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Assessment of Happy Seeder for Direct Sowing of Wheat without Burning of Rice Residue

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Air pollution from crop residue burning in India is an environmental menace that makes headlines every year – is a major ill effect of farm mechanization. Keeping the severity of the problem in view, KVK, Rohtas introduced happy seeder in Rabi 2016-17 with objective to assess its suitability for crop residue management. The intensively cultivated irrigated rice–wheat area is fundamental to employment, income and livelihoods for about three million population of the district. Happy seeder of Kamboj make, Zero-till machine of National make and local made seed drill were used for comparative study of residue management. Seed drill was used where rice residue were completely burned before sowing. Zero-till machine was used where about 50% residue was remais after buring. The significant change were observed in plant population, bundel weight and grain yield in these trials with respect to farmers practice. It is concluded that happy seeder not only improves the farmers income but also conserve the most of the production inputs. Reduction in green house gass emission, nutrient recycling, soil health improvemnt are added advantages of happy seeder technology.

Keywords: Happy seeder; rabi; zero-till machine; rice residue; air pollution.

1. INTRODUCTION

Air pollution from crop residue burning in India – an environmental menace that makes headlines every year – is a major ill effect of farm mechanization. India is an agrarian state with diverse farming practices according to agro-climatic zones. Large amount of husk and other

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biomass is also generated after farm yield processing in the agro industries. The agricultural residue mainly leaves and stubbles are utilized as animal fodder, roofing and shedding of homes, cattle shed, domestic usage fuel and small scale industries raw material and fuel [1]. Mechanized harvesting leaves residues in the field in the form of stalks, stubbles, and straws that are burnt by the farmers to clear the field for the next crop. Biomass burning after harvesting for wheat (during April-May) and rice (during November- December) is a recurring problem. India, the second largest agro-based economy with year-round crop cultivation, generates a large amount of agricultural waste, including crop residues. In the absence of adequate sustainable management practices, approximately 92 seems a very small number of metric tons of crop waste is burned every year in India, causing excessive particulate matter emissions and air pollution [2]. The problem becomes severe in winters when large parts of northern India choke on smog and haze triggered by large scale crop residue burning. The multitude of agricultural activities increases the amount of agro-products produced and this has led to an overall increase in environmental pollution and waste generation. The nature of the activities deployed, and the waste generated depends on the geographical and cultural factors of a country [3-5]. Besides air pollution, it also affects soil health and water quality. The problem is severe in irrigated agriculture, particularly in the mechanized rice-wheat system. The main reasons for burning crop residues in field include unavailability of labour, high cost in removing the residues and use of combines in rice-wheat cropping system. Farm residues blazing emit a high magnitude of air pollutants like N_2O, CO_2, CH_4, CO, NH_3, SO^2, Hydrocarbons, VOCs and suspended particulate matter at a diverse pace which is observed in any grassland or forest fire because of separate composition of the farm residues and burning forms [6,7].

Rice–wheat cropping system is the major agricultural production systems of Rohtas district, occupying about 1.95 lakh ha (78% of cultivable land , of which 1.5 lakh ha(62% of cultivable land) are in the Sone canal command area (assured irrigation). This intensively cultivated irrigated rice–wheat area is fundamental to employment, income and livelihoods for about three million population of the district. Rohtas stands first in production and productivity of rice in Bihar (contributes 6.1% in total rice area and 11.2% in total rice production of Bihar) and produced 6.2 per cent of total state wheat production (1st position) in 6.2 per cent of wheat cultivated area of state in year 2015-16 (Economic Survey of Bihar 2016-17).

The nexus of assured canal irrigation, long duration paddy variety (MTU-7029), migration of labourers from agriculture, heavy soil, very short window for wheat sowing, clogging of zero-tillage machines in residue laden field and ever increasing dependency on combine harvesters compels the farmers to go for open field crop residue burning. Dei et al. estimated the crop residue generation and utilization in Rohtas district and given in Table 1. Increased uncertainties of the monsoon rains is leading to late release of canal water to the command areas where rice is the pre dominant crop thriving on the irrigation needs [8,9].

