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Table of Contents

Articles

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1-6

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**IMPACT ASSESSMENT OF ZERO- TILLAGE ON
PRODUCTION, PRODUCTIVITY AND COST BENEFIT RATIO
OF WHEAT CULTIVATION IN SIRSA DISTRICT**

Dr. Abhey Singh¹

Associate Professor & Chairperson, Department of Economics,
Chaudhary Devi Lal University, Sirsa, India
Email: abheygodara@gmail.com

Rajdeep Kaur²

Ph.D. Scholar, Department of Economics, Chaudhary Devi Lal
University, Sirsa, India
Email: rajdeep.dhot@gmail.com

ABSTRACT

Zero tillage is also called No-tillage or direct sowing. It is a way of growing crops without disturbing the soil through tillage. Zero-tillage cultivation is a farming practice that reduces cost of land preparation and irrigation. The Present study was undertaken in Sirsa District to analyse the impact of this technology. The study was conducted through primary data collection during the years 2014-15. Total Operational costs, Gross Returns, crop yield and Cost-benefit-analysis were calculated both for zero tillage and Non Zero tillage methods of sowing. The average wheat yield per acre was 1.69 percent high with Zero tillage. Net return was 23197.45 Rs in Zerotillage plot as compared with conventional tillage which was 20111.69 Rs. Cost-Benefit analysis calculated showed that Zero tillage method was economically the most feasible (C/B= 1:0.37) and attractive option as compared to conventional (C/B=1: 0.55) in Sirsa District. Constraints related to this technology and suggestions have been discussed for further improvement.

Keywords: Zero Tillage; Net Returns; Total Operational Cost; Cost Benefit Analysis

INTRODUCTION

Haryana is primarily an agricultural state. About 70 per cent of residents are engaged in agriculture. Wheat and rice are the major crops. Introduction of Green revolution has substantially increased the production of wheat and rice. But now there is a need of 2nd Green Revolution to improve the agriculture in India. The major challenge to wheat production is enhancing of its productivity and profitability. To meet the growing demands under the constrains of scarcity of natural resources and environmental fluctuation the task of increasing wheat production has become daunting. Technological advancement makes it possible to increase production. Haryana has promoted resource conservation technology in rice-wheat system. Most widely adopted resource conserving technology in Haryana has been zero-tillage for wheat after rice. Zero tillage is also called No-tillage or direct sowing. It is a way of growing crops without disturbing the soil through tillage. Zero tillage cultivation systems leave fields unturned and allow crop stubble to remain on the soil surface from harvest to sowing. This resulted in reduces erosion, nitrogen runoff and phosphorus runoff. Zero Tillage not only increase the wheat production but also sustain at higher level without adversely affecting the natural resources. Zero-tillage cultivation is a farming practice that reduces costs. The potential benefits of zero tillage are early planting. In Haryana most of the farmers grow Basmati varieties, which are late maturing.

Late planting of wheat after mid-November caused yield losses. Zero-tillage cultivation avoid the delay in planting and enhance the productivity of wheat. So, this techniques is time saving. Zero-tillage cultivation also protects the environment. Zero tillage improves the air quality by reducing dust and emission from farming operation. It also protects the atmosphere by releasing less carbon from soil. Zero tillage technique is also helpful to conserves water in the soil profile because the soil is not tilled at all and exposed to the drying elements of the atmosphere. The moisture is remained within the soil profile. So, the Wheat is directly planted into the stubble of the previous crop.

OBJECTIVES

From the above discussion, Zero tillage technology consider resource conservation technology which enhance the production and productivity of Wheat crop. Zero Tillage technology reduces the cost of the production as compared to conventional method. Keeping this view in mind, the present study has been taken up following specific objectives:

1. To analyses the Impact of Zero-Tillage technology on production and productivity of Wheat
2. To examine the impact of Zero-Tillage technology on Cost-Benefit ratio.
3. To identify the Constraints in adoption of Zero tillage technology.

METHODOLOGY

Sampling Design: For this study, Sirsa district has been selected on the basis of highest area of wheat and paddy crops. Because of this wheat/paddy cropping pattern is the main user of the Zero tillage. In Sirsa district, two blocks were selected on the same criteria of maximum area covered under wheat and paddy crops. 10 farmers who adopted Zero tillage technology for wheat production were selected from each block. An equal number of farmers who did not adopt zero tillage or conventional tillage were selected. So, a total of 40 respondents have been selected for the study.

