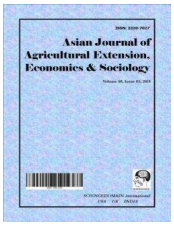

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Performance of Front Line Demonstration on Zero Tillage Wheat Sowing in Ambala District of Haryana, India

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Authors' contributions

This work was carried out in collaboration between all authors. Author GP designed the study and wrote the first draft of the manuscript. Authors AK and VDS managed the analyses of the study. Author RK managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Krishi Vigyan Kendra conducted frontline demonstrations (30 Nos.) on sowing of wheat by zero tillage method at farmers' field (12 hectare) during years 2015-17 in Ambala. The data on productivity, economics and water saving in demonstrated plots were calculated and compared with the corresponding farmer's practice. It was observed that yield of demonstrated plots was 11.60 per cent higher than farmer's practices. The extension gap, technology gap and technology index were 5.42 q/ha, 2.92 q/ha and 5.30 per cent respectively. Due to reduced cost of cultivation and higher crop yield, the gross and net return was also higher in zero tillage as compared to the farmer's practice. The BCR was 3.31, 3.35 and 3.74 in zero tillage, which was higher than in farmer's practice 2.59, 2.59 and 2.83 respectively. The depth of irrigation was also less, i.e. 33.03 ha-cm and 41.04 ha-cm respectively in zero tillage and farmer practice. Higher yield and returns

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due to reduced cost of cultivation and water saving in the FLDs over the farmer's practice created greater awareness and motivated the other farmers to adopt this latest wheat sowing technology.

Keywords: FLD; wheat; zero tillage; yield gap; economics.

1. INTRODUCTION

India is the second largest producer of wheat in the world with an average annual production of 92 Mt (million tonnes) in recent years [1]. The seven-fold increase in wheat production (12.57 million tonnes in 1965-66 to 84.27 million tonnes in 2010-11) during the last five decades has been a remarkable and unparalleled achievement [2]. Haryana is one of the major wheat-growing states in the country and produces 13.10 million tonnes wheat with a yield level of 5.20 t/ha [3]. The largest acreage and highest production of wheat are in Uttar Pradesh, but the highest average yield (5.02 t/ha.) was observed in Haryana followed by Punjab (4.90 t/ha.) during 2011-12. For instance, it is important to note that wheat productivity in Haryana during 2010-11 was 4.65 t/ha, while it was 3.98 t/ha during 2014-15 besides a slight increase in cultivated area.

In Haryana, many farmers grow late-maturing, fine-grained basmati varieties of rice, causing late sowing of wheat. The delay of every successive day in planting beyond November third week decreases the grain yield. 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 [4] and rapid and widespread adoption of Zero Tillage (ZT) has been started in Haryana state from 2001 [5]. Savings in input cost, fuel consumption and irrigation water-use have been reported due to the adoption of zero tillage in wheat cultivation [6,7].

As the main aim of Krishi Vigyan Kendra is to reduce the time lag between generation of technology at the research institution and its transfer to the farmers for increasing productivity and income from the agriculture and allied sectors on a sustained basis. The KVKs are grass root level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different 'micro farming' situation in a district [8]. Despite the documented positive agronomic, economic and environmental impacts, conservation tillage under wheat has not yet become widely popular in many parts of Ambala. In Ambala zero tillage sowing of wheat has only been practised in Ambala-I block. For its horizontal expansion, we planned to conduct front line demonstration of this innovative sowing method. The present study has been undertaken with the following objectives:

- To study the differences between demonstrated packages of practices *vis-à-vis* practices followed by the local farmers (farmers' practices) in terms of extension gaps/technology gaps.
- To compare the yield of summer moong of demonstrated plots with the farmers' practices for its economic analysis and irrigation water consumption.

