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Effect of Different Seed Rates and Row Spacing on Yield Attributes and Yield of Late Sown Wheat (*Triticum aestivum* L.)

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ABSTRACT

Background: Wheat (*Triticum aestivum* L.) is the most important cereal crop throughout India and other parts of the world. In late sowing conditions the variety selection, seed rate and row spacing is an important factor for a better crop yield. Higher seed rate and narrow row spacing are used in late sowing as compared to normal sowing conditions.

Methods: The present field experiment was conducted at the Students Research Farm, Khalsa College, Amritsar, Punjab, India during *rabi* season of 2020-21. A field experiment was laid out in split-plot design with replicated three times comprising four levels of seed rate *viz.* (100, 110, 120 and 130 kg/ha) and three-row spacing *viz.* (12, 15 and 18 cm) of wheat cultivar DBW 187 (Karan Vandana).

Result: The result showed that the number of tiller per meter, spike length, grains per spike, test weight, grain, straw and biological yield were significantly affected by different seed rates and row spacing. The seed rate 120 kg/ha recorded significantly higher grain yield (50.47 q/ha), effective tiller per meter row length (70) and the number of grain per spike (58), whereas 130 kg/ha gave significantly higher straw yield (73.40 q/ha). The crop sown with row spacing 18 cm showed significantly higher grain yield (49.13 q/ha), straw yield (72.70 q/ha), biological yield (121.83 q/ha), effective tiller per meter row length (68), spike length (12.10 cm) and number of grain per spike (56.16).

Key words: Late sowing, Row spacing, Seed rate, Wheat.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the world's most important widely cultivated food crop; it's grown under various agro-climatic conditions. India is the second-largest producer of wheat in the world after China. In Punjab wheat was cultivated on an area of about 3.5 million hectares with a production of 18.26 million tonnes (Anonymous, 2020). In India, Punjab occupied the first position in wheat productivity and second in production after UP. Among, the factor responsible for low wheat yield, delay sowing, traditional sowing method, low seed rate and improper row spacing are very important (Iqbal *et al.,* 2010). The time of wheat planting and the variety selection have important impact on better crop output. These factors not only affect germination, but also crop growth behavior, number of tillers, number of grains per spike and eventually the yield.

In the cotton belt, wheat sowing is delayed due to late maturing cotton varieties and final picking goes up to December. Some areas where the sowing of wheat crop is delayed due to some crop rotations like basmati rice-wheat, maize/rice/groundnut-potato-wheat, ratoon sugarcane-wheat and rice/maize-vegetable peas-wheat. Higher wheat grain yield with better quality requires an appropriate seedling rate and optimum row spacing for different cultivars. An increase in seed rate above optimum levels may only enhance production cost without any increase in grain yield (Rafique *et al.,* 2010). Row spacing composes resource availability and utilization by particular plants in a given species (Rahel and Asfaw, 2016). The tillering capacity and the yield components of wheat crop can be optimized by proper spacing (Hussain *et al.,* 2012). In addition proper row spacing is important for maximizing light interception, penetration, light distribution in crop canopy and average light utilization efficiency of the leaves in the canopy and affects the yield of a crop (Mehmood *et al*., 2012).

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MATERIALS AND METHODS

The study was carried out during *rabi* season 2020-21 under field conditions at the Students Research Farm, Khalsa College, Amritsar, Punjab, India. The soil of the experimental field was categorized as sandy loam. The soil was tested with low organic carbon (0.39 per cent) and available nitrogen (179 kg/ha). However, available phosphorus (22 kg/ha) and potassium (296 kg/ha) were in the medium category. The soil pH (8.4) and electrical conductivity (0.21 dS/m) values were within the normal range. The experiment was conducted with four different seed rates *viz.* (Treatments S_{100}, S_{110}, S_{120}

and S_{130} kg/ha) and three-row spacing (Treatments R_{12}, R_{15} and R_{18} cm). The experiment was laid out in spilt plot design (SPD) with replicated thrice. All field activities (land preparation, planting, fertilizer application and weeding) were done according to local production practices. All data on growth, yield and yield components were measured from the central areas of each plot. Statistical analysis of the data recorded was done as per split-plot design using CPCS-1 software developed by the Department of Mathematics and Statistics, Punjab Agricultural University, Ludhiana.

RESULTS AND DISCUSSION

The number of effective tillers per meter row length

The number of effective tillers per meter row length differed significantly by different seed rate and different row spacing. The data indicated that effective tillers per meter row length was significantly higher at seed rate of120 kg/ha (70) and row spacing of 18 cm (68). The number of effective tillers per meter row length increased with increase seed rate up to 120 kg/ha and increase with narrow to wider row spacing. The higher number of effective tiller per meter row length due to more uniform distribution and less intra row plant to plant competition compared with the narrow row spacing Mali and Choudhary (2013) and Kalpana *et al.* (2014). Ram *et al.* (2013) recorded the highest effective tillers at seed rate of 125 kg/ha which was statistically at par with seed rate of 112 kg/ha.