Source of Data: The study was conducted through primary data collection during the years 2014-15. Interview schedule method has been used as the main tool for the data collection.

Analytical Techniques: Total Operational costs, Gross Returns, crop yield and Cost- benefit-analysis were calculated both for zero tillage and Non Zero tillage methods of sowing. The study has been taken operational cost because the other cost like land rent was same for zero tillage adopter and non adopter. The cost of irrigation was calculated by No. of irrigation apply multiplied by the time required to irrigate with the cost of canal, electricity or diesel consumption per hour. Diesel was taken on actual expenditure basis. Electricity was taken based on per unit rate fixed by the Haryana Electricity Distribution Corporation. For analytical techniques simple average and percentage methods have been used. Net income was calculated as the difference between gross Returns and Operational cost of production. Cost Benefit Analysis was calculated by divide the operational cost to Net returns.

RESULTS AND DISCUSSION

In this study firstly to compare the productivity of wheat crop by Zero tillage technology with the no Zero tillage technology in Dabwali and Sirsa Blocks. After then, the comparative analysis of Cost Benefit Ratio of Zero tillage and Non Zero Tillage methods in Wheat crop area has been discussed. Various Constraints of Zero tillage technology faced by the farmers have been identified in the study. Thus, results and discussion related to above discussed topic was given as below:

Table 1. Impact of Zero-Tillage Technology on Production and Productivity of Wheat (Area in Acre and Quantity in Quintals)

Particulars		Zero Tillage	Non zero tillage	% Deviation in Productivity
Dabwali Block	Area	336	295	-
	Production	6902	5957	-
	Productivity	20.54	20.19	1.73

Sirsa Block	Area	345	221	-
	Production	7285	4613	-
	Productivity	21.11	20.87	1.16
District SIRSA	Area	681	516	-
	Production	14187	10570	-
	Productivity	20.83	20.48	1.69

Source: Field Survey

This Table 1 shows that production and productivity of Wheat crop have the positive deviated from Non- Zero tillage farmers as compared to Zero tillage farmers in each Block as well as in Sirsa district. Impact of Zero Tillage was positive on the production of wheat. Dabwali Block showed the strong productivity of Wheat crop from Zero tillage technology as compared to Sirsa Block and it were 1.73 percent in Dabwali Block and 1.16 in Sirsa Block. The overall results show the positive production and productivity. The main reason behind the positive production and productivity is Zero tillage technology that allow the farmers to plant Wheat early as compared to traditional method of plating. So this allow more time for crop growth and higher yield.

Table 2. Comparative Analysis of Cost Benefit Ratio of Zero tillage and Non Zero Tillage Methods in Wheat Production of Dabwali and Sirsa Blocks (Cost in Rupees)

Items	Dabwali Block		Sirsa Block	
	Zero Tillage	Non- Zero Tillage	Zero Tillage	Non- Zero Tillage
Land preparation Cost				
1.Ploughing	0	1355	0	1495
2.Planking	0	420	0	405
Sowing	680	360	690	500
Seed Cost	790	800	780	760
Total Human Cost	1210	1257.5	1110	1155
Irrigation Cost	542.5	743.59	1158.52	1695.59
Fertilizer Cost	2202.65	2461.45	2040.55	2230.05
Pesticide Cost	900	950	930	1010
Weeding Cost	190	245	210	255
Harvesting Cost	1070	1080	1100	1110
Working Capital	7585.15	9672.54	8019.7	10615.64
Interest Rate 9 %	682.66	870.52	721.71	955.40
Operational Cost	8267.81	10543.06	8740.78	11571.047
Gross Returns (Main +By Product)	31205	30914	32198.5	31423.5
Net Returns	22937.18	20370.93	23457.71	19852.45
Cost Benefit ratio	1: 0.36	1: 0.51	1: 0.37	1: 0.58

