RESEARCH PAPER International Journal of Agricultural Engineering | Volume 10 | Issue 2 | October, 2017 | 521-525
e ISSN–0976–7223 ■ Visit us : *www.researchjournal.co.in* ■ **DOI: 10.15740/HAS/IJAE/10.2/521-525**

Practicing farmer training on happy seeder: An effort for paddy residue management in Ambala district (Haryana)

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Received : 12.07.2017; **Revised :** 24.08.2017; **Accepted :** 10.09.2017

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■ **ABSTRACT :** Practicing farmers trainings were conducted in the then adopted village Landa in block of Barara of Ambala district in Haryana during 2012-13. During 2013-14 and 2014-15 these were conducted in village Spheda and Goli in the block of Ambala-II and Saha, respectively. The innovative farmers of the above villages were selected for conducting these demonstrations. The per cent reduction in weed population in the happy seeder sown crop over the farmer's practice was 24.49, 27.19 and 21.88, respectively during the demonstration period. The average grain yield of wheat in percentage was 9.09, 8.89 and 9.68 higher in happy seeder sown fields as compared to the conventional sown fields. In general Rs. 2920 per hectare was saved in happy seeder fields over farmer's practice for sowing of the fields. Due to reduced cost of cultivation and higher crop yield, the gross and net return was also higher in happy seeder as compared to the conventional sowing. The BCR was 3.74, 3.82 and 4.06 in happy seeder, which was higher than in conventional sowing 2.81, 2.85 and 3.01, respectively.

■ **KEY WORDS :** Wheat practicing farmer trainings, Happy seeder, Yield, Economics

■ **HOW TO CITE THIS PAPER :** Prem, Guru, Ahmad, Afzal, Singh, Vikram D. and Kumar, Ramesh (2017). Practicing farmer training on happy seeder: An effort for paddy residue management in Ambala district (Haryana). *Internat. J. Agric. Engg.*, **10**(2) : 521-525, **DOI: 10.15740/HAS/IJAE/10.2/521-525.**

Wheat (*Triticum aestivum* L.) is the second most important cereal in India after rice contributing substantially to the national food security by providing more than 50% of the calories to the people who mainly depend on it. The production level of wheat in India had a quantum jump from 6.46 million tones from an area of 9.75 million ha in 1950-51 to more than 93 million tones from an area of about 30 million hectares during 2011-12 (http://farmer.gov.in/imagedefault/pestanddiseasescrops/wheat.pdf). Haryana for instance is an important wheat-growing state in the country and produces 10.5 Mt of wheat with yield level of 4.21 tonnes per hectare (Anonymous, 2011). During its inception *i.e.* in 1966-67 the area and productivity was 0.7 m ha and 1.42 ton ha^{-1}, respectively. While it was 2.5 m ha and 4.45 ton ha^{-1} during 2012-13 (http://dwd.dacnet.nic.in/wheat_prod1/wheat-annx3.pdf and http://dwd.dacnet.nic.in/Publication/StatusPaper.pdf).

It is important to note that 58 per cent of cultivated area is under rice-wheat cropping system in Haryana. Out of total paddy area which is around 1.21 m ha, about 65% area of rice was under the cultivation of scented rice and 35% under non-scented rice varieties and hybrids during 2010-11 in the state (Anonymous, 2013). Scented rice varieties are harvested manually as its residue can be used as animal feed and avoid shattering losses during mechanical harvesting. Non-scented rice varieties and hybrids are harvested mechanically by means of combine harvesters.

Due to high silica content in rice straw in general and in straw or residue of non scented rice varieties and hybrids in particular, it is considered poor feed for animals. It also does not have other economic uses and remains unutilized. To vacate fields for the timely sowing of wheat, majority of the rice straw is burnt in situ by the farmers because residues interfere with tillage and seeding operations for the next crop. Burning of rice stubble is rapid and cheap option for farmer which causes a serious atmospheric pollution, as well as human health problem. Besides, it also results in the loss of plant nutrients and organic carbon of the soil and thus deteriorates the soil health and texture. Residue burning results in (a) losses of C (almost 100%) and nutrients (90% N, 60% S and 25% of each of P and K) (Dobermann and Fairhurst, 2002) and (b) emissions of greenhouse gasses (annual emissions of 110.00 2306.00, 2.00, and 84.00 Gg of CH_4, CO, N_2O and NOx, respectively Gupta *et al.*, 2004). In addition to the large inefficiencies, the conventional rice–wheat system is faced with widespread yield stagnation or decline, resulting in a serious threat to the sustainability of this important crop rotation (Ladha *et al.*, 2003).

