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Impact of different sowing methods and crop residue management on yield and economics of wheat in Punjab

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Abstract
A field experiment was conducted during *Rabi* season 2020-21 at Experimental farm of University Institute of Agricultural Sciences, Chandigarh University, Gharuan (Mohali) to study the impact of different sowing methods and crop residue management on yield and economics of wheat in Punjab. The experiment comprised of 7 treatments of different combinations of sowing methods and crop residues *viz*. mould board plough + crop residue, zero tillage + crop residue, dibbler + crop residue, happy seeder + crop residue, rotavator + crop residue, seed drill + crop residue and control. The experimental design was RBD (Randomized block design) with three replications. Results revealed that yield attributes, grain yield and straw yield of wheat were increased with the use of mould board plough + crop residue. The yield attributes and yield of the crop were highest with the use of mould board plough + crop residue. Sowing method (mould board plough) and crop residue management significantly increased the grain yield of wheat over untreated plot (control) by 48.85 per cent. Mould board plough + crop residue recorded maximum net returns per rupee invested (1.31) over control (0.51).

Keywords: crop residue, dibbler, mould board plough, sowing methods, zero tillage

Introduction

Wheat (*Triticum aestivum*) is second most important cereal crop in the world after rice and is one of the most important stable food crop. The most common type of cultivated wheat species is *T. aestivum*. Asians prefer *T. aestivum* species and is called as common bread which can be utilized for making bread, roti and bakery items. The straw can be utilized as animal food or as mulch. The crop provides proteins, carbohydrates and many more nutrients and vitamins which help the dietary cycle of human beings. India is one of the country which produce wheat and is at second in position after China in case of the production. There are many states in the country which produces wheat crop which includes Punjab, Haryana, UP, MP, Rajasthan and so on. Among the states Punjab has the maximum productivity of wheat in the country. Crop residue management is one of the major task in case of cultivation and this is the same problem which is there in Punjab and Haryana Regions. It is not possible to spend a huge amount of money for the management of crop residues by the small and marginal farmers. For them the cost of cultivation is a burden and hence they prefer burning of straw than any other crop residue management method. Crop residue management can be done by following different methods such as crop residue removal, crop residue burning and crop residue incorporation. The burning of straw causes environmental pollution and which leads to increase in greenhouse gases such as CO_2, methane and CFC. Another method of residue management is crop residue incorporation in to the soil. The concept is returning the residue from the origin to promote source of organic matter and is a way to increase soil physical properties such as water holding capacity and overall quality. Using crop residue as incorporation is one of the best management practices. The application of crop residue in to the field may affect the soil fauna and flora which regulates the soil health. Each and every management practice is important for the crop production to achieve desirable yield without causing large energy consumption. The optimum amount of seed rate is to be used for the maximum plant growth and development. If proper method of sowing is utilized, the optimum plant population can be maintained. Even if one gives the maximum effort in crop production and ignoring the sowing techniques, the predictable yield cannot be produced. if the optimum seed rate is maintained, it enhances the resource availability, sunlight uptake, moisture content, nutrient availability and proper root and shoot growth from the early stages of the plant growth (Harishankar, 2017) [6]. The different methods of sowing include line sowing, dibbling, drilling, sowing behind the plough, broadcasting and transplanting. There are many studies regarding the application of crop residues in the soil and all of them suggests that application of crop residues along with the manure and fertilizer application increases not only the yield of the crop but also encourages the soil physio-chemical and biological properties. The incorporation of crop residues followed by reduced tillage also improves the soil fertility status and crop yield. The best sowing method followed by the best crop management activities gives the great production and productivity in any crop. Keeping all these facts in view, the present investigation was undertaken to find the impact of different sowing methods and crop residue management on yield and economics of wheat in Punjab.

Material and Methods

The experiment was conducted at Experimental farm of University Institute of Agricultural Sciences, Chandigarh

University, Gharuan (Mohali) during *Rabi* season of 2020-21 to examine the impact of different sowing methods and crop residue management on yield and economics of wheat in Punjab at an altitude of 309 meters above sea level in the semi-arid, sub-tropical latitude 30º7' N and 76º5' E longitude. The soil of the experimental site was clay loam in texture and nearly neutral in reaction. The soil was low in organic carbon and available nitrogen, medium in available phosphorus and available potassium. The experiment was laid out in Randomized Block design with three replications having seven treatments of different combinations of sowing methods and crop residue management *viz.* mould board plough + crop residue, zero tillage + crop residue, dibbler + crop residue, happy seeder + crop residue, rotavator + crop residue, seed drill + crop residue and control. The layout of experiment was carried out manually and plots were prepared and then levelled. Wheat variety "Unnat PBW-343" was sown using seed rate of 100 kg ha^{-1} in first week on well prepared seed bed in December, 2020. The recommended dose of NPK in wheat crop used was 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} in irrigated condition, respectively. Half dose of nitrogen and whole P_2O_5 and K_2O were incorporated in soil, as per the treatments, as basal dose and remaining half dose of nitrogen was top dressed at tillering stage of the wheat crop interculture, weeding and other palnt protection measures are done according to the need. To obtain the true treatment effects, four outer rows (two on each side) and 0.25 m on either side of each row were removed and then net plot of 6.0 m x 2.5 m was harvested with the help of combine.