This Table 2 explained that there was difference in cost benefit ratio of Zero tillage Technique and non Zero tillage technique for Wheat crop in Dabwali and Sirsa Block. Ploughing cost (Rs. 1495) of non zero tillage was significantly high in Sirsa block while the planking cost was less (Rs 405) as compared to Dabwali block. Sowing cost by Zero tillage was almost same in both Blocks. But some difference was observed in the sowing cost of no zero tillage. It was recorded 500 Rs in Sirsa Block while it was 360 Rs in Dabwali Block. There was no large difference found in seed cost for zero tillage and Non zero tillage in Both Blocks. Human cost was high in Dabwali Block for Zero tillage and Non zero tillage as compared to Sirsa Block. A large difference was found in the case of irrigation in both Blocks. The irrigation cost was calculated Rs 542.5 for Zero tillage adopter in Dabwali Block while it was Rs. 1158.52 in Sirsa Block. It was due to difference in water level in both Blocks. It was observed that water level of Sirsa block was low as compared to Dabwali block. The cost of irrigation for Conventional tillage was high in Both block because the number of irrigation required for non zero

tillage field was more as compared to Zero tillage field. Weedicide cost was also low in the case of zero tillage for both of the blocks. Some difference was found in Harvesting Cost of Both blocks. Yet it was almost similar for zero tillage and non zero tillage for same block. Overall it was concluded that cost of Zero tillage was low as compared to non zero tillage in both block. Total operational cost was 8267.81 Rs per acre of the zero tillage, significantly lower than that of Rs. 10543.06/ per acre of Non zero tillage in Dabwali Block. Same reduction was found in Sirsa Block. The result showed that the Gross return was obtained significantly higher than conventional method (32198.5 Rs as compared to 31423.5 Rs) in Sirsa Block. Due to reduction in land preparation cost, irrigation cost and fertilizer cost and weeding cost, Cost- Benefit for zero tillage method was economically the most feasible (C/B= 1:0.36) in Dabwali block and C/B=1: 0.37 in Sirsa Block. On the other hand it was (C/B= 1: 0.51) for non zero tillage in Dabwali block as against (C/B= 1: 0.58) in Sirsa Block of wheat production.

Table:3 Comparative Analysis of Cost Benefit Ratio of Zero tillage and Non Zero Tillage Methods in Wheat Production of Sirsa District

Items	Zero tillage	Non zero tillage/ Conventional tillage
Land preparation Cost	0	1425
1.Ploughing	0	412.5
2.Planking		
Sowing	685	430
Seed Cost	785	780
Total Human Cost	1160	1206.25
Irrigation Cost	850.51	1219.59
Fertilizer Cost	2121.6	2345.75
Pesticide Cost	915	980
Weeding Cost	200	250
Harvesting Cost	1085	1095
Working Capital	7802.11	10144.09
Interest Rate 9 %	702.18	912.96
Operational Cost	8504.29	11057.58
Gross Returns (Main + By Product)	31701.75	31168.75
Net Returns	23197.45	20111.69
Cost Benefit ratio	1: 0.37	1: 0.55

Table 3 presents that the Gross return was significantly higher than conventional method (31701.75 Rs.) as compared to 31168.75 Rs). Because the Wheat crop was grown 10-15 days early that was result in timely sowing of wheat crop and increases in yield. Total operational cost was Rs.8504.29/ per acre in the Zero tillage, significantly lower than that of Rs. 11057.05/ per acre in Non zero tillage. Cost- Benefit analysis calculated shows that Zero tillage method was economically the most feasible (C/B= 1:0.37) and attractive option as compared to conventional (C/B=1: 0.55). It was the result of reduction in land preparation cost, irrigation cost and fertilizer cost. Land Preparation cost included Ploughing and Planking was Zero because the sowing was directly by zero tillage into the residues of the previous crop. It was recorded Rs. 1425 for ploughing and Rs.412 for planking. Sowing by Zero tillage is higher as compared to conventional method. (685 Rs as compared to 430 Rs). It was showed that farmers were investing less on irrigation cost per acre because Zero tillage-tillage conserve moisture and reduce irrigation costs. It was observed that the zero tillage field at first irrigation required less time to fill the field as compared to Non Zero tillage field. The irrigation cost was calculated Rs 850.51 for Zero tillage adopter, on the other it was Rs. 1219.59 for non zero tillage adopter. The use of Zero tillage is potentially fertilizer saving because some quantity of NPK remain in stubble. Weedicide cost for Zero tillage plot was (200 Rs) less as compared to non Zero tillage (250 Rs).Seed and harvesting cost were almost similar in both Zero tillage and non zero tillage plots.