The number of grains per spike and spike length (Table 1)

The number of grains per spike increased with increased seed rate and row spacing. The higher numbers of grains per spike were recorded at seed rate of 120 kg/ha (58.00) and row spacing of 18 cm (56.66). The higher number or grains per spike of wheat in wider row spacing might be due to more space and nutrients utilization by the plants. These results were similar as Ali *et al.* (2016) and Nizamani *et al.* (2014). A thoughtful perception of data relating to spike length revealed that treatments with seed rates 100 kg/ha showed maximum spike length (12.29 cm) which was statistically at par with 110 kg/ha seed rate (12.01 cm) and the minimum was recorded at 130 kg/ha seed rate (11.40 cm). The spike length increased with decreasing seed rate 130 to 100 kg/ha. Significantly highest number of spike length was recorded (12.10 cm) in the spacing of 18 cm statistically at par as 15 cm row spacing, which was found to be superior over the treatment with row spacing 15 and 12 cm (11.68 and 11.82 cm). Spikes per meter row length increased with increasing row spacing. These findings substantiate the results of Rahel and Fekadu (2016) and Baloch *et al*. (2010).

Test weight

The test weight under 100 kg/ha was significantly higher to other seed rate (44.44 g) and it was statistically at par with seed rate 110 kg/ha (41.73 g). The row spacing 15 cm showed significantly higher value of 1000 grain weight (44.56 g).

Effect of different seed rate and row spacing on yield (Table 2)

Grain yield

The higher grain yield was recorded in the case of 120 kg/ha seed rate which was statistically at par with 130 kg/ha seed rate (47.52 q/ha) and the lowest grain yield recorded with 100 kg/ha seed rate (43.83 q/ha). It was due to increased seed rate under high input environment continued their photosynthesis for longer period and thus higher accumulation of plant biomass (Gupta 2013). Wider row spacing (18 cm) produced the significantly higher number of tillers (68) and spikes (12.10) per metre row length over narrow row spacing (12 cm) and the higher grain yield (49.13) recorded at 18 cm row spacing which was statistically at par as 15 cm row spacing. These results are supported with Iqbal *et al.* (2020). The grain yield and harvest index was registered with spacing 15 cm as 48.93q/ha and 40.53 per cent, respectively.

Straw yield and biological yield

The straw yield observed significantly higher with spacing of 18 cm (72.20 q/ha). The maximum straw yield was recorded in seed rate of 130 kg/ha and minimum at 100 kg/ha

Table 1: Effect of different seed rate and row spacing on yield attributes of late sown wheat.

Treatment	Yield attributes			
	Effective tiller per meter row length	1000 grain weight	Spike length(cm)	Number of grain per spike
Seed rate (kg/ha)				
100	59.00	44.44	12.29	50.00
110	62.00	42.66	12.01	52.00
120	70.00	41.74	11.68	58.00
130	65.00	39.40	11.40	56.44
CD (p=0.05)	4.83	2.89	0.37	2.11
Row spacing (cm)				
12	60.00	40.50	11.61	51.16
15	64.00	44.37	11.82	54.00
18	68.00	44.74	12.10	56.66
CD (p=0.05)	3.17	2.57	0.30	1.63
Interactions	NS	NS	NS	

Table 2: Effect of different seed rate and row spacing on yield of late sown wheat.

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	HI
Seed rate (kg/ha)				
100	43.83	66.43	110.27	39.47
110	45.85	68.75	114.60	40.00
120	50.47	71.88	122.35	41.25
130	47.52	73.40	120.92	39.29
CD(P=0.05)	3.90	3.74	7.32	NS
Spacing (cm)				
12	44.95	67.47	112.42	39.98
15	46.67	70.17	116.84	39.91
18	49.13	72.70	121.83	40.32
CD (p=0.05)	2.40	2.64	4.61	NS
Interactions	NS	NS	NS	NS

seed rate (73.40 and 66.43 q/ha). The straw yield recorded at 130 kg/ha and 18 cm row spacing was statistically at par with 120 kg/ha and 15 cm row spacing. According to Ram *et al.* (2012) increase in seed rate enhanced the straw yield in late sown wheat. The biological yield was recorded maximum at 120 kg/ha seed rate and 18 cm row spacing.

CONCLUSION

The finding of this study indicated that the yield attributing characters like the number of effective tillers per meter row length and grains per spike increase with increase in seed rate up to 120 kg/ha. The test weigh was recorded maximum at 100 kg/ha seed rate and it was decreased with increasing seed rate. The length of spikes was increased when the seed rate was decreased. The grain yield and biological yield also increased significantly with increasing seed rate up to 120 kg/ha. Among row spacing, 18 cm performed better in terms of growth parameters, yield attributes, grain yield, straw yield and biological yield.

Conflict of interest

All authors declared that there is no conflict of interest.

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