Result and Discussion

Yield attributes of wheat

The perusal of data presented in Table 1 revealed that the maximum number of effective tillers were found in mould board plough + crop residue (270.33) followed by dibbler + crop residue (265.25). The lowest number of effective tillers m^{-2} (244.40) was found in control. This might be due to the fact that addition of crop residues in to a deep ploughed soil which positively affect the crop growth by increasing the bulk density, porosity and microbial growth of soil. Similar results were found by Anand *et al* (2020) [2]. The highest length of spike was found in mould board plough + crop residue (11.74) which was statistically at par with dibbler + crop residue (11.28) and seed drill + crop residue (10.85). This might be due to the application of crop residue as it increases the uptake of nutrients by increasing the holding capacity of soil. The water holding capacity and nutrient holding capacity of the soil will be improved by the addition of crop residue in the soil. This can help the crop to attain its growth and yield to the maximum as it gets nutrients when required than leaching out from the soil un-utilized. The result was in accordance with (Hemmat and Eskandari, 2006) [7]. Maximum number of grains $spike^{-1}$ was found in mould board plough + crop residue (54.25) followed by dibbler + crop residue (51.65). The lowest number of grains was found in control (48.70). These results are in accordance with Anand *et al* (2020) [2] who reported that mould board ploughing will increase the yield attributes of wheat like number of grains $spike^{-1}$. Different treatments on sowing method and crop residue management had no significant effect on 1000 grain weight of wheat crop. However, mould board plough + crop residue (44.48 g) had maximum weight of 1000 seeds. (Fischer *et al*, 2002) [4] also found that 1000 grain weight was not affected by the crop residue management as well as the tillage operations.

Yield of wheat crop

Grain yield, straw yield, biological yield and harvest index of crop was evaluated and presented in the Table 2. Results revealed that highest grain yield was found in mould board plough + crop residue (4153 kg ha^{-1}) which was at statistically at par with dibbler + crop residue (3948 kg ha^{-1}). The lowest grain yield was found in control (2790 kg ha^{-1}). The grain yield in mould board plough + crop residue was 5.19 percent more than dibbler + crop residue. Seed drill + crop residue also showed 33.51 per cent increase in grain yield than control. Strudley *et al* (2008) [8] reported that mould board plough increases the grain yield by increasing the soil properties while, Usman *et al* (2014) [9] concluded that the application of crop residue also improves the yield of the crop. Gautam *et al* (2020) [5] also reported that highest grain yield was found in residue incorporation + mould board plough compared to other traditional methods. Hence, it can be concluded that both mould board plough and residue management might be the reason for the increase in grain yield. The maximum straw yield was found in mould board plough + crop residue (6694 kg ha^{-1}). The lowest straw yield among all the treatments was found in control (5091 kg ha^{-1}). This might be due to the fact that the higher nitrogen dynamics through crop residue and the loosen soil through mould board plough results in highest straw yield. Similar findings were also reported by (Chen *et al* 2014) [3].

Biological yield was affected significantly by different types of sowing methods and by residue management. 37.6 per cent biological yield was increased by mould board plough + crop residue than control. (Ahmad *et al* 2018) [1] also found that the biological yield of the wheat crop was significantly affected by mould board ploughing at the time of sowing. Harvest index did not significantly increased by the effect of sowing methods and crop residue management.

Economics

Data presented in Table 3 revealed that maximum cost of cultivation was incurred under happy seeder + crop residue (Rs 51344 ha^{-1}) as compared to the lowest cost of cultivation incurred under control (Rs 55144 ha^{-1}). The cost of cultivation while using mould board plough + crop residue was less compared to other best treatments such as dibbler + crop residue (Rs 58244 ha^{-1}) and seed drill + crop residue (Rs 58844 ha^{-1}). Mould board plough + crop residue gave significantly higher gross returns (Rs 118847 ha^{-1}) as compared to control (Rs 83108 ha^{-1}). Dibbler + crop residue also had best gross returns comparatively (Rs 113858 ha^{-1}). Mould board plough + crop residue recorded significantly higher net returns (Rs 67503 ha^{-1}) as compared to control (Rs 27964 ha^{-1}). Dibbler + crop residue also had best net returns comparatively (Rs 55614 ha^{-1}). Mould board plough + crop residue had been maximum net returns per rupee invested (1.31) over control (0.51). Among other treatments, happy seeder + crop residue (1.05) and rotavator + crop residue (1.03) also had better net returns per rupee invested.