2. MATERIALS AND METHODS

The soils of the district are generally sandy loam to sandy clay loam in texture which is low to medium in organic carbon (0.4 to 0.75%), medium to high in available phosphorus (10-25 kg/ha) and low to medium in potash (100-200 kg/ha). The area is characterized by sub-tropical, semi-arid climate with dry summers (March-June) and severe winters (December-January) with an average annual rainfall of 1100 mm (75-80% of which is received during July to September), minimum temperature of 0 to 4ºC in January, the maximum temperature of 38-42ºC in June. The conventional rice-wheat rotation was being followed on the field from last 15 years.

The front line demonstration on zero tillage wheat sowing in Ambala district of Haryana was conducted from the year 2015 to the year 2017. Each demonstration was of 0.4 ha area and wheat seed and zero tillage seed drill was supplied as critical input for partial fulfilment and other inputs were applied as per the recommendation and wheat variety HD-2967 was most commonly grown at their fields. The sowing of wheat was done during 30th October to 5th November in zero tillage, whereas it was sown from 12th to 20th November in conventional tillage

Table 1. Details of wheat grown under FLD and farmer practice

S. no.	Particulars	Frontline demonstration	Farmer practice
1	Variety	HD-2967	HD-2967
2	Laser levelling	Yes	No
3	Seed rate (kg/ha)	100	112.5
4	Seed treatment	Raxil-2 D.S. 1gm/kg seed	No
5	Sowing method	Zero tillage sowing after harvesting of paddy	Conventional tillage *i.e.* 2 disking + 2 cultivator + 2 planker + seed drill + planker
6	Sowing date	30th October to 5th November	12th to 20th November
7	Fertilizer application (N:P:K) and Zinc sulphate (kg/ha)	150:60:60 and 25kg zinc sulphate Soil test based	175:24:0 and no zinc application
8	Weed control	Less emergence and easy to control through single application of weedicide	More emergence and difficult to control even with higher doses of weedicides
9	Plant protection measures	Need based spray of insecticides and fungicides	Over dose/ un recommended brands of insecticides and fungicides

(farmer's practice) and harvested during mid of April.

The total of 30 frontline demonstrations in 12 hectares was conducted at farmers' field in different villages of district Ambala. Along with frontline demonstrations (FLD), practicing farmer training on calibration, operation and maintenance of zero tillage seed drill was also imparted. All fertilizers were drilled at the time of sowing in demonstrated fields, whereas, it was broadcast in farmers' practice. Three irrigation is given to crop in zero tillage, while in addition to this three irrigation in conventional tillage fields, one pre-sowing irrigation was also given.

3. RESULTS AND DISCUSSION

3.1 Grain Yield

The crop from all the plots was harvested under the supervision of the KVK scientists. The yield from both the plots, *i.e.* demonstration and farmers' practices were compared and it is evident from the data in Table 2 that an average yield of demonstrated plots was 11.60 per cent higher than that of farmer's practices. The grain yield under demonstrated plots were 52.50, 50.00 and 53.75 q/ha with an average of 52.08 q/ha from the year 2015 to 2017. However, it was 47.50, 45.00 and 47.50 q/ha with an average of 46.67 q/ha under farmer's practice. The highest increase in grain yield (13.16 %) was observed in the year 2017. The reasons behind the increase of yield under demonstrated plots might be due to timely sowing and adoption of other recommended technologies about which the farmers were ignorant. [9] also observed the higher wheat yield in zero tillage as ZT wheat farmers could sow the crop much earlier than their conventional counterpart and early sowing is associated with higher yield, a significant and positive yield impact (Increased by 8 per cent) observed in the study area. In southeastern conditions of Turkey conditions, it has been found that no tillage had resulted into lowest fuel consumption and maximum field efficiency and concluded that and corn can also be sown after lentil with conservation tillage and direct seeding [10].

3.2 Extension Gap

To fulfil the objective number 1, an extension gap between demonstrated technology and farmers practices was also calculated and it ranged from 5.00 to 6.25 q/ha during different three years and on an average basis, the extension gap of 5.42 q/ha was calculated (Table 2). This gap might be attributed to the adoption of improved technology practices such as proper seed rate, use of seed treatment material, nutrient management, pest management etc. in demonstrated plots which resulted in higher grain yield than the traditional farmers, practices. On the basis of the extension gap, the farmers were motivated to adopt the recommended package of practices to reduce the extension gap and to increase their grain yield.

