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Effect of Sowing Dates and Varying Seed Rates on Growth and Yield of Wheat (*Triticum aestivum* L.)

Pallvi[1*], Kumari P.[2] and Ravinder[3]
[1]M.Sc. Scholar, Department of Agronomy, School of Agriculture, Abhilashi University, Mandi (Himachal Pradesh), India.
[2]Assistant Professor, Department of Agronomy, School of Agriculture, Abhilashi University, Mandi (Himachal Pradesh), India.
[3]Assistant Professor, Department of Soil Science, School of Agriculture, Abhilashi University, Mandi (Himachal Pradesh), India.

(Corresponding author: Pallvi)*
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ABSTRACT: A field experiment was conducted at the Research Farm of the School of Agriculture, Abhilashi University, Mandi (H.P.) during *Rabi* 2021-2022 to study the effect of sowing dates and varying seed rates on growth and yield of wheat. The experiment was laid out in split plot design with three sowing dates *i.e.* D_1 - 9th November, D_2 - 29th November and D_3 - 19th December and three seed rates S_1 - 100 kg/ha, S_2 - 110 kg/ha and S_3 - 125 kg/ha using three replication. Results of study revealed that wheat sown on 9th November resulted in better crop growth (plant height, number of shoots and dry matter accumulation), yield attributes (number of effective tillers and number of grains per spike) and higher yield (grain and straw) than crop sown on 29th November and 19th December, though the effect of 9th and 29th November sown crop was at par with each other in above parameters. Seed rate of 125 kg/ha being statistically at par with 110 kg/ha was recorded with significantly better crop growth, higher yield attributes and yield than seed rate of 100 kg/ha.

Keywords: Sowing date, seed rate, wheat, growth, yield.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the second most important cereal crop next to rice and a key crop of the green revolution and post green revolution era. In India, wheat occupies an area of about 31.61 million hectares with a production of around 109.52 million tonnes and productivity of 3464 kg/ha (Anonymous, 2022). In Himachal Pradesh, it occupies an area of 340 thousand hectares with total production of 672 thousand metric tonnes and productivity of 1976 kg/ha (Anonymous, 2021). The ideal sowing time and optimum seed rate is a key challenge to sustain the wheat productivity under changing environment. Crop sowing at appropriate time provides favourable conditions for wheat growth and development (Tahir *et al.,* 2019). High yield can be obtained in early sowing due to extended duration at grain filling stage as delayed sowing causes the warmer conditions which reduces the growing season length that lead to decrease in yield (Hussain *et al.,* 2012). The proper sowing date for wheat in Himachal Pradesh ranges from 25th October to 15th November, however sowing of wheat used to continue up to 15th December (Akhtar *et al.,* 2002). Each week delay of wheat sowing reduces the crop vegetative length and reproductive stages and causes yield reduction (Akmal *et al.,* 2011). Therefore, selection of proper sowing dates is vital to obtain high yield of wheat crop.

Optimum seeding rate is considered as another important management factor for improving yield of wheat. Higher seeding rate produces more plants in unit area resulting in less intra-crop competition hereby affecting the yield and production cost. On the other hand, lower seeding rate may reduce the yield drastically (Behzad and Amani 2020). If very high seed rate is used, plant population will be more and there will be competition among plants for water, nutrients and sunlight resulting in low quality and low yield. If very low seed rate is used, the interplant competition during vegetative growth will be less but intra-plant competition at grain formation stage will be more due to higher number of tillers (Ozturk *et al.,* 2006). Manipulation of seed rate has been also emerged as an option for weed management. High seed rate of 125 kg/ha caused reduction in weed density and biomass in wheat (Hemlata *et al.,* 2023). Therefore, for better yield optimum seed rate is necessary. Keeping in view the above facts and to study the effect of sowing dates and varying seed rates on growth and yield of wheat, the present study was undertaken.

MATERIALS AND METHODS

A field experiment was conducted during *Rabi* 2021-2022 at the Research Farm of the School of Agriculture, Abhilashi University, Mandi (H.P.) situated at 31°29′ N

latitude and 77° 00′ E longitude with the elevation of 1406 m above mean sea level. Soil of the experimental field was acidic in reaction (pH 5.5), medium in organic carbon (0.74%), low in available nitrogen (220 kg/ha), medium in available phosphorus (18.5 kg/ha) and available potassium (196 kg/ha) contents. The experiment was laid out in split plot design with three sowing dates *viz.*, D_1 - 9th November, D_2 - 29th November and D_3 - 19th December in main plats and three seed rates *viz.* S_1 - 100 kg/ha, S_2 - 110 kg/ha and S_3 - 125 kg/ha in sub plots. 'HS 507' variety of wheat seeds were sown on 9th November, 29th November and 19th December in lines 20 cm apart using varying seed rates of 100, 110 and 125 kg/ha. Crop was fertilized with recommended dose of nitrogen, phosphorous and potassium *i.e.*, 120, 60, 40 kg/ha through urea, single super phosphate and murate of potash, respectively. The observations on growth characteristics, yield attributes and yield of wheat were recorded through standard procedures. The data recorded on various aspects in the present study were subjected to the statistical analysis using analysis of variance as per procedure suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Growth parameters: The growth attributes of wheat *viz.* plant height (cm), number of shoots (per m^2) and dry matter accumulation (g/m^2) were significantly affected by sowing dates and seed rates at 120 days after sowing (Table 1). Wheat sowed on 9th November and 29th November being at par with each other resulted in significantly taller plants, higher shoot number and dry matter accumulation than wheat crop sown on 19th December. This could be due to favourable weather conditions and crop growing period in optimum sowing dates *i.e.* timely sown 9th November. Late sowing on 19th December resulted in lesser growth period which forced the crop to flower earlier and also mature earlier which thus resulted in lower plant height, shoot number and dry matter accumulation (Kaur *et al.*, 2020).

