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Research Article

AN ECONOMIC ANALYSIS OF MECHANIZED SOWING OF RABI CROPS USING TRACTOR DRAWN SEED – CUM-FERTILIZER DRILL IN RAICHUR DISTRICT OF KARNATAKA

SATISHKUMAR M.[1*] AND UMESH K. B.[2]

[1]Department of Agricultural Economics, College of Agriculture, Bheemarayangudi, Yadagir, 585287, University of Agricultural Sciences, Raichur, 584104 Karnataka
[2]Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka 560065
*Corresponding Author: Email-sati.4855@gmail.com

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Abstract- The present study was conducted to analyse the economic benefits of mechanized sowing of *rabi* crops using tractor drawn seed-cum-fertilizer drill in comparison with the animal drawn seed drill used by the farmers in Raichur District of Karnataka. The primary data was collected from a sample of 120 numbers of *Rabi* crop growing (Jowar and Bengalgram) farmers through personal interview using pre-tested structured schedule. The results revealed that the mechanized sowing of crops required less labour per hectare compared to that of bullock sowing. The mechanized method of sowing has resulted an increase in grain yield by 1.17 q/ha in Jowar and 0.69 q/ha in bengalgram. The relative benefits of *Rabi* crops cultivation through mechanized cultivation over partially mechanized cultivation revealed a net gain of Rs. 2990 per hectare in jowar and Rs. 1737 per hectare in bengalgram, respectively.

Keywords- Labour, Mechanized, Net gain, Seed-cum-fertilizer drill, Yield.

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Introduction

Agricultural land in India depends upon rainfall for high yields and crop productivity. After Rajasthan, the state of Karnataka has the second largest area under rainfed agriculture. Rabi Jowar and bengalgram are the major crops grown during Rabi season in northern parts of Karnataka. The sowing of these crops mainly depends upon the occurrence of rainfall. Korwar, *et al*., [2] reported that if the sowing is delayed by one week, the yields are expected to decrease by 10–15 percent under rainfed situation. Therefore, the sowing operation has to be performed within the very short time to take the advantage of monsoon and residual soil moisture [2]. The rainfed areas offer a greater push to achieve the faster agricultural growth as compared to irrigated areas in which potential opportunities have already been explored. Thus, there is large untapped potential in rainfed agriculture, which needs to be tapped by addressing the key challenges in the rainfed areas. Technology and machinery enhanced the ability, quality, accuracy and efficiency of the human being. By using technology in any field the rate production and quality automatically increases [6].

Farm mechanization has been useful to bring about a significant improvement in agricultural productivity. Khobragade, *et al.,* [2] in his study reported that, tractor operated seed-cum-fertilizer drill works better than bullock drawn seed drill in respect of effective field capacity, field efficiency, depth of placement of seed, yield of crop, yield of fodder and cost of sowing per hectare in sorghum cultivation. Hence, the present study aims to analyse the economic benefits of mechanized sowing of Rabi crops using tractor drawn seed-cum-fertilizer drill in comparison with the animal drawn seed drill used by the farmers in Raichur District of Karnataka.

Methodology

The present study was carried out in the Sindhanur taluk of Raichur district of Karnataka. The detailed information about quantity of inputs used and their prices, output levels and their prices and other information were collected from a sample of 120 numbers of Rabi crop growing (Jowar and Bengalgram) farmers through personal interview using pre-tested structured schedule for the agricultural year 2015-16. The sample respondents were post-stratified into partially mechanized and mechanized based on the degree of farm mechanization and the following distinctions were drawn.

a) Partially Mechanized: Sowing was done by traditional method using bullock pairs.
b) Mechanized: Sowing was done by tractors using seed-cum-fertilizer drill.

