EVALUATION OF HAPPY SEEDER AS RESOURCE CONSERVATION TECHNIQUE IN LUDHIANA DISTRICT OF PUNJAB, INDIA

Devinder Tiwari, Harshneet Singh Sran[1], Karun Sharma, S C Sharma and Rajbir Singh[a2]

ABSTRACT

Declining water table in the Punjab State demands for development of new technologies and agronomic practices in order to enhance the water use efficiency for cultivation of different crops. Wheat being major cereal *Rabi* crop grown in more than 80 per cent of the cultivable area and require 4-5 irrigations. The first irrigation is generally applied at 20-25 days after sowing and subsequent irrigations are applied at 30-35 days interval. The requirement of water for the wheat crop varies from 210-350 mm depending upon the soil type, date and method of sowing 'rainfall etc. After harvesting paddy, wheat crop is needed to be sown in window of 15-20 days. Due to this shorter span of wheat sowing majority of the farmers in the state resort to burn paddy straw for early clearance of the fields. To tackle the issue of stubble burning a technology was required for in-situ residue management and timely sowing of the crop. Among various *in-situ* residue management technologies, Happy Seeder technology had a major breakthrough due to its rapid expansion in the past two years. Present study was conducted in four adjoining villages of Ludhiana district of Punjab *viz* Begowal, Lall Kalan, Mallipur and Araichan, where the technology was rapidly adopted in recent years. The aim of the study was to assess the economic viability, conservation soil and water resources, impact and prospects of Happy seeder technology in the state. The responses of 150 farmers showed that this technology was easy to operate, environment friendly and economical (saving Rupees 3500/- per ha). Majority of the farmers (65%) also acclaimed that there was saving of one irrigation (70 mm) under this technology in comparison to conventional sowing. Thus average water requirement for wheat crop under this technology was lesser i.e. 215 mm as compared 285 mm required in conventional sowing. It was also found that sowing of wheat with Happy Seeder resulted in rejuvenation of soil micro-flora and fauna, reduction of weeds especially the obnoxious *Phalaris minor* to an extent of 62 percent and better crop health as compared to conventionally sown ones. However, the long-term impacts of this technology on conservation of natural resources (water and soil), flora and fauna, role of civil society in rapid adoption of technology, technology contribution towards poverty alleviation etc. needs to be further explored.

Keywords: Natural Resource Conservation, Happy Seeder Technology, Crop Residue Management

1. INTRODUCTION

Paddy-Wheat cropping system is major cropping system of Punjab. Intensive cropping system and use of high yield varieties has resulted in production of huge quantities of crop residue. With the introduction of combines, more than 90 per cent of paddy-wheat area is harvested by the combine harvesters thus generate 20 million tonnes of paddy straw. This use of combine harvesters on large scale was found to be an important determinant factor of farmers' decision to burn on field rice residues (Gupta 2010). Further long duration varieties having heavy straw load, occupying

[1] *Krishi Vigyan Kendra Ludhiana
[2] [a]ICAR-Agricultural Technology Application Research Institute, Ludhiana

significant area in the state poses major challenge for the farmers to dispose off left over straw. In-situ incorporation of such a large quantity of residues is energy intensive, costlier and time consuming affair (Yadvinder-Singh *et al.* 2010). Due to shorter time span (10-15 days) between harvesting of paddy and sowing of next wheat crop, high input cost for incorporation, non availability of efficient residue management machinery with the farmers, lack of proper enforcement of law to check burning, the farmers of the state resort to burn the crop residue for early clearance of fields. Such residue burning causes substantial environmental pollution, burning of roadside vegetation, road accidents etc. Polluted air also poses detrimental effects to human and animals health; especially to children and old age people. This practice of burning also contributes towards green house gases emission (Gujral *et al.* 2010). Besides these environmental and human health issues this practice also results in deterioration of soil health, loss of plant nutrients, organic carbon of the soil etc. As per estimates one tonne of straw contain approximately 400 kg of organic carbon, 5.5 kg of Nitrogen, 2.3 kg of P_2O_5, 25 kg of K_2O, 1.2 kg of S and 50-70 per cent of micro nutrients are lost through straw burning thus costs more than Rs. 200 crores (Sidhu *et al.* 2007).

