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GRAIN YIELD IN RAISED BED PLANTED WHEAT IN CENTRAL PLAIN ZONE OF PUNJAB

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Abstract

An experiment was conducted at research farm of Lovely Professional University at Phagwara during *rabi* season of 2017-18 on HD 2967 variety of wheat (*Triticum aestivum*). The experiment was laid out RBD (Randomized Block Design) with nine treatments and three replications. The results of experiment showed that planting method of wheat on raised beds improved the growth and grain yield through yield contributing characters like plant height ,leaf area index, number of tillers, number of spikelets, number of grains/spike, test weight, grain yield t/ha and straw yield. Treatment applied with recommended dose of NPK on raised bed (T6) registered highest grain (7.0 t/ha) yield in wheat.

***Key words*:** Grain yield, nitrogen, raised bed, wheat

Introduction

Wheat is the major rabi season crop of North and Central India. The total area under wheat in India is about 31 mha with production of 96 million tonnes (Anonymous, 2013). In Indo-gangetic plains, north-western states of Punjab and Haryana is highly productive rice-wheat zone contributing about 69% of the total food output in the country (about 84% wheat and 54% rice), called as the food basket of India. Adoption of new crop establishment methods and changing *management* practices in the system may be some ways of increasing productivity, resource conservation providing benefits to farmers. Due to limited availability of water for irrigation, low groundwater table and erratic rainfall conditions, it is issue of prime importance to conserve precious water and land for future food security.

Different methods of wheat establishment proved to be better than traditional methods as reported by various studies. Bed planting method increased the yield of grain and straw in wheat crop as compared to flat method (Vipin *et al*., 2017). Bed planted wheat applied with 120 kg ha^{-1} N produced more grain yield (15%), nitrogen uptake, nitrogen use, agronomic and recovery efficiencies as compared to flat planting. Twenty nine percent higher economic returns were obtained in bed planted wheat (Majeed, 2014). Zhang, 2007 reported that, winter wheat produced 5.2% higher grain yield when FIRB (furrow irrigated raised bed-planting) was done than conventional flat planting (FP) and water consumption was 12% lesser in FIRB compared to flat planting. Similar results also found by Kumar (2006-08) by stating, an average 40% water saving in bed planting and thereby increased water productivity and crop yield in wheat. Line planted wheat 30cm apart produced significantly higher number of spikes, thousand grain weight and grain yield (51q ha^{-1}) than broadcast method (Khan, 2005). Soybean and wheat planted on raised beds recorded about 17% and 23% higher WUE, respectively, than in flat layout.

The net returns were greater in no-tillage and permanent raised beds than with conventional tillage (Ram *et al.,* 2013). Bhuyan *et al*., 2012 observed 16% increased grain yield of aman rice when planted on beds along with about 42% saving of irrigation water. This study justified the bed planting method as a new approach for optimum fertilizer and water use efficiency with higher yield as compared to conventional flat method. Twenty one percent higher grain yields in wheat was observed with bed planting than flat sown method by increased number of panicles m^{-2}, number of grains $panicle^{-1}$ and 1000-grain weight of wheat. Sterility percentage was lower in bed than conventional method. Weed infestation was less in bed planting. It saved 41-48 % irrigation water. The cost of cultivation was lower and gross return; gross margin and benefit-cost ratio were higher in bed planting than conventional method (Mollah, 2001). Maximum grain yield, productive tillers, grains per spike and thousand grain weight was recorded, where wheat was planted on raised beds on 15 November during two years of experimentation (Farooq and Cheema, 2014). At raised bed wheat cultivation saving 14.30% water with increasing 15.66% grain yield than flat bed. Maximum applied water productivity 1.81 kg m^{-3} was observed in raised bed full irrigation condition (Zaman *et al*., 2017). The bed configuration 90 cm bed, 4 rows (B90–4) and irrigation schedules at 0.8 IW/CPE registered significantly highest grain yield, straw yield, harvest index, net return, benefit: cost ratio, N, and K uptake

(Sagar *et al*., 2017). The benefits of the raised bed-planting system with furrow irrigation compared with conventional flat planting with flood irrigation were found to improve grain quality and increase grain yield by more than 10% (Fahong *et al*., 2004).

Biological yield was significantly higher in flat planted wheat in comparison with bed planted wheat due to lesser 1000 grain weight (Tanveer, 2003). The mean grain yield (6.25 t ha^{-1}) in flat planting method was 12 % higher than bed planting method (5.49 t ha^{-1}). Interactions between planting methods and genotypes were not significant for most yield components (Killic *et al*., 2015).

