International Journal of Bio-resource and Stress Management 2016, 7(6):1387-1391 HTTPS://DOI.ORG/10.23910/IJBSM/2016.7.6.1720

Short Research Article

Impact of Conservation Agricultural Practices on Economics of Wheat Cultivation in Haryana

Vikram Yogi*, Amit Kar and Pramod Kumar

Division of Agricultural Economics, Indian Agricultural Research Institute, Pusa, New Delhi (110 012), India

Article History

Manuscript No. AR1720
Received in 26th October, 2016
Received in revised form 30th October, 2016
Accepted in final form 6th November, 2016

Correspondence to

**E-mail*: agrico.vikramyogi@gmail.com

Keywords

Zero tillage, rotavator, conventional, cost of cultivation

Abstract

Conservation agriculture can be seen as a new way forward for conserving resources and enhancing the productivity to achieve the goal of sustainable agriculture. The current study was undertaken in wheat to examine the economic feasibility of conservation agriculture practice comparison with conventional agricultural practices in the wheat growing district of Karnal and Kurkshetra in Haryana state. The sample size of 120 farmers was taken from the four villages. Cost estimation was done to examine the economic feasibility of conservation agriculture. Garrett's ranking was used to find out the factors responsible for adoption of conservation agriculture. The cost of cultivation in the zero seed drill farms (₹ 33, 232 ha^{-1}) was lower than the cost incurred by the conventional farms (₹ 37, 211 ha^{-1}) and the Rotavator farms (₹ 36, 838 ha^{-1}). This was due to lower cost incurred towards human labour, machine labour, seed and irrigation in zero seed drill farms. The benefit costratio under zero tillage was 2.02 and under rotavator and conventional method were 1.80 and 1.73. This shows that zero tillage is economically feasible. The result showed that the reasons for practicing conservation technology were reduction in cost and higher income. The respondents in the main reasons for not adopting the conservation technology is 'availability rotvator, the high cost of machine like turbo seeder, non availability of zero seed drill; extension benefits limited to large and progressive farmers are the constraints for non adoption of conservation practices.

1. Introduction

Indian agricultural sector has undergone several significant changes since Independence. Introduction of high yielding varieties associated with better package of practices during the green revolution, mechanization and diversification of the production system have raised crop yield and farm income significantly. Haryana is a one of the major state where these transformations have taken place. The conventional mode of agriculture through intensive agricultural practices was successful in achieving goals of production, but simultaneously led to degradation of natural resources. To ensure the past gain resource conservation technologies have received the high priority to sustain the past gain and further enhance the resource productivity to meet the emerging need of food grain for the fast growing Indian population. The major challenge to wheat production in the state is the enhancing of its productivity and profit ability. In Haryana, many farmers grow late-maturing, fine-grained basmati varieties of rice, causing late sowing of wheat (Tripathi et al., 2013). The delay of every successive day in planting beyond November third week decreases the grain yield progressively (Ali et al., 2010; Irfaq et al., 2005; Sharma, 1992). Therefore, to avoid delay in planting and reduce the cost of production, farmers have started adopting resource conserving technologies such as zero tillage and surface seeding in wheat production (Gupta and Seth, 2007). Savings in input cost, fuel consumption and irrigation water-use have been reported due to adoption of zero tillage in wheat cultivation. Farmers prefer this technology also due to farm labour shortage. Large numbers of farmers in the study area are adopting these technologies. Therefore, the present study was undertaken with the objectives: To examine their economic feasibility and identify the factors responsible for adoption of conservation agricultural practices.

2. Materials and Methods

Primary data from a total sample of 120 farmers were collected using multistage sampling technique for the agricultural year 2012−13. Karnal and Kurukshetra district were selected purposively on account of a large area under conservation

agricultural practices for wheat cultivation in Haryana. Two blocks were selected randomly from each district. Further from each block two villages and thirty farmers from each village wereselected randomly. Thus, a total of 120 sample farmers were selected for the present study. The primary data was collected on various aspects of conservation and conventional practices of wheat cultivation. Yield acre^{-1} of wheat, labour requirement, seed, PPC, fertilizer applied, irrigation, machinery charges farm inventory for fixed cost details were collected from the selected farmers through interview method. Focused group discussions and key informants meeting were conducted at village level. Secondary data was collected from different institutes.

3. Analytical Tools

Keeping in view the stated specific objectives of the study, different statistical models (both tabular and functional analysis) have been applied for the analysis of related data.

3.1. Cost concept

All input and output parameters pertaining to wheat production were based on average values. The cost concept, i.e., variable cost and fixed cost, was considered for the estimation cost of wheat production. The gross operational cost was taken into account in this study to calculate netincome and benefit-cost ratio. The gross operational cost included alldirect expenses paid in cash and kind for cropproduction such as hired human labour, machine labour, seeds, fertilizers, irrigation, plant protection measures, overhead charges and imputed value of family labour. The overhead charges included land revenue paid to the state government, interest on working capital and fixed capital and charges paid for repairs, maintenance and depreciation of fixed assets. The cost of irrigation was calculated by multiplyingthe time required to irrigate the farm with cost of electricity or diesel consumption hour^{-1}. The cost of electricity was taken based on unit^{-1} rate fixed by the Haryana Electricity Distribution Corporation. The cost on human labour, machine labour and diesel were taken on actual expenditure basis. Gross income included the total value of main crop and by-products. Net income was calculated as the difference between gross income and cost of production.