3.3 Technology Gap

The technology gap was calculated by deducting the demonstrated plot yield from the potential

Table 2. Grain yield and gap analysis of FLDs and farmer practices

Year	No. of demons	Area (ha)	Yield (q/ha)		Increase (%)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
			Demo	F.P.				
2015	10	4	52.50	47.50	10.53	5.00	2.50	4.55
2016	10	4	50.00	45.00	11.11	5.00	5.00	9.09
2017	10	4	53.75	47.50	13.16	6.25	1.25	2.27
Average	10	4	52.08	46.67	11.60	5.42	2.92	5.30

Table 3. Economic analysis and water saving in demonstrated plots and farmers' practice

Year	Cost of cultivation (Rs./ha)		Gross returns (Rs./ha)		Net return (Rs/ha)		B:C ratio		No. of irrigation (no.) and depth of irrigation (ha-cm)		Irrigation water saved (%)
	Demo	F.P.	Demo	F.P.	Demo	F.P.	Demo	F.P.	Demo	F.P.	Demo
2015	26780	31235	88563	80938	61783	49703	3.31	2.59	3 (32.94)	4 (41.04)	24.59
2016	27100	31850	90750	82625	63650	50775	3.35	2.59	3 (33.21)	4 (41.31)	24.39
2017	27500	32450	102756	91913	75256	59463	3.74	2.83	3 (32.94)	4 (40.77)	23.77
Average	**27127**	**31845**	**94023**	**85158**	**66896**	**53313**	**3.46**	**2.67**	**3 (33.03)**	**4 (41.04)**	**24.25**

yield of the wheat crop. The recorded technology gap was 2.50, 5.00 and 1.25 q/ha during the study period. The average technology gap was found 2.92 q/ha. The difference in technology gap during three years could be due to more feasibility of recommended technologies like sowing time, seed rate, seed treatment, nutrient management and plant protection measures especially IPM. Higher technology index reflected the inadequate proven technology for transferring to farmers and insufficient extension services for transfer of technology.

3.4 Economic Analysis and Water Saving

The cost of cultivation (Rs/ha) during the year 2015 to 2017 was 26780, 27100 and 27500 respectively in zero tillage sown wheat. While it was 31235, 31850 and 32450 in conventionally sown fields (Table 3). Particularly in conventional sowing due to more number of tillage operations, the average higher cost of cultivation in conventional sown field was 4718 (Rs/ha). Due to reduced cost of cultivation and higher crop yield, the gross and net return was also higher in zero tillage as compared to the conventional sowing. The BCR was 3.31, 3.35 and 3.74 in zero tillage, which was higher than in conventional sowing 2.59, 2.59 and 2.83, respectively.

On waterfront, zero tillage technology consumes less water as one pre-sowing irrigation does not require. In addition to this during the average time for irrigation were 7.65 hr/ha and 9.50 hr/ha in zero tillage and conventional sowing respectively. Consequently, the depth of irrigation was also less in zero tillage as compared to conventional sowing, i.e. 33.03 ha-cm and 41.04 ha-cm, respectively in zero tillage and conventional sowing. [11,12] also reported saving in input cost and irrigation water use in zero tillage wheat cultivation.

4. CONCLUSION

In the present scenario of rising inputs cost and labour shortage in agriculture, farmers need input saving alternative technologies to sustain crop production. In zero tillage wheat cultivation, both yield and net returns were 11.60% and 25.40% higher than conventional wheat sowing. Similarly average 24 % irrigation water was saved in zero tillage. The increase in yield of wheat to the extent of FLDs over the conventional sowing created greater awareness and motivated the other farmers to adopt this latest wheat sowing technology. The beneficiary farmers of FLDs also play an important role as a source of information. The concept of frontline demonstrations may be applied to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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