



Effect of seed rate and row spacing on yield of late sown wheat (*Triticum aestivum*)

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Abstract

A field experiment was conducted during *Rabi* 2019 at Experimental Research Center of Chandigarh University, Gharuan (Mohali) to study the effect of seed rate and row spacing on yield of late sown wheat. There were total six treatments comprising of wheat with treatment details were M1: row spacing main plot 18 cm M2: 22 cm S1: 75 kg/ha seed rate, S2: 100 kg/ha seed rate, S3: 125 kg/ha seed rate, S4: 150 kg/ha seed rate. The experiment was laid down in split plot design with three replications with different row spacing as main plots and seed rate as subplot treatments. Growth parameters i.e. plant height (91.33 cm) at harvesting in treatment S2 followed by treatment M2 (88.83 cm), number of effective tillers at harvesting in treatment S2 (3.55) followed by treatment M2 (2.48), dry matter accumulation at harvesting in treatment S2 (711.56) followed by treatment M2 (704.80), yield attributes, grain yield highest in treatment S2 (45.83 kg/ha) followed by treatment M2 (44.00 kg/ha) and straw yield recorded highest in treatment S2 (69.05 kg/ha) followed by treatment M2 (68.15 kg/ha). Which were more in case of treatment of seed rate was S2: (100 kg/ha). And among different row spacing, M2: (22 cm) gave the best results.

Keywords: row spacing, seed rate, growth, and, yield

Introduction

Wheat (*Triticum aestivum*) is the most important food crop of the world. It is the most grown cereal crop in the world. Wheat is grown from Scandinavia to South America and across Asia making it more widely grown than any other staple food crop. Wheat is grown on 215 million hectares of land area worldwide with an annual production of 734.74 metric tons (according to the ministry of agriculture). The area under wheat cultivation is about 30 million hectares with an annual production of 99.70 million tones with an average productivity of 3371 kg/ha (according to the ministry of agriculture). Wheat is mainly grown in the states of U.P., Haryana and Punjab contributing 60% of total wheat production in India. Wheat is one of the most important food crops from the national food security perspective and also a major agricultural export commodity. Seed rate can impact wheat tillering, grain yield and protein quality. Hence, achieving higher agronomic performance and better end-use quality requires optimizing and periodically reviewing management practices such as seeding rates. It was reported that, in a dense wheat population, grain yield was decreased due to competition between plants that induced self-regulation. However, in cultivars that produce fewer tillers, higher seeding rates compensated for reduced tiller and promoted more main stem spikes. Wheat quality was not reduced at higher seeding rates as protein content; kernel weight and test weight were unaffected. On the other hand, it was stated that protein concentration declined as seeding rates and yields increased. The decrease in plant height in response to lowering the seeding rate to 100 kg ha⁻¹ may reflect formation of more secondary tillers in less populated stands, which tend to be shorter in stature. At the highest seeding density, the increased intra-plant competition may have also contributed to the reduction in plant height. Chaudhary et al,

(2000) and Arif et al, (2003) reported increased tillers with increase in seed rate. The results are also in line with Rafique et al, (1997), who observed a linear increase in the number of tillers as the seed rate was increased. Whereas, the findings are not in accordance with Bellatore et al, (1985) who found decreased tillers as the seed rate was increased. The results are in line with Ali et al, (1996), who explained that lower seeding rates significantly increased the number of grains and vice versa. By increasing seed rate the number of grains spike⁻¹ is reduced concluded that by increasing seed rate the 1000- grains weight is reduced. These results are in analogy with the findings of earlier workers (Arif et al., 2003) who reported higher yield with seed rate of 150 kg ha⁻¹, however disagree with those of Rafique et al. (1997) who concluded that seeding rates did not influence the grain yield of wheat.

Materials and Methods

This experiment was conducted during the 2019-2020 *Rabi* season at University farm, University Institute of Agricultural Sciences, Chandigarh University, Gharuan (Punjab) to study the Effect of seed rate, row spacing on yield of late sown (*Triticum aestivum*). The experiment was laid out in a split plot design with three replications having a plot size of 5m x 2m. Row spacing of 20 cm was maintained. Wheat variety PBW-343 was sown at the different seed rate on 14-12-2019.

During this study two different row spacing i.e. (M1) 18 cm and (M2) 22 cm in main plot and four different seed rate i.e. (S1) 75 kg/ha, (S2) 100 kg/ha (S3) 125 kg/ha, (S4) 150 kg/ha seed rate were evaluated. Data was analyzed for growth and yield attributing characters like plant height (cm), dry matter accumulation (m²), leaf area index, number of effective tillers (m²), number of spikelets/spikes, test weight and grain yield were recorded. The data recorded on

different aspects in the present study was subjected to the statistical analysis using analysis of variance as per procedure recommended by Gomez and Gomez (1984).

Results and Discussion

Effect of different row spacing and seed rate on growth parameters (plant height, leaf area index, and dry matter accumulation), yield (grain) and yield attributes (number of effective tillers, test weight, number of spikelets/spike).

Plant Height

The data on plant height recorded at different growth stages are presented in table 4.1 and depicted in fig. 4.1 Plant height continues to increase from 30 DAS till harvest under all the treatments. The increase in plant height was maximum between 60 to 90 DAS and thereafter it was only marginal to harvest. At all the stages of crop growth significantly taller plants were observed in treatment, seed rate 100 kg per hectare. Row spacing (22cm) recorded significantly maximum height (89.58cm), whereas, row spacing (18cm) recorded lowest plant height (86.17cm) at harvesting stage, respectively. Similar findings were obtained by Chaudhary *et al.* (2012) [2]. This might be due to the effect of proper space between the rows and optimum seed rate.

