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Performance of Wheat with Different Sowing Techniques under Rice-Wheat Cropping System

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Abstract: The present study aims at investigating the impacts of different planting methods on the growth and yield of wheat. The five different agronomic sowing methods covers **Broadcasting of seed and cross ploughing by cultivator** (T1)**, sowing of wheat by zero tilled seed drill** (T2)**, two cross ploughing by cultivator than broadcasting of seed** (T3)**, two cross ploughing by cultivator than sowing behind the plough** (T4) **and two cross ploughing by cultivator than sowing of wheat by zero tilled seed drill** (T5) **were applied to check the performance of growth and yield of wheat. Sowing methods of wheat recorded statistically significant difference in growth as well as yield attributing characters of wheat and it was produced maximum in treatment T2, where sowing of wheat was done by zero tillage. Grain yield (35.6 q/ha) and straw yield (44.9 q/ha) of wheat were also produced maximum when wheat was sown by method of zero tillage. The treatments T1 was recorded significantly lower grain and straw yield of wheat.**
Keywords: Wheat, Planting methods, Growth, Yield, Zero tillage

Introduction

South Asia has the key cropping arrangement in Indo-Gangetic Plains is Rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.). Rice-wheat is the leading cropping system of Bihar. However, the productivity of rice and wheat has deteriorated and declined owed to climate change and abridged soil productivity, affectation a serious threat to the sustainability of the rice-wheat cropping system (Ladha *et al.,* 2009). Low levels of soil organic matter, over mining from soil sand burning of crop residues are some of the major reasons for declining rice-wheat productivity in the region (Singh and Sidhu, 2014). Thus, Bihar is also known as the 'Granary of India' has shouldered a heavy responsibility in assuring food security for the nation. However intensive agricultural practices have led to the degradation of natural resources like water, soil and air. Unsystematic pumping of groundwater in Bihar diagonally the past several decades has in danger of extinction the sustainability of not only

the ecology but also of the cultivation of rice crops. In addition to the water-stress, agricultural practices such as extensive and imbalanced use of chemicals and fertilizers have deteriorated the soil fertility and groundwater quality. Residue burning is another problem that has not only resulted in soil fertility loss but also contributed to severe air pollution thereby leading to global warming. Direct seeding with zero-till drill technology is one such practice that potentially addresses the issues of labor, water, soil health, etc. (Malik *et al*, 2005; Gupta and Sayre, 2007; Jat *et al*, 2009; Gathala *et al*, 2011; Jat *et al*, 2013). The residue on the soil surface reduces evaporative losses, retains the soil moisture and temperature, as well as canopy temperature (Jat *et al*, 2009) and helps to counter terminal heat effects. Residue retention also leads to significant improvement in the sustainability index (Alvarez and Steinbach, 2009; Jat *et al*, 2011; Jat, 2013).

Materials and Methods

Experiment was conducted at research farm of Bihar Agricultural College, Sabour (Bhagalpur), Bihar and also on farmer's field. Wheat variety HD 2733 was sown in last week of November at all locations after the harvest of paddy and harvested in third week of April. The experiment was laid out in factorial randomized block design with following treatments replicated five times. Sowing methods: T1- Broadcasting of seed and cross ploughing by cultivator, T2- Sowing of wheat by zero tilled seed drill, T3- Two cross ploughing by cultivator than broadcasting of seed, T4- Two cross ploughing by cultivator than sowing behind the plough and T5- Two cross ploughing by cultivator than sowing of wheat by zero tilled seed drill. The most predominant wheat variety HD 2733 was sown as per recommended agronomic practices. Nitrogen, phosphorus and potassium were applied through urea, single superphosphate and muriate of potash, respectively. The crop was sown in the first week of November with 125 kg/ha seed rate (Anonymous, 2017). The observations on plant height and Number of total tillers were recorded at different progressive growth stages. Data on grain and straw yield of each crop was recorded and statistically analyzed.

Results and Discussions

Growth characters:

The height of wheat plant is an important yield contributing parameter. The height was measure at physiologically maturity. The data presented in Table-1 Showed that increase in height of plants results in boost the growth rate and ultimately higher yield of crop. The different sowing methods of wheat crop showed significant results for plant height. The highest plant height was observed in treatment T2 (18.83cm, 59.95cm, 71.50 and 72.0cm) at almost all growth stages as compared to other treatments. The lowest plant height was produced in the treatment T1. The similar finding was observed in Abbas *et al*., 2009, who also concluded that planting methods have effect on plant height. The good results are found in zero tillage methods.

The different sowing methods have influence in total number of tillers of wheat crop. Irrespective of the treatment, formation of tillers per sq. meter of wheat increased with time, the peak being observed at 60DAS followed by decline. Formation of tiller completely stopped beyond 60DAS and the maximum number of tiller per plant was observed at 60 DAS. The results are shown in table-1 depicted that treatment T4 consisting of two ploughing by tractor drawn cultivator than sowing behind the plough was significantly more number of tillers than the treatment T1 consisting of broadcasting of seed than two cross ploughing by tractor drawn cultivator however at last stage i.e. at 120DAS T5 gets significantly higher numbers of tillers than the treatment T1. It was found to be statistically at par with the treatment T3 consisting of Two cross ploughing by tractor drawn cultivator than sowing by method of broadcasting which itself significantly higher than treatment T2 consisting of Sowing of wheat by zero tilled seed drill. This treatment was again significantly more number of tillers than the treatment T1 at almost all growth stages. These results are line with Dimitrios *et al*., 2011.

