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Impact analysis of farm mechanization on productivity and returns of field crops during *Rabi* and *Kharif* season in Sirsa district of Haryana

Naresh Kumar, Neeraj Pawar, Mohit Sehal, Jasbir Singh and Rajesh Kathwal

Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

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Corresponding Author: Naresh Kumar

Abstract

The present study was carried out in Sirsa district of Haryana during 2011-22 with the objectives of examining the impact of farm mechanization on productivity, income and employment and breakeven point of tractor use. Two blocks of district Sirsa were selected purposely under the study were Baragudha and Odhan. Three villages per block were also purposely selected i.e., Rori, Suratia and Baragudha from Baragudha and Gadrana, Odhan and Desu Malkana from Odhan block. Further, 20 farmers per village were selected to comprise a sample size (N) of 120 farmers randomly. There were three categories of farmers based on the land holding under study, which were small (0-8-2.4 ha), medium (2.4-3.2 ha), large (3.2-4.8 ha). Under *kharif* crops, maximum impact in terms of BC ratio has been estimated for the small farmers in cotton (2.09) and paddy (1.11) crops, respectively, particularly in case of small farmers who owned the machines as compared to the large and medium farmers under the same category. Wheat and mustard crops during *Rabi* season were most promising crops among the small farmers who had mechanized their farms. The maximum benefit cost ratio of 1.57 was estimated among the small farmers under own mechanized farmers in wheat followed by mustard (1.54). The benefit: cost (B: C) ratio in guar were Rs. 1.70/- and Rs.1.31/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 6.31 over custom hiring mechanized farm.

Keywords: Returns, income, variable cost, BC ratio, mechanization

Introduction

Farm machines have played a paramount role in increasing the agricultural production and have grown to a sizable industry in India. The level of adoption of new technology including farm mechanization by Indian farmers is still low. In developed countries, the farmers have adopted highly advanced, efficient and labor-saving agricultural machinery and equipment. However, in India the mechanization of agricultural farms much below the desired level. Tractor is the basic unit of farm mechanization, its adoption in a region is an index of the level of farm mechanization of that area. Use of tractors ensures better quality of work in farm operations, timely completion of farm activities, better management and supervision.

Mechanization of agriculture helped in transforming American agriculture from the situation where one farmer fed 5 people in 1880 to that where one farmer could feed 80 people in 1982 (Ani and Onwualu, 2002) [2]. Agricultural mechanization has been accepted as the crucial input not only for increasing agricultural productivity and promoting industrialization of the rural sector, but also for promoting overall economic development of the nation. The key to economic development lies in raising agricultural productivity which directly involves the utilization of more energy resources (Jekayinfa, 2006) [3].

Higher productivity and greater output are the two major contributions of farm mechanization. After the initiation of green revolution, Haryana has made a tremendous progress in the field of agriculture. The state which was a deficient even in its food requirements, not only became self-sufficient, but also made large contribution to the food grain pool of the country. This was due to the adoption of new technology by the farmers of the state, particularly through the increased use of HYV seeds, chemical fertilizers, and irrigation water and farm mechanization. Mechanization has led to the proper utilization of inputs like fertilizers, pesticides and water. It is well established that with the use of modern equipment, the utilization efficiency of these inputs has substantially increased. In fact, farm mechanization has enabled the farmers to cultivate larger holdings and to practice intensive cropping system.

Taking all these facts and problems into consideration a comprehensive study on different aspects of mechanization is, therefore, considered very essential to have an understanding the problem in prospective. Hence, the present study was carried out with the objective to assess the impact of farm mechanization on own and custom hiring farm mechanization in district Sirsa.

Materials and Methods

The present study was confined to Sirsa district of Haryana state. Among the seven blocks of district Sirsa, Baragudha and Odhan were selected purposively for this study. Rori, Surtia and Baragudha villages in Baragudha block and Gadrana, Odhan and Desu Malkana villages in Odhan block were selected with purposively (Table 2). Further a list of tractor owner farmers for each selected village was prepared and then, 20 farmers from each village were selected randomly to form a sample of 120 farmers for the study. The farmers were categorized into small, medium and large according to size of land holding.