3.2. Identify of factors responsible for adoption of conservation agriculture practices

Garrett's ranking techniquewas used to organize the farmers' responses on factors responsible for adoption of conservation agriculture practices. Garrett's ranking techniqueprovides the change of orders of factors and advantages into numerical scores. Garrett's formula for converting ranks into per cent is:

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

Where, R_{ij} is the rank given for i^{th} factor by j^{th} individual and N_j is the number of factors ranked by j^{th} individual.

4. Results and Discussion

The data were analysed and the results are presented on conservation agricultural practices in Haryana. Cost analysis has been done for economic feasibility of conservation practices. Factors responsible for adoption of conservation practices are presented.

*4.1. Cost of cultivation of wheat in Haryana among different practic*es

It could be observed from Table 1 that the zero tillage and conventional mode of practices of wheat cultivation farmers incurred a total cost of ₹ 33328 and ₹ 37294 ha^{-1} respectively. The cost of cultivation on the zero seed drill farms was lower than the cost incurred by the conventional farms due to higher cost incurred towards human labour, machine labour, seed and irrigation. This result coincides with that obtained by Tripathi et al. (2013). The cost incurred on PPC was higher in case of zero seed drill farms. This is because of high infestation of weed in zero tillage. The seed cost was high in conventional farms as the seed rate used was higher compared to zero tillage. Expenditure on human labour was relatively higher in conventional farms due to more family labour worked under conventional farms. The rental charge of machine labour was higher so the expenditure on machine labour was high in conventional farms. The expenditure on irrigation was high in case of conventional farms because farmers were using more number of irrigation compared to zero tillage.

The total fixed cost was higher in conventional farms than that

Table 1: Cost and return in wheat production using zero tillage, rotavator and conventional tillage methods in Haryana (₹ ha^{-1})

Particular	Zero tillage	Rotavator	Conventional
Cost on human labour	10097	11275	11613
Cost on machine labour	5021	6314	6578
Cost on seed	3033	3183	3405
Cost on fertilizer	5860	5798	5706
Cost on PPC	3528	3750	2807
Irrigation charges	3250	3764	4171
Overhead cost	2443	2754	2931
Gross operational cost	33232	36838	37211
Gross return	67355	66264	64230
Net return	34027	29375	26936
Benefit–cost ratio over operational cost	2.02	1.80	1.73

of zero tillage farms because of high depreciation of machine in the conventional farms and also farmers in conventional system of farming were possessing more machinery and farming implement and hence were getting high depreciation cost, which lead to high total fixed cost. Gross returns in case of zero tillage farms were higher compared to conventional farm. The benefit cost ratio was found to be 2.02 for zero tillage and 1.73 for the conventional tillage.

Table 1 show that the cost of cultivation on the zero seed drill farms (₹ 33, 232 ha^{-1}) was lower than the cost incurred by the Rotavator farms (₹ 36, 838 ha^{-1}). This was due to higher cost incurred towards human labour, machine labour, seed, fertilizer and irrigation. As more family labour, more charge of machine labour with higher expenditure on irrigation was involved in Rotavator tillage; expenditure was relatively higher in Rotavator tillage. The total fixed cost was higher in Rotavator farms due to high depreciation of machine and Rotavator system possessed more machinery and farming implement hence they were also getting high depreciation cost, these lead to high total fixed cost. Gross returns in case of zero tillage farms were higher than that of Rotavator farm, due to lower cost of cultivation. The benefit cost ratio had been worked out and it was found to be 2.02 for zero tillage and 1.80 for the Rotavator tillage.

4.2. Impact of CA on resource use

The major farm inputs used for the production of wheat in Conventional tillage (CT) and Zero tillage (ZT) methods are mentioned in Table 2. It was observed that through the zero tillage farmers can save 13% human labour, 23% machine labour, 10% seed cost and 22% irrigation water in ZT compared

Table 2: Impact of CA on major farm inputs used in wheat production in Haryana (₹ ha^{-1})

Particular	Conventional	Zero tillage	% change
Cost on human labour	11613	10097	-13
Cost on machine labour	6578	5021	-23
Cost on seed	3405	3033	-10
Cost on fertilizer	5706	5860	2
Cost on PPC	2807	3528	25
Irrigation charges	4171	3250	-22

to CT method of wheat production. Several studies have also shown that ZT method of wheat production provides several benefits such as saving ofirrigation water, reduction in production cost, less requirement of labour and timely establishment ofcrops, resulting in improved crop yield and higher net income (Tripathi et al., 2013., Laxmi et al., 2007., Farooq et al., 2006). This suggests that by adopting zero tillage method, farmers can save a substantialquantity of resources which helps to overcome the problems of human and machine labour shortage at the time of land preparation and sowing operations.