Yield attributing characters

Two cross ploughing by cultivator than sowing of wheat by zero tilled seed drill T5 produced significantly higher number of effective tillers (226.28/sq. m) than the treatments T4 (216.38/sq. m), T2 (208.7/sq. m) and T1 (175.18/sq. m) however it was statistically at par with the treatment T3. The superiority of the treatment were found in the following sequence T2 >T4 >T5>T3>T1.

Incase of other yield attributing characters like number of grains / ear head, length of earhead, weight of grains per ear head and test weight, zero tilled seed drill recorded significantly higher value than rest of the treatments however treatment T1 produced lowest value in almost all characters. In case of number of grains it was followed by treatment T3, T4 and T5 which was statistically at par among themselves. However incase of test weight it was followed by treatment T4 but significantly higher value than the treatment T3, T5 and T1.

Grain and straw yield

It was observed from the data that treatment T2 i.e. zero tilled seed drill produced maximum grain yield (24.9 q/ha) which was 42.97 per cent higher than the treatment T1. It was followed by treatment T4 however it was statistically at par among themselves. It was again followed by treatment T3 and T5. However these two treatments (T3 and T5) were also statistically at par among themselves. Ultimately the order of superiority of treatments was recorded as T2>T4>T5>T3>T1. The results are described that highest grain yield was produced by zero tillage technique and supported by Kahloon *et al*., 2012, Tripathi, 2013, Sharma *et. al*., 2008, Abbas *et. al*., 2009, Rehman *et. al*., 2010. Better root development was resulted in better uptake of nutrient that ultimately resulted in increase in crop productivity and yield (Izumi *et. al*., 2004 and Merril *et. al*., 1996.

Straw yield has similar trend in which zero tilled seed drill (T2) produced significantly higher straw yield (44.9 q/ha) than all other treatments which were recorded in the following descending order T2>T4>T5>T3>T1. These results are close finding with Naresh *et al*., 2014, who stated that straw yield was more in zero tillage as compared to other planting method.

Conclusion

Zero tillage technology provided the facility of wheat sowing in opposition to the burning of paddy straw. The technology is moreover time savings because the zero tillage can be brought into the field without delay after the paddy harvest and is ecofriendly. Along with the different sowing methods, the highest grain yield was obtained with zero tillage method. Thus zero tillage can take part in a key role in retaining soil health as well as the environmental health of Bihar.

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Table-1 Growth characters of wheat at different progressive growth stages as influenced by different treatments

Sowing Technology	Plant height (cm)				No. of total tillers			
	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS
T1-Broadcasting of seed and cross ploughing by cultivator	16.28	49.3	61.95	62.2	170.8	209.53	205.85	183.88
T2-Sowing of wheat by zero tilled seed drill	18.83	59.95	71.50	72.0	197.3	232.50	236.38	217.63
T3-Two cross ploughing by cultivator than broadcasting of seed	17.55	56.78	68.68	70.00	202.4	254.0	254.20	235.0
T4-Two cross ploughing by cultivator than sowing behind the plough	18.13	70.65	70.65	71.63	215.6	258.2	260.95	236.25
T5-Two cross ploughing by cultivator than sowing of wheat by zero tilled seed drill	18.03	69.63	69.63	70.78	210.9	250.6	254.0	246.28

SEM±	0.3269	0.4919	0.3027	0.3676	6.2179	11.9552	10.3122	6.1560
CD @ 5%	07122	1.0718	0.6596	0.8009	13.5488	26.0503	22.4702	13.42

Table-2 Yield attributing characters and yield of wheat (q/ha) as influenced by different treatments

Sowing Technology	Effective Tillers /m^2	No. of grains/ ear head	Weight of grains /ear head (g)	Test weight	Length of ear head (cm)	Grain yield (q/ ha)	Straw yield (q/ ha)
T1-Broadcasting of seed and cross ploughing by cultivator	175.18	39.5	1.05	37.60	7.9	24.9	31.4
T2- Sowing of wheat by zero tilled seed drill	208.7	43.7	1.40	42.20	9.3	35.6	44.9
T3- Two cross ploughing by cultivator than broadcasting of seed	219.5	40.18	1.17	38.70	7.2	32.3	40.3
T4- Two cross ploughing by cultivator than sowing behind the plough	216.38	40.15	1.35	40.90	8.8	35.3	44.8
T5- Two cross ploughing by cultivator than sowing of wheat by zero tilled seed drill	226.28	39.15	1.25	39.80	8.0	32.3	41.0

SEM±	4.1718	1.0194	0.0228	0.4398	0.1738	0.6945	0.7599
CD @ 5%	9.0946	2.2224	0.0497	0.9588	0.3788	1.5134	1.6558