Collection of data

Both primary and secondary data were collected for the present study. Primary data required for the study were collected from the sampled respondents by personal interview method using well-structured schedules, which were developed specially for the purpose of study. Secondary data were collected from various issues of the statistical abstract of Haryana, Directorate of Economics and Statistics and Directorate of Agriculture, Government of Haryana, Chandigarh and other published and unpublished sources. The collected data pertained to the agricultural year 2011-12.

Analysis of data

The collected data were thoroughly checked for consistency and accuracy and then the same were transferred on master sheet for having a clear view and subjecting them to further classification and analysis.

Gross returns

Primary data required for the study were collected from the sampled respondents by personal interview. Income was calculated by multiplying the prices with production of different crops grown by the selected respondent farmer. The variable cost was worked out by assessing the operational cost incurred on material input, human labour, bullock labour, machinery cost etc.

Net returns (Rs.): Gross returns (Rs.) – Total cost (Rs.)

Results and Discussion

Economics of own mechanized and custom hiring farms

A. Impact of mechanization on *kharif* season crops

(I) Paddy

Costs and returns analysis of paddy was given in table 3. The average variable cost among small, medium and large farmers was higher in case of own mechanized farms by 2.22 per cent over custom hiring mechanized farms which were Rs. 32536/- and Rs. 31827/-, respectively. Similarly, in case of own mechanized farms, the total cost incurred was Rs. 81479/- which was found higher over total cost estimated in custom hiring mechanized farms *i.e.,* Rs. 81316/- in. The per cent increase in total cost was calculated as 0.22. In case of gross returns, Rs. 87771/- and Rs. 83077/- were calculated in case of own and custom hiring mechanized farms. The increase was 5.65 per cent in own mechanized farm over custom hiring mechanized farms. The increase in yield was 5.65 per cent which resulted in the higher gross returns in own mechanized farms over custom hiring mechanized farms. The returns over variable cost in paddy were Rs. 55234 and Rs.51249/- in own mechanized and custom hiring mechanized farms, respectively. The per cent increase was calculated as 7.77 over custom hiring mechanized farms. The net returns in paddy were Rs. 6292/- and Rs.1761/- in own mechanized and custom hiring mechanized farms. The per cent increase was 257.29 over custom hiring mechanized farms. The cost of production in paddy were Rs. 1745/- and Rs.1840/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 5.44 over own mechanized farms.

The benefit: cost (B: C) ratio in paddy were Rs. 1.48/- and Rs.1.02/- in own mechanized and custom hiring mechanized farms, respectively. This might due to reason that the expenditure on custom hiring farms was higher but the paddy yield was low. The low yield on custom hiring farms was due to the unavailability of implements from sowing to harvesting.

(ii) Cotton

Costs and returns analysis of cotton was clearly depicted in table 3. The costs and returns analysis of cotton involved variable cost, total cost, gross returns, return over variable cost, net return, cost of production and benefit: cost (B:C) ratio. The average variable cost among small, medium and large farmers was higher in case of own mechanized farms by 5.01 per cent over custom hiring mechanized farms which were numerically Rs. 30083/- and Rs. 28646/- respectively. Similarly, in case of total cost own mechanized farms resulted in higher total cost of Rs. 53299/- over Rs. 51896/- in custom hiring mechanized farms. The per cent increase in total cost was calculated as 2.70 In case of gross returns, Rs. 107724/- and Rs. 98773/- were calculated in case of own and custom hiring mechanized farms. This increase was 9.06 per cent in own over custom hiring mechanized farms. The increase in yield was 9.24 per cent which resulted in the higher gross returns in own mechanized farms over custom hiring mechanized farms. The returns over variable cost in cotton were Rs. 77641 and Rs.70127/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 10.71 over custom hiring mechanized farms. The net returns in cotton were Rs. 54425/- and Rs.46877/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 16.10 over custom hiring mechanized farms. The cost of production in cotton were Rs. 2167/- and Rs.2307/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 6.46 over own mechanized farms.