Zero-till wheat has been adopted on a large area in the rice-wheat (RW) system in the north-west IGP with positive impacts on wheat yield, profitability, and resource use efficiency (Erenstein and Laxmi, 2008 and Ladha *et al.*, 2009). It has not been possible to manage crop residues in no-till systems with tine-type openers. Loose straw accumulates in the seed drill furrow openers, the seed metering drive wheel loses traction due to the presence of loose straw and the depth of seed placement is non-uniform due to frequent lifting of the implement under heavy trash conditions. The potential benefits of no-till can be fully realized only when it is practiced continuously and the soil surface should remain covered at least 30% by the previous crop residues. The use of new-generation planters (Happy seeder) will lead to wider adoption of conservation agriculture in the region (Sidhu *et al.*, 2007).

By knowing the fact that happy seeder has the potential to sow the wheat into the stubbles of paddy. This machine was managed through CSISA (Cereal System Initiative for South Asia) project which was then working at Karnal Hub (Haryana). Along with front line demonstrations (FLD), practicing farmer training was also imparted. As PF training is also an activity, which is conducted in a systematic manner in farmers' fields to show worth of a new practice/technology. Either "Seeing is believing" or "Learning by doing" is the basic philosophy of training. These trainings educate farmers through results obtained in terms of higher yields and economic gains in terms of net returns. The data were recorded during the study period for the following purposes:

- Comparison of the yield and weed count of happy seeder with the farmers practices.

- Economics of the happy seeder in comparison to farmer practice.

METHODOLOGY

The practicing farmer training was conducted in the then adopted villages Tangail, Mullana and Spheda in 2012-13, Goli and Khanpur in 2013-14 and Nagla-jattan and Pasiala in 2014-15 of Ambala in Haryana. The innovative farmers of the above villages were selected for conducting demonstrations through training. Several farmers put their fields under happy seeder for wheat sowing without burning residue. Plot size of 4000 m^2 was selected for happy seeder and conventional seeding of wheat. In plots with residue, the wheat was sown directly into the stubbles of paddy. In farmer practice/ conventional sowing the wheat was sown after burning of paddy residues + 2 disking + 2 cultivator + 2 planker + seed drill + planker. Sowing and other practices were followed as per the package of practices for *Rabi* crops recommended by the Punjab Agricultural University, Ludhiana. A seed rate of 100 kg/ha was used, with row spacing 20 cm, sowing depth 5-7 cm, half dose of nitrogen (50 kg N/ha) was applied (broadcasted) at time of first irrigation and a further 60 kg N/ha as urea was broadcasted with second irrigation to wheat. Weeds were controlled by spraying clodinafop 15 WP at 30-35 days after sowing.

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, maximum temperature of 38-42ºC in June, and relative humidity of 67 to 83 per cent throughout the year.. Conventional rice-wheat rotation was being followed on the field from last 15 years.

As HD-2967 was the most popular variety of wheat and all the farmers of three locations chosen the same for sowing. The sowing was done from 30th October to 3rd November during all the three years in case of wheat sown with happy seeder. In case of conventional sowing the wheat was sown from 7th to 12th November in the same period (Table 2.). The demonstrated fields were harvested in the month of April. Demonstrations at farmers' fields were regularly monitored by the scientists of Krishi Vigyan Kendra, Tepla from sowing to harvesting. The grain yield of demonstration as well as farmers field was calculated separately for economic comparison.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Weed count :

Data on weed count before the spray of herbicide collected from the happy seeder and farmer's practice sown wheat are depicted in the Table 1. The higher average weed count was recorded in conventional sowing 34.30, 21.70 and 22.40 with average value of 26.13 during three years, respectively. In case of happy seeder sown fields these were 25.90, 15.80 and 17.50 with average value of 19.73 during study period. The reduced weed population in the happy seeder sown crop could be due to the minimum disturbance of soil as well as by the mulching with paddy residue. Higher number of weed count in the conventional sowing plots may be due to pulverisation of soil, which created favourable conditions for germination of weeds. The per cent reduction in weed population in the happy seeder sown crop over the farmer's practice was 24.49, 27.19 and 21.88, respectively during the demonstration period. Such reduction of weed count in happy seeder sown and conventional sown practices were also reported by Singh *et al.* (2013a) and Singh *et al.* (2013).

Crop and straw yield :

The average grain yield of wheat (q ha^{-1}) in plots sown with happy seeder was 48.00, 49.00 and 52.10 with average of three year demonstration period was 49.70, respectively. Consequently, the conventionally sown farmer's field obtained 44.00, 45.00 and 47.50 with average of 45.50 three year, respectively. The average grain yield of wheat in percentage was 9.09, 8.89 and 9.68 higher in happy seeder sown fields as compared to conventional sown fields (Table 1). Singh *et al.* (2013b) observed that it might be due to the higher number of tillers per plant and ear length. Secondly, it could be due to the presence of paddy straw on the soil surface, which resulted in more availability of moisture for longer period during the growing season.