To tackle the issue of stubble burning a technology was required for in-situ residue management and timely sowing of the next wheat crop. Among various in-situ residue management technologies, Happy Seeder technology had a major breakthrough due to its rapid expansion in the past two years. This machine combines both the function of stubble mulching and seed drilling. It consists of a rotor mounted with the gamma type blades for managing the paddy residues and a zero till drill for sowing of wheat. Happy seeder cuts the standing stubbles/loose straw coming in front of the sowing tyne and clean each tyne twice in one rotation of rotor for proper placement of seed in soil. The rotor blades push the residues as surface mulch between the seeded rows (Singh *et al.* 2013).

Research studies conducted in the past also indicate that use of happy seeder for wheat sowing results in saving of time, fuel and money and also there are better grain yield results (Singh *et al.* 2013) and saving of irrigation water (Kaur *et al*. 2016) as compared to conventional sowing.

Keeping in view the above benefits, the present study was planned to assess the economic viability, conservation soil and water resources, impact and prospects of happy seeder technology in Ludhiana district of the state.

2. METHODS

The study was conducted in four adjoining villages of Ludhiana district of Punjab *viz* Begowal, Lall Kalan, Mallipur and Araichan, where the technology was rapidly adopted by the farmers in recent years. A sample of 150 farmers who have adopted this technique were randomly selected from these villages through probability proportional to size sampling method. A well structured interview schedule was used to record the responses from these sampled farmers. In addition random selection of 25 plots each of happy seeder and convention method of sowing was made for physical observation on various agronomic and plant parameters such as plant height, number of effective tillers, grain quality, weed count, irrigations, grain yield applied and economic analysis in comparison to conventional practice.

3. RESULTS AND DISCUSSION

The data presented in Table 1 shows the response of respondents regarding benefits of using happy seeder technology. More than 90 per cent of the farmers considered happy seeder technology labour saving, time saving and eco-friendly. Majority of the

farmers also considered happy seeder technology economical as wheat sowing with happy seeder not required any field preparation. Approximately 2/3rd respondents (65%) also acclaimed that there was saving of one irrigation (70 mm) under this technology in comparison to conventional sowing. Ease of operation, lesser requirement of weedicide sprays, low percentage of lodging, better grain and straw quality were the other benefits reported by the farmers.

Table 1. Distribution of respondents according to benefits availed by the respondents for sowing of wheat with happy seeder

(n= 150)

Sr. No.	Parameters	Frequency (%)
1.	Ease of operation	84 (56.0)
2.	Environment friendly	148 (98.7)
3.	Economical	128 (85.3)
4.	Time saving	135 (90.0)
5.	Water saving	118 (65.0)
6.	Labour saving	143 (95.3)
7.	Less weedicide load	109 (72.7)
8.	Lesser lodging of crop as compared to conventional sowing	112 (74.7)
9.	Better grain and straw quality	78 (52.3)
10.	Better yield	79 (52.7)

Table 2: Comparative evaluation of different methods of wheat sowing on agronomic and plant parameters

Parameter	Method of sowing	
	Happy Seeder (Mean±SD)	Conventional Method (Mean±SD)
Plant height (cm)	98.5±2.2	98.0±2.3
No of tillers/m row	117.2±2.6	113.0±4.0
Ear length (cm)	11.8±0.3	11.5±0.4
1000 grain weight (gm)	46.2± 0.7	45.7± 0.5
Weed count per sq m	25.4±5.6	56.7±8.4
Irrigation water requirement (mm)	215±33.2	285±40.9
Days to maturity	162±6	156±4
Yield (q/ha)	53.2±2.6	51.4±4.1

The data presented in Table 2 compares agronomic and plant parameters under different wheat sowing techniques. The observations show that wheat sowing with happy seeder is better in every aspect as compared to the conventional method of sowing. The average plant height of happy seeder was found to be comparable (98.5 cm) with conventional method sown wheat crop (98.0 cm). As far as numbers of effective tillers are concerned, these were found to be more per meter row length under happy seeder sown wheat (117.2) as compared to conventional method