The benefit: cost (B: C) ratio in cotton was Rs. 2.02/- and Rs. 1.90/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 6.31 over custom hiring mechanized farms. This might due to reason that the expenditure on custom hiring farms was higher but the cotton yield was low. The low yield on custom hiring farms was due to the unavailability of implements from sowing to harvesting.

(iii) Guar

The average variable cost among small, medium and large farmers was slightly higher in case of custom hiring mechanized farms by 0.63 per cent over own mechanized farms which were numerically Rs. 21403/- and Rs. 21538/-, respectively. The farmers having custom hiring mechanized farms had higher total cost of Rs. 39028/- as compared to Rs. 38096/- in own mechanized farms. The per cent increase in total cost was calculated as 2.44. The gross returns of Rs. 64378/- and Rs. 50694/- were calculated in case of own and custom hiring mechanized farms, respectively. The increase in gross returns was 26.99 per cent in own mechanized farms over custom hiring mechanized farms. The increase in yield was 27.80 per cent which resulted in the higher gross returns in own mechanized farms over custom hiring mechanized farms. The returns over variable cost in guar were Rs. 42975 and Rs. 29156/- in own mechanized and custom hiring mechanized farms, respectively. The per cent increase was calculated as 47.39 over custom hiring mechanized farms. The net returns in guar were Rs. 26283/- and Rs.11666/- in own mechanized and custom hiring mechanized farms, respectively. The per cent increase was calculated as 125.29 over custom hiring mechanized farms, respectively. The cost of production in guar were Rs. 2833/- and Rs.3708/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 30.88 over own mechanized farms.

The benefit: cost (B: C) ratio in guar were Rs. 1.70/- and Rs.1.31/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 6.31 over custom hiring mechanized farm. This might due to reason that the expenditure on custom hiring farms was higher but the guar yield was low. The low yield on custom hiring farms was due to the unavailability of implements from sowing to harvesting.

B. Impact of mechanization on *Rabi* season crops

(i) Mustard

Costs and returns analysis of mustard was clearly depicted in table 4. The average variable cost among small, medium and large farmers was higher in case of own mechanized farms by 2.05 per cent over custom hiring mechanized farms which were numerically Rs. 19228/- and Rs. 18840/-, respectively. Similarly, in case of total own mechanized farms resulted in higher total cost of Rs. 44242/- as compared to Rs. 42914/- in custom hiring mechanized farms. The per cent increase in total cost was calculated as 3.09. The gross returns on own mechanized farms were Rs. 62654/- and Rs. 50388/- on custom hiring mechanized farms. This increase was 24.34 per cent in own mechanized farms over custom hiring mechanized farms. The increase in yield was 22.29 per cent resulting in the higher gross returns in own mechanized farms over custom hiring mechanized farms. The returns over variable cost in mustard were estimated as Rs. 43426/- and Rs.31550/- in own mechanized and custom hiring mechanized farms, respectively. The per cent increase was calculated as 37.64 over custom hiring mechanized farms. The net returns in mustard were Rs. 18364/- and Rs.7465/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 146.0 over custom hiring mechanized farms. The cost of production in mustard was Rs. 2484/- and Rs.2944/- in own mechanized and custom hiring mechanized farms. The per cent increase in cost production of mustard in custom hiring mechanized farms was calculated as 18.52 over own mechanized farms. The benefit: cost (B: C) ratio in mustard were Rs. 1.41/- and Rs.1.17/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 20.51 over custom hiring mechanized farms. This might due to reason that the expenditure on custom hiring farms was higher but the mustard yield was low. The low yield on custom hiring farms was due to the unavailability of implements from sowing to harvesting.

