

Sustaining the Yield of Late Sown Wheat Through Zero-Tillage Technology

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ABSTRACT

The zero-tillage technology is time saving, economically viable, better fertilizer use efficiency, less weed infestation and acceptable technology among the farmers during rabi cropping season from 2003-04 to 2007-08 in the district Faridabad of Haryana State. The findings have clearly showed that by sowing wheat crop with zero-tillage machine we can advance sowing of wheat crop by 8-12 days over conventional sowing. The percent increase in yield with ZT sowing over conventional sowing ranges from 3.5 to 6.0 and weed intensity was also observed low in ZT sowing. The results have also shown that there was fuel saving to the tune of 36.0 to 46.0 litre /ha, seed saving was 15 to 25 kg. /ha, saving in cost of irrigation was Rs. 315 to Rs. 605/ha and an additional grain yield of 1.9 to 2.5 q/ha was obtained with ZT sowing over conventional sowing. The over all net profitability gains ranges from Rs. 3450 to Rs. 6395 per hectare with ZT sowing over conventional sowing during the period of study i.e. 2003-04 to 2007-08. The farmers were willing to adopt ZT machine for sowing of wheat as the number of ZT machines increased from 65 to 385 and the area sown with ZT machine increased from 1500 to 8200 ha in 2003-04 and 2007-08 respectively.

Keywords : *Zero-tillage technology; Conventional sowing; Zero-till machine; Weed intensity;*

Rice-wheat cropping system occupies more than 13.5m ha in the Indo-Gangetic plains including India, Pakistan, Bangladesh and Nepal. This system is a major contributor to food and livelihood security of millions of rural and urban poor in Indo-Gangetic plains. The rice-wheat cropping system gained prominence in the country only during post green revolution period. Release of new high yielding varieties of rice and wheat supported by area expansion under irrigation and increased use of chemical fertilizers and agro chemicals resulting in a massive shift in this cropping pattern and ultimately into growth of the system in terms of area, production and productivity. The rice-wheat cropping system is dominant crop rotation of district Faridabad. The total cultivable area of district is 121, 000 ha whereas the rice-wheat crop rotation occupies 29, 000 ha and 105, 000 ha, respectively. The productivity of wheat is low due to delayed sowing following late harvesting of medium to long duration rice varieties resulting in sub-optimal crop establishment of wheat. To overcome the problem of late planting of wheat in rice-wheat cropping system the crop must be sown with ZT machine. By adopting Zero-tillage machine for sowing of wheat

farmers can advance their sowing by 10-12 days, savings in cost of preparatory tillage, less weed infestation particularly *Phalaris minor*, saving in irrigation water and above all this technology is eco-friendly. As land is fixed so, sustainable land management practices are urgently needed all over the world to preserve the production potential of agriculture land while ensuring the environmental safety.

METHODOLOGY

To popularize ZT machine in district Faridabad for sowing of wheat in rice-wheat cropping system large number of On - Farm trials were conducted on an area of 8, 10, 10, 12 and 12 ha during rabi 2003-04, 2004-05, 2005-06, 2006-07 and 2007-08 crop season ,respectively and whereas the number of participatory farmers were 20, 25, 25, 30 and 30 ,respectively in above said crop seasons. Based on rice-wheat cropping system and other factors like soil type and existing irrigation sources 5-village covering three blocks of the district Faridabad were selected and the study was carried out on different aspects of wheat crop production with ZT sowing over conventional sowing. The saving in seed cost was

calculated with seed price of the respective year whereas income from additional grain yield was calculated with Minimum Support Price (MSP) as declared by government.

RESULTS AND DISCUSSION

The KVK, Faridabad introduced ZT machine in district for the first time in 2001-02 and total area under ZT sowing was 50ha. But now the total number of zero-tillage machine has increased upto 385 and area of wheat sown with ZT machine had reached to 8200 ha during 2007-08 (Table 1). This increase in number of ZT machines and area under ZT sowing show that farmers have attached to the adoption of this technology is shown by their willingness to buy new zero-tillage machine.