Table 1: Effect of irrigation scheduling and organic nutrient sources on plant height, dry matter accumulation, and leaf area index.

Treatments	Plant height (Harvesting)	Dry matter accumulation (Harvesting)	Leaf area index (90 DAS)
Sowing methods			
18 cm	86.17	680.13	3.43
22 cm	89.58	711.56	3.57
CD (P=0.05)	1.79	1.74	0.10
Seed rate			
120 kg/ha	86.17	682.77	2.23
100 kg/ha	91.33	704.80	4.16
90 kg/ha	88.83	696.12	3.80
80 kg/ha	85.17	699.70	3.80
CD (P=0.05)	1.83	3.24	0.14

Dry matter accumulation

The data (table 1) pertaining to dry matter accumulation meter^{-2} at different growth stages as influenced by various treatments are presented in table 4.3 and depicted in figure 4.3 Dry matter accumulation increased progressively with the advancement of crop age. Most dry matter accumulates between 90 DAS and at harvest time.

At all the stages of crop growth, significantly maximum dry matter accumulation was observed in treatment, seed rate 100 kg per hectare (704.80). Row spacing (22cm) recorded significantly dry matter accumulation (711.56), whereas, row spacing (18cm) recorded minimum dry matter accumulation (680.13) at harvesting stage, respectively. Similar findings were obtained by William *et al.* (2014). This might be due to the effect of proper space between the rows and optimum seed rate.

Leaf area index (LAI)

The data (table 1) pertaining to Area of green (photosynthetically active) leaves was recorded at 30, 60, 90 DAS then leaf area index was calculated. The LAI of different stages are given in table 4.4 and depicted in fig 4.4.

The perusal of data indicated that LAI increased with advancement of crop age reaching peak value at 90 DAS. The increase in LAI was more from 30-60 DAS period as compared to 60-90 DAS. At all the stages of crop growth, significantly maximum LAI was observed in treatment, seed rate 100 kg per hectare (4.16). Row spacing (22cm) recorded significantly maximum LAI (3.57), whereas, row spacing (18cm) recorded minimum LAI (3.43) at harvesting stage, respectively. Similar findings were obtained by Hiromi *et al.* (2019). This might be due to the effect of proper space between the rows and optimum seed rate.

Table 2: Effect of irrigation scheduling and organic nutrient sources on number of effective tillers, number of spikelets/spike, test weight, and grain yield.

Treatments	Number of effective tillers	Number of spikelets/spike	Test weight	Grain yield
Sowing methods				
18 cm	221.83	16.67	34.42	38.42
22 cm	239.50	19.92	39.00	45.83
CD (P=0.05)	4.36	1.24	0.95	3.74
Seed rate				
120 kg/ ha	227.67	17.83	37.17	40.33
100 kg/ha	235.00	20.00	37.83	44.00
90 kg/ha	230.83	16.67	36.00	42.17
80 kg/ha	229.17	18.67	35.83	42.00
CD (P=0.05)	4.64	1.19	1.11	1.72

Number of effective tillers

Critical analysis of data (table 2) A close perusal of the effective tillers data present in Table 4.5 and depicted in figure 4.5 revealed that seed rate 100 kg per hectare caused a significant improvement (235^{-2}) in number of effective tillers and was lowest in control (227.67^{-2}), other treatments were at par with each other. Row spacing (22cm) recorded significantly higher effective tillers (239.50), whereas, row spacing (18cm) recorded significantly lower effective tillers (221.83) respectively. Similar findings were obtained by Tanveer *et al.* (2003). This might be due to the effect of proper space between the rows and optimum seed rate.

Number of fertile spikelets/spike

The data (table 2) pertaining to fertile spikelets per ear presented in table 4.5 and depicted in figure 4.5 showed significant increase in fertile spikelets (20) then and lowest in seed rate 75 kg per hectare (16.67) other two treatments were at par with each other. Row spacing (22cm) recorded significantly higher fertile spikelets (239.50), whereas, row spacing (18cm) recorded significantly lower fertile spikelets (221.83) respectively Similar findings were obtained by Pirzada *et al.* (2018). This might be due to the effect of proper space between the rows and optimum seed rate.

Test weight

The given data. (table 2) pertaining to test weight is given in table 4.5 and depicted in figure 4.5. The data clearly showed that seed rate 100 kg per hectare resulted in significant increase in the test weight which was (37.83 gm) and was lowest in control (37.17 gm) Row spacing (22cm) recorded significantly higher test weight (39 gm), whereas, row spacing (18cm) recorded lowest test weight (34.42 gm) respectively. Similar findings were obtained by Lateef *et al.* (2018). This might be due to the effect of proper space between the rows and optimum seed rate.

Grain yield

A perusal of the data.(table 2) Grain yield of wheat as effect of seed rate and row spacing are given in Table 4.6 depicted in figure 4.6. A careful purview of data revealed that grain yield was significantly higher in seed rate 100 kg per hectare (44 q ha⁻¹) then the other treatments. It was lowest in seed rate 75 kg per hectare (40.33 q ha⁻¹). Row spacing (22cm) recorded significantly higher grain yield (45.83 q ha⁻¹), whereas, row spacing (18cm) recorded lowest grain yield (38.42 q ha⁻¹) respectively.

Conclusion

It was concluded that the treatment (100 kg/ha) seed rate has given superior results in different seed rates. Among the different row spacing seed drills have given higher yield and superior results. And also the net returns and B: C ratio was recorded highest in treatment S2 in seed rate and M2 amongst the different sowing methods.

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