Table 3 showed that through the zero tillage farmers can save 10% human labour, 20% machine labour, 5% seed cost, 6% PPC cost and 14% irrigation water compared to Rotavator method of wheat production. This suggests that there is significant impact on resource use by adopting zero tillage method. Farmers can save a substantial quantity of resources.

Table 4 showed that there was no significant difference in

Table 3: Impact of CA on major farm inputs used in wheat production in Haryana (₹ ha^{-1})

Particular	Rotavator	Zero tillage	% change
Cost on human labour	11275	10097	-10
Cost on machine labour	6314	5021	-20
Cost on seed	3183	3033	-5
Cost on fertilizer	5798	5860	1
Cost on PPC	3750	3528	-6
Irrigation charges	3764	3250	-14

wheat yield with and without ZT method of cultivation. It was observed that there is only 1.6% more yield in Zero tillage (ZT) compared to Rotavator. Some study had showed that by adopting conservation practices farmer can increase yield up to 12 pert (Erenstein and Laxmi, 2008). The gross and net returns in ZT of wheat production were higher by 2.2% and 16.1% respectively, as compared to using Rotavator method. The higher net return obtained in ZT was mainly due to reduction in the total cost of cultivation by 10%. This analysis suggests

Table 4: Yield, cost and return in zero tillage and rotavator methods of wheat production in Haryana

Particular	Zero tillage	Rotavator	% change
Yield (t ha^{-1})	5.23	5.15	1.6−10
Gross operational cost	33328	36888	
Gross return	67355	66264	2.2
Net return	34027	29375	16.1

that ZT technology offers ample scope to generate additional income and helps in conservation of scarce resourc.

Table 5 showed that through zero tillage farmer can get 4.6% more yield. The gross and net returns in ZT of wheat production were higher by 5.1% and 26%, respectively, as compared to in CT method. The higher net return obtained in ZT was mainly due to reduction in the total cost of cultivation by 11.5%. Similar results have been reported by many other

Table 5: Yield, Cost and Return in Zero tillage and conventional tillage methods of wheat production in Haryana

Particular	Zero tillage	Rotavator	% change
Yield (t ha^{-1})	5.23	5.00	4.6−11.5
gross operational cost	33232	36838	
Gross return	67355	64230	5.1
Net return	33931	26853	26

studies conducted on this aspect and explained the fact that the net revenue in wheat production was significantly higher under ZT than under CT method (Erenstein et al., 2007; Iqbal et al., 2002). The cost of wheat grain production was lower by 14.34% in ZT as compared to in CT method. This analysis suggests that ZT technology has significant impact to generate additional income and helps inconservation of scarce resources.

4.3. Factor responsible for adoption of conservation agricultural practices

The reasons for adoption of conservation technologies, as reported by the respondents, were analyzed using Garrett ranking technique and the results are presented in Table 6. The reasons for practicing conservation technology were: reduction in cost etc., and higher income, ownership of equipment, timely

Table 6: Factor responsible for adoption of conservation agricultural practices

Sl. No.	Factors	Score	Rank
1.	Reduced cost	56.91	I
2.	High income	52.06	II
3.	Timely sowing	50.29	III
4.	Ownership of equipment	50	IV
5	Subsidy and government promotion	46.61	V

sowing of wheat and government promotion and subsidy. Results showed that, out of the five reasons identified by the respondents, reduction in cost was ranked first, as the farmers in conservation method incurred lower input cost for seed, irrigation, machinery etc. Respondent ranked second to the high income. The respondents ranked, timely sowing and ownership of equipment and government promotionwere given third, fourth, fifth, respectively. These factors induce the farmer to adopt zero tillage technology in their field. Subsidy on equipment and custom hiring facilities also help the farmer to adopt conservation agriculture. Need for the timely sowing of wheat also induces the farmer to adopt conservation practices, late sowing of wheat causes reduction in the yield of wheat.

4.3. Reasons for non-adoption of conservation practices

The respondents in the conventional method reported five main reasons for not adopting the conservation technology. They ranked 'availability of Rotavator as the foremost reason for not adopting the conservation method on their farms. If farmer has the Rotavator, they till their field with Rotavator and they don't adopt zero seed drill. The 'high cost of machine' like turbo seeder, was ranked second. High costs of the machine farmer are not able to purchase the machine. Other constraints are non availability of zero seed drill; extension benefits limited to large and progressive farmers are the constraints for non adoption of conservation practices (Table 7).

Table 7: Constraints for non adoption of conservation agricultural practices

Sl. No.	Factors	Score	Rank
1.	Availability of rotavator	61.03	I
2.	High cost of machine	60.88	II
3.	Non availability of machine	58.68	III
4.	Lack of extension activities	43.82	IV
5	Others	25	V

5. Conclusion

The impact of conservation practices was significant to save human labour, machine labour, seed, fertilizer and irrigation water under conservational tillage than under conventional method. Due to resource saving, net return has been significantly higher in zero tillage technology. The analysis has shown that ha^{-1} production of wheat was 4.6% higher in zero tillage than in conventional tillage method. The availability of rotavator machine was major constraints in adoption of zero tillage. However reduce cost and high income helps to adopt the conservation practices.

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