About 25% of nitrogen, 25% phosphorus, 50% of sulphur and 75% of potassium uptake by cereal crops are retained in residues, making them valuable sources of nutrients which on burning, lost entire amount of C, 80% of N, 25% of P, 50% of S and 20% of K present in straw

Table 1. Status of annual residue generated and utilized in Rohtas District

Sl. No	Particulars	Crop	Acreage, ha	Residue productivity (t/ha)	Residue produced (t)
1.	Residue generated	Paddy	195000	9.0	1755000
		Wheat	155000	4.0	620000
		Gram	3607	1.5	5410.5
		Lentil	5225	1.0	5225.0
		Mustard	1500	4.0	6000
		Khesari	4871	1.5	7306.5
		Red Gram	496	3.0	7306.5
		Total			**2401422**
2.	Residue utilized as fodder	Total number of animal (Cow+ buffalo)			575000
		Fodder requirement @7 kg/animal/day			1459000
3.	Surplus residue				942422

(MNRES-2009). Keeping the severity of the problem in view, KVK, Rohtas introduced happy seeder in Rabi 2016-17 with objective to assess its suitability for crop residue management. happy seeder can plant wheat crop without land preparation in standing rice stubbles with uniform drilling of seed and fertilizer in single pass. It conserve irrigation water as chopped residue lyes over the field surface and works as a mulch. This mulch controls weed infestation and improes soil fertility and micro-environment without distrubing the environment.

2. MATERIALS AND METHODS

Happy seeder of Kamboj make, Zero-till machine of National make and local made seed drill were used for comparative study of residue management. Seed drill was used where rice residue were completely burned before sowing. Zero-till machine was used where about 50% residue was remais after buring. Happy Seeder was used for wheat sowing in full residue condition i.e. without any burning of crop residue. Seed rate of wheat was kept 125 kg/ha. Wheat variety HD-2976 was used in all trials. Fertilizer rate was kept 120:60:40(N:P:K, urea and MOP was used in all trials. No of irrigation were kept 3 in all cases. Seven farmes of three village were selected having plot size of 0.5 acre in each trials. All sowing was done in first week of December. Yield and yield attributing characteristics were recorded by using a meter quadrent for Rabi 2016-17 and 2017-18. Plant population fifteen days after sowing was counted in all trials at three different randaom location and averaged to get the value at each trials. Data of each sites were averaged before taking for statistical analysis. Data analysis was done with the help of MS-excel package available with MS-office software.

3. RESULTS AND DISCUSSION

These trials were carried out at seven farmers field in both the years. Results of yield and yield attributing charactrisitcs are given in Table 2. This Table sows that the significant change were observed in plant population, bundel weight and grain yield in these trials with respect to farmers practice.

Table 2. Statistical table of yield and yield attributing charactrisitcs

Treatmants	Plant population 15 DAS (m^2)	No of effective tiller (m^2)	No of grain per ear	Bundel weight (kg/m^2)	Yield (kg/ha)	Test weight (gm)
Seed drill	99.46*	194.87	74.44	1.152	5084	34.63
Zero-till	96.84*	202.07	73.96	1.283*	5402*	35.57
Happy seeder	83.22	199.40	76.31	1.361*	5593*	36.79
CD at 5%	9.06	8.34	3.13	0.018	0.004	0.068

Table 3. Economic analysis of the treatments

Treatmants	Cost of cultivation	Gross return	Net return	B:C ratio
Seed drill	38920	93546	64626	2.40
Zero-till	35640	99728	74088	2.79
Happy seeder	34360	102911	78551	2.99

Economic analysis of the treatments is given in Table 3. This table shows that the maximum economic return was obtained in happy seeder sown wheat. This is because of organic mulch of crop residue mitigate the effect of weed infestation, temprature stress, water stress and terminal heat.

4. CONCLUSION

It is clear from the above discription that happy seeder not only improves the farmers income but also conserve the most of the production inputs. Reduction in green house gass emission, nutrient recycling, soil health improvemnt are added advantages of happy seeder technology. Requirement of heavy tractor and limiting operating condition(in fogy days operation of happy seeder become difficult) in the month of December. For wide spread of technology it should be promoted through custom hireing centres and huge subsidy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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