Materials and Methods

The field experiment was performed in the Research Farm of Lovely Professional University situated at 31° 15' N and 75°42' E and 235 m above sea level in Punjab during kharif season 2017 - 2018. This experimental field falls in Central Plain Zone (PB-3) of Punjab. Experiment was conducted with 9 treatments replicated thrice in randomized block design with different nitrogen doses and two planting methods viz. flat and raised bed planting. Time of sowing is 2nd December 2017. HD 2967 variety is taken for sowing. Observations are taken are plant height, leaf area index, number of tillers, number of spikelet, number of grains/spike, test weight/100 seeds, grain yield t/ha, straw yield t/ha .

Results and Discussion

Growth and Yield Parameters on Flat and Raised bed (Presented in table 1)

Plant height: Plant height ranged from 82.3 cm (control) to 102.3 cm under T4 (Rec.PK+130% N), though there is no significant difference among different treatments.

Leaf Area Index (LAI): Highest leaf area index (4.0) is observed for T8 followed by T7 and T4 treatments. T4, T7 and T8 treatments are at par with each other at 0.05 level of significance.

Number of Spikelets per plant: Largest number of spikelets per plants are observed for T6 (Raised bed(RB)+Rec. NPK followed by the treatment under flat sowing (FB) +Rec. NPK. Statistically, no difference among treatments is observed w.r.t. number of spikelets

Number of grains/spikelet: Number of grains in each spikelet varies from 55 to 69, lowest in control to highest in T6 treatment. Number of grains in T6 treatment also differs significantly from control.

Grain and Straw yield: Highest grain yield (6.83 t ha^{-1}) is observed under the treatment raised bed applied with recommended dose of fertilizers and is followed by T7 and T5 with grain yields to the tune of 6.18 and 5.94 t ha^{-1}.Similar trends in straw yield is noticed for T6 followed by T7 treatment.

However, difference in grain yield under raised bed planting from flat bed planting shows that highest difference (44%) is for recommended dose of PK with 110% nitrogen applied treatment. Similar observation is recorded for straw yield but the difference is 30% as shown in Fig. 1 and 2.

Table 1: Growth and yield contributing parameters in wheat

Planting Method	Plant height (cm)	Leaf Area Index	No. of spikelets/ plant	No. of grains/ spikelet	100 grain wt. (g)
Control (T0)	82.3	2.4	14.7	55.3	2.3
Flat Bed Sowing					
Rec.PK+75%N (T1)	96.8	2.8	18.7	64.3	4.0
Rec.NPK (T2)	101.3	3.2	21.7	66.7	4.0
Rec.PK+110%N (T3)	101.0	3.5	18.3	65.3	3.3
Rec.PK+130%N (T4)	102.3	3.8	15.7	65.3	3.3
Raised Bed Sowing					
Rec.PK+75%N (T5)	99.5	2.9	21.0	63.0	5.7
Rec. NPK (T6)	102.0	3.3	23.0	68.7	6.3
Rec.PK+110%N (T7)	100.7	4.0	20.0	63.3	7.0
Rec.PK+130%N (T8)	99.7	4.4	21.0	66.0	5.0

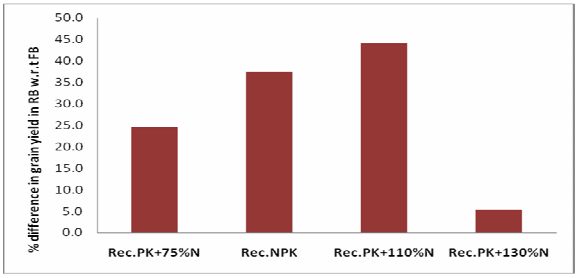

Fig 1. : Difference in grain yield(%) among treatments

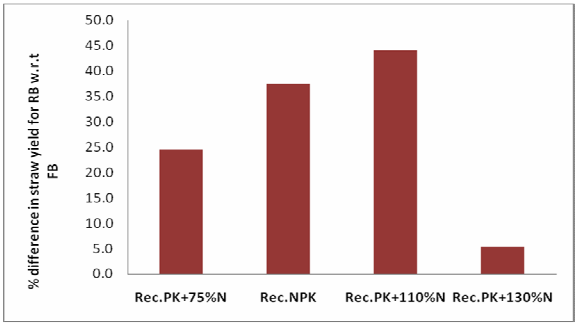

Fig 1. : Difference in straw yield (%) among treatments

Conclusion

It can be concluded from these results that raised bed planting provides higher grain yield as compared to traditional method of sowing. Different doses of nitrogen show change in grain yield for both methods of planting. Even then, by increasing 10% N to both types of planting create a gap of 44% in yield as compared to 37% under recommended dose of nitrogen applied. 20% extra dose of nitrogen to the treatments has not given any yield advantage in both types of planting methods. It can be suggested on the basis of results that grain yield may be increased by choosing raised bed planting in wheat without any extra dose of nitrogen, provided cost of cultivation should not increase.

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