Analytical tools and techniques employed

a) Estimation of costs and returns

The modern cost and returns concepts were employed in analyzing the data. Costs were categorized under fixed and variable cost headings *viz.,* Farm Yard Manure (FYM), Fertilizer, Plant Protection Chemicals (PPC), Seeds, Human and Bullock labour, Machine cost and so on. Individual costs were added up to arrive at Total Variable Cost (TVC), Total Fixed Cost (TFC) and Total Cost (TC). Output quantity was multiplied with the price realized to arrive at Gross Income (GI). Net Income (NI) was calculated by deducting total cost from Gross Income. Gross Income was divided by the total cost to arrive at return per rupee of expenditure.

b) Partial budgeting method

Relative benefits of *Rabi* crops cultivation through mechanized and partially

mechanized methods in the study region were estimated through partial budgeting method. It is a method of making a comparative study of costs and returns resulting from a change in a part of the farm business. Increase in costs and decrease in returns is the total additional cost (Total debits) and the decrease in costs and increase in returns is the total additional benefits (Total credits) due to mechanized cultivation of crops. The difference between the total credits and total debits is the net benefit due to mechanization.

Results and Discussion

Cost structure of jowar cultivation

The cost structure of jowar under partially mechanized and mechanized cultivation is presented in [Table-1]. The results revealed that, the mechanized sown jowar required less labour (23.69 man days) per hectare compared to that of bullock sown (27.76 man days). The cost incurred on human labour was Rs.6,941 in partially mechanized farms, while it was Rs.5,922 in the case of mechanized farms. The fertilizer cost was the major item of variable cost constituting 16.60 percent (Rs.8,092) and 18.25 percent (Rs.8,774) of the cost of cultivation in partially mechanized and mechanized farms. The variable cost was Rs.32,808 and Rs.31,644 constituting 67.29 and 65.83 percent of the cost of cultivation in partially mechanized and mechanized farms, respectively. Among the fixed costs, the rental value of land was the major item in both the cases. The cost of cultivation of jowar was Rs.48,759 per hectare in partially mechanized farms which was slightly higher than that of mechanized farms (Rs.48,068/ha).

Table-1 *Cost structure of Jowar and Bengalgram cultivation in Sindhanur taluk of Raichur district (Rs. /ha)*

Particulars	Jowar				Bengalgram			
	Partially Mechanized		Mechanized		Partially Mechanized		Mechanized	
	Qty.	Cost (Rs.)	Qty.	Cost (Rs.)	Qty.	Cost (Rs.)	Qty.	Cost (Rs.)
Variable cost								
Human labour (Mandays)	27.76	6941 (14.24)	23.69	5922 (12.32)	33.54	8386 (19.06)	28.79	7197 (16.55)
Bullock labour (BP days)	03.84	2487 (05.10)	01.35	809 (01.68)	04.36	2727 (06.20)	02.58	1545 (03.55)
Machine labour (hrs)	05.54	3322 (06.81)	07.00	5097 (10.60)	05.43	3257 (07.40)	08.13	5100 (11.73)
FYM (Cartload)	03.38	984 (02.02)	01.36	499 (01.04)	04.76	1631 (03.71)	01.91	714 (01.64)
Seed (kg)	08.77	1491 (03.06)	09.60	1624 (03.38)	59.11	3546 (08.06)	70.31	4219 (09.70)
Fertilizer		8092 (16.60)		8774 (18.25)		1829 (04.16)		1823 (04.19)
PP chemical		4500 (09.23)		3839 (07.99)		4028 (09.15)		4150 (09.54)
Threshing		2570 (05.27)		2735 (05.69)		915 (02.08)		979 (02.25)
Irrigation		150 (00.31)		150 (00.31)		150 (00.34)		150 (00.34)
Misc.		125 (00.26)		125 (00.26)		125 (00.28)		125 (00.29)
Interest on working capital @ 7 %		2146 (04.40)		2070 (04.31)		1862 (04.23)		1820 (04.19)
Total variable cost		32808 (67.29)		31644 (65.83)		28456 (64.67)		27822 (63.98)
Fixed cost								
Depreciation		888 (01.82)		1361 (02.83)		484 (01.10)		599 (01.38)
Land revenue		63 (00.13)		63 (00.13)		63 (00.14)		63 (00.14)
Rental value of owned land		15000 (30.76)		15000 (31.21)		15000 (34.09)		15000 (34.50)
Total fixed cost		15951 (32.71)		16424 (34.17)		15547 (35.33)		15662 (36.02)
Total cost of cultivation		48759		48068		44003		43484