(113.3). This might be attributed to more row to row spacing (22.5 cm) in happy seeder sown plots as compared to conventional sown plots (17.5 cm or less). The average ear length was 11.8 cm and 11.6 cm for happy seeder and conventional method respectively. The data on grain quality parameters (1000 grain weight basis) shows that under happy seeder sown plots bolder size grains were obtained as compared to conventional method sowing. It was also observed that the crop sown with happy seeder machine took 7-10 days more towards maturity then conventional sown wheat. This can be attributed to higher soil moisture content and longer period of availability of soil moisture in straw retaining fields.

The average water requirement for wheat crop under this technology was lesser i.e. 215 mm as compared 285 mm required in conventional sowing. The lesser water requirement in happy seeder can be attributed to the mulching effect provide by the loose retained in the field. Su et al, 2007 also observed that straw mulch act as shield against evaporation which further disconnects the capillarity of the subsoil, thereby reduces soil water evaporation, which results in improvement in soil water condition. Higher soil moisture content in Happy Seeder Sown wheat reduce the demand of irrigation thus saving about one irrigation on an average as compared to conventional method of wheat sowing.

It was also observed that presence of loose paddy straw as mulch and no tillage in happy seeder sown fields suppresses the germination of weed seeds and growth of weeds particularly Phalaris minor. Lower population of weeds was observed in Happy Seeder sown wheat (25.4 weeds per m^2) than in conventional tillage plots (56.7 weeds per m^2). The lower weed count in happy seeder sown plots can be attributed to smothering and allelopathic effect of mulch. These findings can be supported by the observation of Rahman *et al.* (2005) in which he observed that rice straw mulching has a significant effect on moisture conservation and weed growth suppression in no-till wheat fields. According to Kamara *et al.* (2000) presence of mulch on the surface affects light interception and limits weed development as a result of reduced photosynthesis.

The in table showed that grain yield in wheat sown with happy seeder was higher as compared to conventional method. Mean yield of Experimental sites in 8 villages was 53.2 q/ ha which was 3.5 % higher than conventionally sown wheat (51.4 q/ha)

Table 3: Comparison between happy seeder and conventional sown wheat plots on the basis of resources employed by the farmers in terms number of tillage operations, time, energy (fuel), number of weedicide sprays and money

(n=150)

Parameter	Method of sowing		Difference
	Happy Seeder	Conventional Method	
Number of tillage operations required for wheat sowing	1-2	6-8	7
Time required (min/ha)	95	220	125
Energy / Fuel used (litre/ha)	9.0	25.5	11.5
Number of Weedicide sprays	1	2-3	1-2
Money spent (Rs./ ha)	2411	5906	3495

As shown in Table 3 that wheat sowing with happy seeder reduces at least 6-7 tillage operations as compared to the conventional method of sowing. Reduced number of operations results in saving of time under happy seeder sowing (95 min/ha) as compared to the conventional method of sowing (220 min/ha) as minimum/no tillage

operations is required. There is saving of 11.5 L of diesel under happy seeder sown wheat in comparison to conventional sowing. Reduction of weed flora due to mulching effect under happy seeder sown plots requires lesser number of weedicide sprays (1-2) thus further reduces the cost of production. The similar results were reported by (Meenakshi 2010).

The responses from 150 farmers further showed that on an average there was saving of approximately Rupees 3500/- per ha under happy seeder sown wheat then the conventional method.

CONCLUSION

From the findings of the above study it is concluded that wheat crop sown with happy seeder requires less time, energy and money without compromising on yield. Retention of moisture, suppression of weed flora and in-situ management of paddy straw makes the happy seeder technology environment and farmers friendly. However, the long-term impacts of this technology on conservation of natural resources (water and soil), flora and fauna, role of civil society in rapid adoption of technology, technology contribution towards poverty alleviation etc. needs to be further explored.

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