Conclusion

The yield attributes and yield of the crop was highest in mould board plough + crop residue treatment. The highest grain yield was found in mould board plough + crop residue which was statistically at par with dibbler + crop residue.

Mould board plough + crop residue had maximum net returns per rupee invested over control. Among other treatments, happy seeder + crop residue and rotavator + crop residue also had better net returns per rupee invested.

Table 1: Effect of treatments on yield contributing characters of wheat

Treatments	No. of effective tillers m^{-2}	Spike length (cm)	No. of grains $spike^{-1}$	1000 grain weight (g)
Mould board plough + crop residue	270.33	11.74	54.25	44.48
Zero tillage + crop residue	249.27	9.42	49.88	40.80
Dibbler + crop residue	265.25	11.28	51.65	43.13
Happy seeder + crop residue	256.09	10.17	50.74	42.05
Rotavator + crop residue	255.67	10.04	50.10	41.87
Seed drill + crop residue	260.39	10.85	51.40	42.60
Control	244.40	8.67	48.70	38.56
SEm (±)	1.60	0.39	0.54	1.44
CD (P=0.05)	4.92	1.21	1.67	NS

Table 2: Effect of treatments on yield of wheat

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index
Mould board plough + crop residue	4153	6694	10848	0.38
Zero tillage + crop residue	3568	6152	9720	0.37
Dibbler + crop residue	3948	6526	10473	0.38
Happy seeder + crop residue	3725	6334	10059	0.37
Rotavator + crop residue	3641	6271	9912	0.37
Seed drill + crop residue	3813	6459	10272	0.37
Control	2790	5091	7881	0.35
SEm (±)	76	82	88	0.01
CD (P=0.05)	233	251	272	NS

Table 3: Effect of treatments on economics of wheat

Treatments	Cost of Cultivation (Rs ha^{-1})	Gross returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	Net returns per rupee invested
Mould board plough + crop residue	51144	118847	67703	1.32
Zero tillage + crop residue	52144	104311	52167	1.00
Dibbler + crop residue	58044	113858	55814	0.96
Happy seeder + crop residue	52744	108406	55662	1.06
Rotavator + crop residue	52144	106394	54250	1.04
Seed drill + crop residue	58644	110838	52194	0.89
Control	54944	83108	28164	0.51
SEm (±)		1391	1391	0.03
CD (P=0.05)		4287	4287	0.08

References

1. Ahmad S, Shafi M, Ullah I, Rehman HU, Khan Z, Khan MA and Zada l. Yield and yield components of wheat as influenced by various tillage operations and seed rates. International Journal of Agricultural and Environmental Research,2018:4(1):54-60.
2. Anand G, Vicky S, Aulakh GS. Effect of various sowing technologies of wheat cultivation under rice-wheat cropping system in the western plain zone of Punjab. Multilogic in Science,2020:9(32):459-461.
3. Chen B, Liu E, Tian Q, Yan C, Zhang Y. Soil nitrogen dynamics and crop residues. A review. Agronomy for Sustainable Development,2014:34(2):429-442.
4. Fischer RA, Santiveri F, Vidal IR. Crop rotation, tillage and crop residue management for wheat and maize in the sub-humid tropical highlands: I. Wheat and legume performance. Field Crops Research,2002:79(2-3):107-122.
5. Gautam A, Singh V, Aulakh GS. Effect of various sowing technologies of wheat cultivation under rice-wheat cropping system in the western plain zone of Punjab. Multilogic in Science,2020:9(32):459-461.
6. Harishankar, Pali GP, Tomar GS. Growth and yield of wheat (*Triticum aestivum* L.) as influenced by methods of sowing and seed rates. Progressive Research – An International Journal,2017:12:340-342.
7. Hemmat A, Eskandari I. Dryland winter wheat response to conservation tillage in a continuous cropping system in north western Iran. Soil and Tillage Research,2006:86(1):99-109.
8. Strudley MW, Green TR and Ascough IIJC. Tillage effects on soil hydraulic properties in space and time: State of the science. Soil and Tillage Research,2008:99(1):4-48.
9. Usman K, Khan EA, Yazdan F, Khan N, Rashid A and Din SU. Short response of spring wheat to tillage, residue management and split nitrogen application in a rice-wheat system. Journal of Integrative Agriculture,2014:13(12):2625-2633.