Note: a) Bullock labour is used for sowing by partially mechanized farmers, Machine labour (Tractor) is used for sowing by mechanized farmers.
b) Figures in parentheses indicate percent to total cost of cultivation

Cost structure of bengalgram cultivation

The cost structure of bengalgram cultivation under partially mechanized and mechanized farms is presented in [Table-1]. The human labour cost was Rs.8,386 and Rs.7,197 per hectare constituting major share of 19.06 and 16.55 percent to the cost of cultivation in partially mechanized and mechanized farms, respectively. The machine labour cost including threshing charges (Rs.6,079) was more in mechanized farms, where the sowing operations were carried out by tractor using seed drill. Whereas, the machine cost including threshing charges was Rs.4,172 per hectare, which was less than that of mechanized farms because the sowing operation was carried out by using bullock power. The cost of cultivation was Rs.44,003 and Rs.43,484 in partially mechanized and mechanized farms. The variable costs constituted around 64 percent and fixed costs constituted around 36 percent of the total cost of cultivation under both the type of cultivation.

Cost and returns of jowar cultivation

The cost and returns of jowar under partially mechanized and mechanized cultivation is presented in [Table-2]. The gross returns from partially mechanized and mechanized cultivation of jowar were Rs.73,425 and Rs.75,327 per hectare, respectively. The net returns per hectare was higher in case of mechanized (Rs.27,259) compared to partially mechanized farms (Rs.24,666) and also the returns per rupee of expenditure was higher in case of mechanized (Rs.1.57) than partially mechanized farms (Rs.1.51). The returns over variable cost were Rs.2.24 and Rs.2.38 in partially mechanized and mechanized farms, respectively. It was observed that, there was not much variation in cost of cultivation in both the cases but the gross returns were more in mechanized cultivation due to more yields. Machine use in agricultural production plays an important role in increasing the productivity and reducing unit cost of production resulting in profitable farming in India [1].

Cost and returns of bengalgram cultivation

The cost and returns of bengalgram under partially mechanized and mechanized cultivation is presented in [Table-2]. It was noticed that the yield obtained was 13.20 quintal and 13.89 quintal per hectare in partially mechanized and mechanized farms. There was little bit variation in the yield, therefore the net returns obtained was more in mechanized farms (Rs.15,779/ha) compared to partially mechanized farms (Rs.14,105/ha). The returns over variable cost were estimated to 2.04 and 2.13 and also the returns per rupee of expenditure were 1.32 and 1.36 in partially mechanized and mechanized farms, respectively.

Table-2 *Cost and returns of Jowar and Bengalgram cultivation in Sindhanur taluk of Raichur district (Rs. /ha)*

Particulars	Jowar				Bengalgram			
	Partially Mechanized		Mechanized		Partially Mechanized		Mechanized	
	Qty.	Cost (Rs.)	Qty.	Cost (Rs.)	Qty.	Cost (Rs.)	Qty.	Cost (Rs.)
Cost								
Variable cost		32808		31644		28456		27822
Fixed cost		15951		16424		15547		15662
Total cost of cultivation		48759		48068		44003		43484
Returns								
Main product (q)	48.62	71305	49.79	73199	13.20	58108	13.89	59263
Byproduct		2120		2128		-		-
Gross returns		73425		75327		58108		59263
Net returns		24666		27259		14105		15779
Cost of production		1003		965		3334		3131
Returns over variable cost		2.24		2.38		2.04		2.13
Returns per rupee of expenditure		1.51		1.57		1.32		1.36