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Science & Technology

However there was much difference in a case of human labour cost. It was founded that Human labour cost was Rs. 1160 for zero tillage adopter while it was Rs 1206.25 for non zero tillage adopter.

Constraints: No doubt Zero tillage technology is resource conserving technology but adoption level of this technology is not increasing rapidly. To make the adoption of this technology faster, there is need to identify the various constraints of Zero tillage adoption. These are given below:

Table 4. Constraints of Zero tillage adoption by Adopter and Non Adopter in Sirsa District

Factors	Number of Farmers (40)
Availability of machine are not sufficient	7 (17.5)
High Cost of machine	26 (65)
Lack of Local manufacture	18 (45)
Standing stubble	18 (45)
Appropriate Moisture at the time of sowing	9 (22.5)
More weeds problem at the time of drilling	12(30)
Hardening of upper layer of soil	24 (60)
Lack of repair	1(2.5)
Not better for Small fields	14 (35)
Others method more effective	17 (42.5)
Not suitable for other crop	34 (85)
Already availability of other machine	23 (57.5)
Reduction in Yield	6 (15)
Risk averter of new technology	8 (20)
Low Income	23 (57.5)
Lack of credit facilities	17 (42.5)
Unavailability of subsidy on machine	19 (47.5)
Lack of training	17 (42.5)
Lack of attention of mass media	14 (35)
Lack of extension literature	19(47.5)

Source: Field Survey

This table explained the obstacles for adoption of Zero tillage in Sirsa District. About 85 Per cent farmers were of view that Zero tillage was suitable only for wheat, It could not be used for the sowing of other crop. 60 Per cent farmers were agree that it was not easy to sowing the wheat by zero tillage due to hardening of upper layer of soil. About 45 per cent reported that there was a problem of sowing with zero tillage in standing stubble. About 15 per cent farmers are afraid of reduction in yield. They were of the opinion that after using zero tillage 2-3 year regular, it caused reduction in yield. About 57.5 per cent farmers did not adopt zero tillage because they have their own other machine like disc, cultivator. So, they were not ready to use zero tillage. About 65 per cent farmers agreed to the fact that Zero tillage machine was costly. Low Income has been shown as major hindrances in adoption of Zero tillage. Extension Constraints were also observed in adoption of technology like lack of training, lack of extension literature that is way farmers were not fully aware about the zero tillage technology. 42.5 per cent farmers were realized that they did not adopt this technology due to lack of training. About 20 percent farmers did not want to take risk of new technology and 17.5 per cent farmers reported the problem of Non availability of machine. Lack of repair was not main problem faced by farmers.

SUGGESTION

Due to aforementioned constraints, the following suggestion might be worthy of consideration:

- Zero tillage technology is very different from past way of doing things. So there is great need to aware the farmers by mass media, extension literature, kisanmela etc.

- Supply of zero tillage drill should be increased.
- Zero-till drills should be supplied on subsidized rates.
- For further improvement in Zero tillage machine, ideas should be taken from farmers. because they have practical experience.
- Government, universities and researcher should be setting up the programs for farmers in which benefit of zero tillage should be explained in easy way.
- Credit plays a very important role in decision making process. So for promoting the new technology availability of credit should be ensured.

CONCLUSION

The study has revealed that the Zero tillage technology is resource conserving approach. By adopting this technology, farmers could save in field preparation, fuel, irrigation water and labour. It was showed that farmers were investing less on irrigation cost per acre because Zero tillage-tillage conserve moisture and reduce irrigation costs. That is why a large difference was found in the cost of irrigation in Sirsa District which was (Rs 850.51) for Zero tillage. On the other hand for No zero tillage it was recorded (Rs 1219.59). Cost-Benefit Analyses used in this study has been showed that Zero tillage method was economically the most feasible (1: 0.37) as compared to the non Zero tillage (1:0.55). The most important benefits of Zero tillage was early planting so this was the result of increase in productivity of wheat with Zero tillage as compared with conventional method. Net return has been significantly higher in Zero tillage technology. Zero tillage technique was also helpful to reduce the pollution because it avoids the burning of straw. However some constraints were also found through the study like high cost of machine, not suitable for other crop etc. Thus, the overall economic impact of Zero tillage technology was positive on economic efficiency of wheat crop as well as production and productivity.

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