. The two major components of the total cost incurred in cultivation of an acre of rice were variable and fixed costs. Of the total variable cost, the expenditure incurred on male labour utilized for various cultivation operations accounted for 17.57 per cent (Rs. 3300.18) of the total variable cost (Rs. 8051.12) followed by female labour (20.94 %) and machine labour (3.18%) and bullock pair (6.36 %). Input cost of Rs. 6358.40 was spent by the traditional rice growers in the study area. In case of semi-mechanical cultivation the total variable cost, the

expenditure incurred on male labour utilized for various cultivation operations accounted for 11.34 per cent (Rs. 1800.17) of the total variable cost (Rs. 5801.37) followed by machine labour (25.20 %). Input cost of Rs. 5831.79 was spent by the semi-mechanical Rice growers in the study area.

Yield and returns structure in rice cultivation

Yield per acre of rice crop as presented in Table 4 in case of traditional rice growers and adopters of semi-mechanical cultivars was 23.50 quintals and 24.75 quintals, respectively. The market price per quintal of rice in case of traditional rice growers and adopters of mechanical harvesting was Rs. 1360.60 and Rs. 1410.00, respectively. The net returns per acre for rice

Table 3. Cost of rice cultivation (per acre).

Particulars	Manual operated farms		semi-mechanical operated farms	
	Amount (Rs.)	Percentage to total	Amount (Rs.)	Percentage to total
A				
I Labour costs				
1 Male (in man days)	3300.18	17.57	1800.17	11.34
2 Female (woman days)	2950.13	20.94	0.00	0.00
3 Machine (in hours) :				
Thresher	0.00	0.00	0.00	0.00
Harvester	0.00	0.00	2200.44	13.86
Tractor/others	600.79	3.18	1800.76	11.34
4 Bullock (in pairs)	1200.02	6.36	0.00	0.00
Sub-Total (I)	8051.12	48.43	5801.37	36.90
II Input costs				
1 Seeds (kg)	1320	6.99	975.25	6.14
2 FYM (t)	480.55	2.55	550	3.47
3 Fertilizers (bags)				
a. Urea	455.10	2.41	485.50	3.06
b. DAP	1104	5.85	1175	7.40
c. Potash	401.25	2.13	425	2.68
4 Plant Protection Chemicals (l/kg)	1560.63	8.27	1360.89	8.58
5 Weedicides	620.90	3.29	480.40	3.03
Interest on working capital @ 7 %	415.97	2.20	379.75	2.39
Sub-Total (II)	6358.40	33.69	5831.79	36.75
B Fixed costs				
1 Land revenue (Rs)	7.50	0.04	7.50	0.05
2 Rental value of owned land (Rs)	3080	11.02	3550	16.07
3 Depreciation (Rs)	753.42	3.99	844.30	5.32
4 Interest on fixed capital	533.21	2.83	779.89	4.91
Sub-total	3374.13	17.88	4181.69	26.35
TOTAL COST (A+B) in Rs	18783.65	100.00	16814.85	100.00

Table 4. Cost and returns from rice cultivation in the study area (per acre).

Sl. No.	Particulars	Manual operated farm	Semi-Mechanically operated farm	% of Difference
1	Yield (quintals/acre)	23.50	24.75	-5.31
2	Average price received by the sample Rice growers (Rs. /quintal)	1360.60	1410	-3.63
3	Gross returns (Rs. /acre)	31974.10	34051.50	-6.49
4	Total Cost of cultivation (Rs. /acre)	18783.65	16814.85	12.48
5	Net returns (Rs. /acre)	13190.45	17613.91	-33.53
6	Undiscounted Benefit Cost Ratio	1.70	2.07	-21.76

Table 5. Constraints faced by the owners of machines in cultivation rice.

Sl. No.	Constraints	Garrett Score	Rank
1	Coverage of long distances in different states/districts	30.70	VI
2	High cost of machines	71.40	I
3	Non-availability of financial support	68.60	II
4	Non-availability of trained machine operators	42.50	IV
5	High cost of maintenance of machines and workers	50.80	III
6	Bad roads/ Transportation problem	35.45	V

cultivation for these two categories found to be Rs. 13190.45 and Rs. 17613.91 leading to returns to cost ratios of 1.70 and 2.07, respectively.

Constraints faced by the owners of machines in cultivation of rice

The major constraints faced by the owners of machines in semi- mechanical cultivation of Rice were coverage

of long distances in different states/districts, high cost of machines, non-availability of financial support, fluctuations in area under the crop and quantity of output, non-availability of trained machine operators, high cost of maintenance of machines and workers and transportation problem due to bad roads.

The above results were supported by the works of Makanga and Singh (1997), Ramesh (2003) and Gurunath et al. (2008).

CONCLUSION

Semi-mechanical cultivation of rice was found to be economical over manual cultivation of rice. The average yield per acre of manual and semi-mechanical cultivation is 23.50 quintals and 24.75 quintals, respectively. Hence, efforts should be made by the Department of Agriculture at the district, block and village level to popularize the mechanized cultivation among the rice growers through awareness camps/workshops. For easy availability of machines during requirement and uniform rates, the cooperative model of custom hiring of agricultural machinery (developed by the Punjab government) should be introduced in rice growing regions of Odisha.

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