Relative benefits of mechanized over partially mechanized jowar farms

The partial budgeting of mechanized sown over bullock sown jowar is presented in [Table-3]. It is evident that, the increment in the net gain in jowar cultivation through mechanized sowing was Rs.2,990 per hectare. The gain was mainly attributed to decrease in human and bullock labour cost compared to partial mechanized jowar farms. The additional cost components of debit side include additional cost incurred on elements like machine, seed and fertilizer. In mechanized farms because of use of tractor drawn seed cum fertilizer drill, the seed as well as fertilizer delivery rate was high because of no manual control over it. Hence the seed rate and fertilizer application were relatively high which adds to the cost of cultivation. Whereas in case of partially mechanized farms because of manual operation of seed and fertilizer application, the seed rate and fertilizer application were relatively low. Apart from this, the high charges of machinery become an additional cost in mechanized farms. The reduction in cost was due to decrease in human labour (Rs.1,019/ha), bullock labour (Rs.1,678/ha), FYM (Rs.485/ha) and plant protection chemical (Rs.661/ha) costs.

Table-3 *Relative benefits of mechanized over partially mechanized jowar farms in Sindhanur taluk of Raichur district (Rs. /ha)*

Debit	Amount (Rs.)	Credit	Amount (Rs.)
A)Increase in costs		**A)Decrease in cost**	
i) Machine labour cost	1940	i) Human labour cost	1019
ii)Seed cost	133	ii)Bullock labour cost	1678
iii)Fertilizer cost	682	iii)FYM cost	485
		iv)PP chemical cost	661
Total	2755	**Total**	3843
B)Decrease in returns	-	**B)Increase in returns**	1902
Total debits	2755	Total credits	5745
Net gain or loss (Total credits - Total debits)= Rs.2990			

Relative benefits of mechanized over partially mechanized bengalgram farms

The partial budgeting of mechanized sown over bullock sown bengalgram is presented in [Table-4]. The results revealed that, the increased cost was Rs.2,712 per hectare in mechanized sown bengalgram and this was mainly due to increased machine labour, seed and plant protection chemical cost. The increase in machine cost was mainly due to mechanized sowing and the increased cost of seed was due to increased seed rate per hectare compared to bullock sowing. While, the decrease in cost was attributed through human labour, bullock labour, FYM and fertilizer cost. The increment in the profit realized in mechanized sown bengalgram was Rs.1,737 per hectare.

Table-4 *Relative benefits of mechanized over partially mechanized bengalgram farms in Sindhanur taluk of Raichur district (Rs. /ha)*

Debit	Amount (Rs.)	Credit	Amount (Rs.)
A) Increase in costs		**A) Decrease in cost**	
i) Machine labour cost	1917	i) Human labour cost	1189
ii)Seed cost	673	ii)Bullock labour cost	1182
iii)PP chemical cost	122	iii)FYM cost	917
		iv)Fertilizer cost	6
Total	2712	**Total**	3294
B) Decrease in returns	-	**B) Increase in returns**	1155
Total debits	2712	Total credits	4449
Net gain or loss (Total credits - Total debits)= Rs. 1737			

Conclusion

The study revealed that mechanized method of sowing reduces the labour cost required in the sowing operation. Similarly, Rahman, *et al.*, [4] concluded that less number of labour per hectare is required to complete the production process by mechanized farm compared to traditional farm. The cost of cultivation of Rabi crops in partially mechanized farms was slightly higher than that of mechanized farms and the relative benefits of different crops cultivation through mechanized cultivation over partially mechanized cultivation revealed a net gain of Rs. 2,990 per hectare in jowar and Rs. 1,737 per hectare in bengalgram, respectively. The mechanized farming was more beneficial in terms of both yield and profit per acre [5]. Therefore, the tractor operated seed-cum-fertilizer drill works better than bullock drawn seed drill in respect of human labour use, yield of crop and cost of cultivation per hectare. Thus, the mechanized method of sowing was much more efficient than the common method of sowing.

Application of research: Government should take adequate measures to promote mechanization by providing financial assistance to farmers

Research Category: Agricultural Economics

Abbreviations

BP days-Bullock Pair Days
FYM-Farm Yard Manure
Ha-Hectare
PPC-Plant Protection Chemicals
q-Quintal
Rs- Rupees

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***Chairperson of research: Dr K. B. UMESH**
University: University of Agricultural Sciences, GKVK, Bengaluru, Karnataka 560065

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