Table 1. Area under zero-tillage sowing of wheat and number of drills in district faridabad, haryana

Year	Number of ZT machines	Wheat Area Sown with ZT machine (ha)	% increase in area over previous year
2003-04	65	1500	-
2004-05	155	4500	200
2005-06	210	6250	313
2006-07	320	7800	420
2007-08	385	8200	446

The zero-tillage technology is not only remunerative but also eco-friendly. It envisages 100% saving in land preparation for wheat sowing because sowing of wheat crop is done with ZT machine just after harvesting of the preceding crop i.e. paddy. While going for ZT sowing of wheat crop farmers should ensure optimum moisture in the field for better germination of crop and the height of stubbles should not be more because it will not allow smooth movement of ZT machine in the field. In the early phase of adoption the farmers were reluctant to sow wheat crop without field preparation. They were anticipating poor seed germination and plant population but after seeing the encouraging performance of zero-tillage machine sown wheat they were fully convinced with the technology as a result of this both number of ZT machine and area had been increased significantly in the district. (Table 1)

Saving in fuel: During the diagnostic survey of the farmers it was found that the farmers generally do 4-6 ploughing with horrow to prepare the field for sowing of wheat / crop. When we calculate the saving in fuel i.e. diesel and it comes to be 36 to 46 litre / ha from 2003-04 to 2007-08 (Table 2)

Saving in wheat seed : It is apparent from the data in table – 2 that there is good saving in seed of wheat i.e. 15 kg. (2003-04), 20 kg. (2004-05 and 2005-06) and 25

Table 2. Monetary gains with zero-tillage sowing over conventional sowing of wheat

S. No.	Particulars	2003-04	2004-05	2005-06	2006-07	2007-08
1.	Area under ZT sowing of wheat (ha)	8	10	10	12	12
2.	No. of participatory farmers	20	25	25	30	30
3.	Cost of field preparation in ZT sowing (Rs./ha)	Nil	Nil	Nil	Nil	Nil
4.	Cost of field preparation in conventional sowing (Rs./ha)	1875	2190	2375	2500	2810
5.	Diesel saving in field preparation with ZT sowing (lt/ha)	36	38	42	45	46
6.	Saving in wheat seed (kg./ha) under ZT sowing.	15	20	20	25	25
7.	Saving in seed cost under ZT sowing (Rs./ha)	160	225	230	345	390
8.	Total cost of irrigation in conventional sowing of wheat (Rs./ha)	2250	2700	3000	3100	3360
9.	Total cost of irrigation in ZT sowing of wheat (Rs./ha)	1935	2270	2490	2540	2755
10.	Saving in irrigation cost in ZT over conventional sowing (Rs./ha)	315	430	510	560	605
11.	Savings in cost of input under ZT over conventional sowing (Rs./ha) (4+7+10)	2350	2845	3115	3405	3805
12.	Average grain yield in ZT sowing (q/ha)	39.3	38.2	42.8	39.5	48.7
13.	Average grain yield in conventional sowing (q/ha)	37.4	36.0	40.3	37.2	46.3
14.	Additional grain yield with ZT over conventional sowing (q/ha)	1.9	2.2	2.5	2.3	2.4
15.	Returns with additional grain yield with ZT over conventional sowing (Rs./ha)	1100	1410	1750	2300	2590
16.	Total profitability gains with ZT over conventional sowing (Rs./ha) (11+15)	3450	4255	4865	5705	6395

kg. (2006-07 and 2007-08). Similar trend was also observed in saving of seed cost and it was Rs. 160, 225, 230, 345 and 390 respectively in years of study undertaken (Table 2).

Saving in irrigation: When sowing of wheat crop was done with zero tillage machine there was on an average 15-20% saving in first irrigation, it indicates an ample saving in irrigation water. This advantage may be further enhanced when sowing is done early i.e. just after harvesting of rice crop on residual moisture. In district Faridabad there is some area in catchment area of Yamuna and this area is low lying and water table is high. To overcome delay in sowing of wheat farmers go for sowing of wheat with ZT machine because if

they go conventional sowing than their sowing of wheat is delayed about 10-12 days. The total saving in cost of irrigation in ZT sown wheat over conventional sowing of wheat was Rs. 315, 430, 510, 560 and 605 per ha in respective years of study (Table – 2).