The straw yield of wheat was also higher in case of wheat sown with happy seeder as compared to the conventional sown wheat. The average straw yield (q ha^{-1}) was 54.24, 53.90 and 59.92, respectively in happy seeder sown wheat, which was 12, 10 and 15 per cent higher than in the conventional sown plots. We also observed that happy seeder own fields have 8-11 days more field duration due to 6-9 days early sowing and 1-2 days late harvesting in same (Table 2). It would be the reason for the higher grain as well as straw yield in happy seeder fields than in conventional sown fields.

Table 1 : Sowing, harvesting date and field duration of the crop

Year	Sowing date		Harvesting date		Field duration (days)	
	H.S.	C.S.	H.S.	C.S.	H.S.	C.S.
2012-13	30 Oct. to 3 Nov.	10 to 12 Nov.	11 to 14 April	10 to 14 April	160-165	151-155
2013-14	31 Oct to 2 Nov.	7 to 9 Nov.	12 to 16 April	11 to 14 April	161-166	153-157
2014-15	31 Oct to 3 Nov.	9 to 11 Nov.	11 to 15 April	10 to 14 April	159-165	151-156

Table 2 : Crop yield, weed count under happy seeder and conventional sowing

Year	No. of demo	Area (ha)	Crop yield (qtl/ha)		Increase (%)	Avg. weed count m^{-2}		% reduction in count
			H.S.	C.S.		H.S.	C.S.	
2012	15	6	48.00	44.00	9.09	25.90	34.30	24.49
2013	15	6	49.00	45.00	8.89	15.80	21.70	27.19
2014	15	6	52.10	47.50	9.68	17.50	22.40	21.88
Avg.	15	6	49.70	45.50	9.22	19.73	26.13	24.52

Table 3 : Economic analysis during three years

Year	Straw yield (qtl/ha)		Cost of cultivation (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		BCR	
	H.S.	C.S.	H.S.	C.S.	H.S.	C.S.	H.S.	C.S.	H.S.	C.S.
2012	54.24	47.52	20250	24500	75648	68904	55398	44404	3.74	2.81
2013	53.90	48.15	21000	25700	80189	73352	59189	47652	3.82	2.85
2014	59.92	50.83	22000	26800	89325	80565	67325	53765	4.06	3.01
Avg.	56.02	48.83	21083	25667	81721	74274	60637	48607	3.87	2.89

Table 4: Particulars showing details of front line demonstration and local check

Particulars	Happy seeder	Conventional sowing
Residue burning	No	Yes
Variety	HD 2967	HD 2967
Seed rate (kg ha^{-1})	100	125
Sowing method	Direct drilling into stubbles of paddy without tillage	Conventional tillage *i.e.* 2 disking + 2 cultivator + 2 planker + seed drill + planker
Avg. cost on field preparation/sowing (Rs. ha^{-1})	2100.00	5100.00
Line spacing	20 cm	20 cm
Tractor hours for sowing one ha	2.50	5.20
Cost on Rodenticide	80.00	-
Saving on sowing (Rs. ha^{-1})	2920.00	

Economics :

The cost of cultivation (Rs. ha^{-1}) from 2012 to 2014 was 20250, 21000 and 22000, respectively in happy seeder sown wheat. While it was 24500, 25700 and 26800 in conventionally sown fields (Table 3.). Particularly in conventional sowing due to more number of tillage operations, the cost of sowing in conventional sown field was 5100 Rs. ha^{-1} and it was quite less *i.e.* 2100 in happy seeder sown fields. In general Rs. 2920 per hectare was saved in happy seeder fields over farmer's practice. Due to reduced cost of cultivation and higher crop yield, the gross and net return was also higher in happy seeder as compared to the conventional sowing. The BCR was 3.74, 3.82 and 4.06 in happy seeder, which was higher than in conventional sowing 2.81, 2.85 and 3.01, respectively.

Constraints :

It involves large capital cost to buy a happy seeder worth Rs. 1.3 lac and less efficiency *i.e.* 5 acres/day along with narrow sowing window for wheat. Till date very few combines have attachment of PAU super straw management system. This system involves chopping and even distribution of the loose straw, which ease in sowing with happy seeder (Anonymous, 2017).

Conclusion :

Recent developments in machinery (Happy seeder) allowing zero-till sowing of wheat with rice residue as surface mulch, while maintaining yield, reduced tillage costs and time savings, avoids the need for burning. Experts such as Singh and Sidhu (2014) also summarised that in intensive irrigated rice wheat cropping system of north-western and central IGP, zero-till wheat planting under rice straw mulch is spreading, with significant savings on farm energy use, cost of cultivation, and irrigation water use; increased wheat productivity and profitability; and improved soil and environmental quality.

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