(ii) Wheat

The average variable cost among small, medium and large farmers was higher in case of custom hiring mechanized farms by 11.97 per cent over own mechanized farms which were Rs. 24488/- and Rs. 27421/-, respectively. The custom hiring mechanized farms resulted in higher total cost of Rs. 59677/- as compared to Rs. 55427/- in own mechanized farms. The per cent increase in total cost was 7.60. In case of gross returns, Rs. 81098/- and Rs. 74132/- were calculated in case of own mechanized farms and custom hiring mechanized farms, respectively. The increase in gross returns was 9.39 per cent in own mechanized farms over custom hiring mechanized farms. The increase in wheat yield was 9.61 per cent resulting in the higher gross returns in own mechanized farms over custom hiring mechanized farms. The returns over variable cost in wheat were Rs. 56610/- and Rs.46711/- in own mechanized and custom hiring mechanized farms mechanized farms, respectively. The per cent increase was 21.19 over custom hiring mechanized farms. The net returns in wheat were Rs. 25671/- and Rs.14454/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 77.60 over custom hiring mechanized farms, respectively. The cost of production in wheat were Rs. 1023/- and Rs.1207/- in own mechanized and custom hiring mechanized farms. The per cent increase was calculated as 17.98 over own mechanized farms (Table 4).

The benefit: cost (B: C) ratio in wheat were Rs. 1.47/- and Rs.1.24/- in own mechanized and custom hiring mechanized farms. This might be due to the reason that the expenditure on custom hiring farms was higher but the wheat yield was low. The low yield on custom hiring farms was due to the unavailability of implements from sowing to harvesting.

C. Net income of small, medium and large farmers

The average net income in *rabi* season of own mechanized farm was Rs. 22819 and custom hiring farms Rs.12172/- *i.e.*, 88.62 per cent increase on own mechanized farm over custom hiring mechanized farms. The average net income in *kharif* season of own mechanized farm was Rs.38786 and custom hiring farms Rs.31105 *i.e.*, 24.84 per cent increase per cent on own mechanized farm over custom hiring mechanized farms. This was due to higher yield on timely operation of own mechanized farm. The results have been confirmed by Singh (2006) [7] and Mada and Mahai (2013) [5] and Singh (2013) [8].

Table 1: Classification of respondents as per size of land holding (2011-12)

Category	Small (0.8-2.4 ha)	Medium (2.4-3.2 ha)	Large (3.2-4.8 ha)	Total
Respondents from Own Mechanized Farms (OMFs)	48	19	11	78
Respondents from Custom Hiring mechanized Farms (CHMFs)	25	9	8	42

Table 2: GPS Location of the sites.

Block	Villages	Latitude	Longitude
1. Baragudha	1. Rori	29.80435	74.97221
	2. Surtia	29.827639	74.973014
	3. Baragudha	29.533309	75.016691
2. Odhan	1. Gadrana	29.80435	74.97221
	2. Odhan	29.533305	75.016695
	3.Deshumalkan	29.91445	74.78377

Table 3: Economics of *kharif* crops of own mechanized farmers and custom hiring farmers in district Sirsa