Gain in grain yield and total returns: It is clear from the table – 2 that the yield obtained from zero-tillage sowing of wheat is more than conventional sowing. Zero tillage sowing gave approx. 1.9 to 2.5 q/ha more yield over conventional sowing if we calculate monetary returns of this additional grain yield with Minimum Support Price (MSP) for respective years it comes out to be Rs. 1190, 1410, 1750, 2300 and Rs. 2590 per hectare in respective years of study. When we calculate

Table 3. Effect of sowing time on intensity of *phalaris minor* and grain yield of wheat

S. No.	Name of the Farmers	Sowing Date		Advancement in days over CT	P. Minor intensity (sq.m)		Yield (q/ha)		% increase in yield over CT
		ZT	CT		ZT	CT	ZT	CT	
1.	D. P	15.11.07	23.11.07	8 days	25	42	50.5	48.8	3.5
2.	B. S	12.11.07	21.11.07	9 days	22	36	53.3	50.7	5.1
3.	O.P.	9.11.07	11.12.07	12 days	35	48	44.7	42.5	5.2
4.	M. S	16.11.07	26.11.07	10 days	27	43	49.6	47.4	4.6
5.	M.Y	27.11.07	08.12.07	11 days	33	45	45.8	43.2	6.0

ZT = Zero-tillage sowing. CT=Conventional-tillage sowing.

Name of the Farmers & address : 1. Sh. Dharam Pal, Badshahpur, (Faridabad), 2. Sh. Bijender Singh, Kithwari, (Palwal), 3. Sh. Om Parkash, Katesra, (Palwal), 4. Sh. Mahabir Singh, Karnera, (Ballabgarh), 5. Sh. Mukesh Yadav, Manjhawali (Ballabgarh)

total returns in zero-tillage sowing over conventional sowing it comes out to the tune of Rs. 3450, 4255, 4865, 5705 and 6395 per hectare in respective years of study (Table 2). Thus, it clearly reveals that the zero-tillage technology is not only economical but also technologically feasible and viable in the Faridabad district of Haryana State where rice-wheat cropping system is widely adopted by resource rich and reasonable poor farmers.

Advantage in wheat sowing: During Rabi 2007-08 advancement in days with zero-tillage sowing over conventional sowing was surveyed and it was found that when crop was sown with ZT machine there was about 8-12 days advancement in sowing when we go for conventional sowing (Table 3).

Intensity of phalaris minor in zt sowing: The population of Phalaris minor weed was recorded less in zero-tillage sown plots as compare to conventionally

sown crop. Non disturbed soil condition did not provide favourable conditions to weed seed buried in soil to germinate. Though the intensity of Phalaris minor (Per sq. m) in ZT sown field and conventional sown field varied from location to location but in most of the cases number of weeds reduced considerably. The weed intensity was less in timely sown crop and more in late sown crop (Table 3).

Increase in grain yield : It is clear from the data that wheat crop sown with ZT machine gave higher yield over conventional sown wheat crop (Table 3). The percent increase in grain yield with ZT sowing over conventional sowing was in range of 3.5 to 6.0. (Table 3). The grain yield was less when sowing of crop was delayed i.e. Dec. and yield was superior when sowing was completed in the month of November. The results of this study are in line with the findings of studies conducted by Dwivedi (2005), Yadav et.al. (2005) and Malik (2008).

CONCLUSION

Although farmers and field functionaries of line department are positive in their attitude about this technology but more sincere efforts are needed for wider adoption of zero-tillage technology. All the agencies which are working for the upliftment of farming

community can play a vital role in educating the farmers about the resource conservation technologies in general and particularly zero-tillage technology. Farmers are of the view that this technology is acceptable to them because it is simple, economically, viable and eco-friendly.

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