Particulars	Paddy								Cotton								Guar							
	Own Mechanized farmer				Custom hiring farmer				Own Mechanized farmer				Custom hiring farmer				Own Mechanized farmer				Custom hiring farmer			
	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average
Variable cost	29201	31514	36894	32536	28198	31151	36133	31827	26732	31257	32261	30083	26849	28813	30276	28646	17372	21572	25266	21403	17601	21081	25932	21538
Total Cost	77431	80261	86745	81479	76727	80484	86736	81316	49281	54571	56046	53299	49561	52186	53941	51896	33172	38262	42853	38096	34261	38626	44197	39028
Yield (q/ha)	45.5	46.8	47.8	46.7	42.2	43.6	46.8	44.2	23.5	24.5	25.75	24.58	21.25	22.75	23.5	22.5	12.75	13	14.5	13.42	10	10.25	11.25	10.5
Gross Returns	85597	87766	89949	87771	79266	81973	87991	83077	103053	107210	112909	107724	93154	99841	103323	98773	61110	62545	69480	64378	48190	49618	54273	50694
Return over variable cost	56396	56252	53055	55234	51068	50822	51858	51249	76321	75953	80648	77641	66305	71028	73047	70127	43738	40973	44214	42975	30589	28537	28341	29156
Net returns	8166	7505	3204	6292	2539	1489	1255	1761	53772	52639	56863	54425	43593	47655	49382	46877	27938	24283	26627	26283	13929	10992	10076	11666
Cost of production per quintal	1702	1717	1817	1745	1818	1848	1855	1840	2097	2227	2177	2167	2332	2294	2295	2307	2602	2943	2955	2833	3426	3768	3929	3708
B:C ratio	1.11	1.09	1.04	1.08	1.03	1.02	1.01	1.02	2.09	1.96	2.01	2.02	1.88	1.91	1.92	1.90	1.84	1.63	1.62	1.70	1.41	1.28	1.23	1.31

Table 4: Economics of *Rabi* crops of own mechanized farmers and custom hiring farmers in district Sirsa

Particulars	Mustard								Wheat							
	Own mechanized farmer				Custom hiring farmer				Own mechanized farmer				Custom hiring farmer			
	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average	Small	Medium	Large	Overall average
Variable cost	16005	19640	22040	19228	16415	18695	21410	18840	21743	23943	27778	24488	24914	27177	30173	27421
Total Cost	38375	45653	48697	44242	39177	41519	48046	42914	51766	54719	59796	55427	56411	59404	63217	59677
Yield (q/ha)	17.00	17.75	18.85	17.83	13.5	14.75	15.5	14.58	54.25	53.5	54.75	54.17	48.5	48.75	51	49.42
Price per q	3476	3523	3520	3506	3597	3258	3520	3458	1498	1497	1496	1497	1520	1482	1499	1500
Gross Returns (Rs.)	59095	62525	66343	62654	48557	48053	54553	50388	81293	80068	81933	81098	73723	72248	76425	74132
Return over variable cost	43090	42903	44340	43426	32155	29348	33148	31550	59550	56125	54155	56610	48809	45071	46253	46711
Net returns	20720	16963	17401	18364	9390	6483	6533	7465	29527	25349	22136	25671	17311	12843	13208	14454
Cost of production per quintal	2257	2567	2596	2484	2902	2818	3098	2944	954	1023	1092	1023	1163	1219	1240	1207
B: C ratio	1.54	1.37	1.36	1.41	1.24	1.16	1.14	1.17	1.57	1.46	1.37	1.47	1.31	1.22	1.21	1.24

Table 5: Net income (Rs. /ha) in *Rabi* and *kharif* season of small, medium and large farmers

Season	Own Mechanized farms				Custom hiring farms			
	Small	Medium	Large	Average	Small	Medium	Large	Average
Rabi	26172	21995	20291	22819	14694	10808	11013	12172
Kharif	42416	37068	36874	38786	30657	30636	32020	31105
Per cent increase in net income during *Rabi* season on own Mechanized farms over custom hiring farms on average net income basis								88.62
Per cent increase in net income during *Kharif* season on own Mechanized farms over custom hiring farms average net income basis								24.84

Conclusion

Farm mechanization resulted more favorable for the small farmers particularly those who owned the various kinds of machines and on small scale as the work force engaged in the manual works. Although machines as in general trend are owned by the large farmers having the financial capacity to purchase, but still there are scopes of handling the area with more precision and look after the machines. In nutshell, the income statues of the small farmers who mechanized their farms by purchasing machines on small scale has been improved in district Sirsa of Haryana.

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