A perusal of data in Table 1 further revealed that plant height, number of shoots and dry matter accumulation increased with increasing seed rate of wheat from 100 to 125 kg/ha. Wheat sown with 125 kg/ha seed rate remaining at par with 110 kg/ha seed rate produced taller plants, more number of shoots and higher dry matter accumulation as compared to 100 kg/ha seed rate. The increased plant height with increased seed rate might be due to fact that plants become thinner and longer to compete the above ground resources specially the solar radiation at the highest seed rate (Tehulie and Zewdie 2021). Higher shoot number with increase in seed rate may be due to more number of plants per unit of area. The effect of seed rates on dry matter accumulation of crop can be ascribed to growth attributes *viz.* plant height and shoot number under the present study. Behzad and Amani (2020); Kumar *et al.* (2017) also obtained better dry matter accumulation of wheat with the highest seed rate of 125 kg/ha.

Yield attributes. Yield attributing characters *viz.* number of effective tillers per square meter and number of grains per spike of wheat were significantly higher with crop sown on 9th November which was statistically at par with crop sown on 29th November. Significantly lowest number of effective tillers per square meter and number of grains per spike were recorded under crop sown on 19th December. It might be due to decrease in temperature in late sowing which reduces cell division, cell expansion and carries a primary effect of on meristematic development of tillers of wheat. Similar results were also reported by Satter *et al.* (2023). Higher numbers of grains per spike with November sowing might be due to favourable climatic condition, which prolonged vegetative as well as reproductive phases of the crop and resulted in more interception of solar radiation and translocation of assimilated photosynthates from source to sink, which caused the plant to produce higher number of grains per spike (Jayashi *et al.*, 2021).

Among seed rates, significantly higher number of effective tillers per square meter and number of grains per spike was recorded where seed rate of 125 kg/ha was used, whereas the lowest number of above parameters was recorded when seed rate of wheat was used 100 kg/ha. Sowing of wheat with seed rate of 110 kg/ha resulted in statistically similar number of effective tillers per square meter and number of grains per spike as of number observed with seed rate of 125 and 100 kg/ha. Higher number of effective tillers under higher seed rate may be because of more number of mother shoot.

Yield: The data pertaining to grain and straw yields of wheat have been given in Table 2. Wheat crop sown on 9th November resulted in significantly higher grain (3426 kg/ha) and straw (6236 kg/ha) yields which remained statistically at par with crop sown on 29th November. Crop sown on 9th November resulted in 6.01 and 18.27 per cent more grain yield and 7.04 and 19.61 per cent more straw yield over 29th November and 19th December sown crop, respectively. The highest yield recorded with 9thNovember sowing was due to significantly higher effective tillers, spike length and grains per spike while lowest yield recorded during last date of sowing (19th December) was due to the lowest value of all these yield attributes which may be result of the least time taken to maturity as compared to other dates of sowing. The decline in yield with delay in sowing may be due to forced maturity of late sown wheat, reduction in plant height, dry matter accumulation and shoot number. Moreover, the yield attributes like effective tillers and grains per spike were reduced under delayed sowing which may be responsible for lesser grain yield. Similar results have been reported by Deshmukh *et al.* (2015); Andarzian *et al.* (2015).

The highest grain (3391 kg/ha) and straw (6086 kg/ha) yields of wheat were obtained with 125 kg/ha of seed rate. The effect of 110 kg/ha of seed rate was found comparable with both the seed rates of 125 and 100 kg/ha. The per cent increase in grain and straw yields with 125 kg/ha seed rate was 7.22 and 12.09 per cent, respectively over 110 kg/ha seed rate and 5.86 and 14.05 per cent, respectively over 100 kg/ha seed rate. Higher wheat grain and straw yields with increase in

seed rate could be because of higher plant population. Yadav and Dhanai (2017); Tahir *et al.* (2019); Chauhdary *et al.* (2016) also reported similar results.

Table 1: Effect of sowing dates and varying seed rates on growth parameters of wheat.

Treatments	120 days after sowing		
	Plant height (cm)	Number of shoots (per m^2)	Dry matter accumulation (g/m^2)
Sowing dates			
9th November	86.0	321	433.52
29th November	82.8	305	407.59
19th December	74.3	276	354.20
SE±	2.5	9.01	13.08
CD(P)=0.05	7.7	27.04	39.25
Seed rates (kg/ha)			
100	78.9	286	373.79
110	80.5	302	403.26
125	83.6	313	418.26
SE±	2.0	6.74	10.27
CD(P)=0.05	6.0	20.22	30.81

Table 2: Effect of sowing dates and varying seed rates on yield attributes and yield of wheat.

Treatments	Number of effective tillers (m^2)	Number of grains per spike	Grain yield (kg/ha)	Straw yield (kg/ha)
Sowing dates				
9th November	265	44.2	3426	6236
29th November	251	41.6	3220	5797
19th December	223	37.8	2800	5013
SE±	8.7	1.23	104.9	214.3
CD(P)=0.05	26.1	3.7	314.9	643
Seed rates (kg/ha)				
100	231	38.7	2981	5231
110	247	41.4	3146	5729
125	263	43.4	3391	6086
SE±	6.83	0.96	82.3	169.3
CD(P)=0.05	20.5	2.9	246.9	508

CONCLUSIONS

The study conclusively indicated that wheat sown on 9th November using seed rate of 125 kg/ha proved better in terms of growth attributes (plant height, number of shoots and dry matter accumulation), yield attributes (number of effective tillers and number of grains per spike) and yield (grain and straw) than crop sown on 29th November and 19th December using seed rate of 100 and 110 kg/ha.

FUTURE SCOPE

It is suggested to farmers of mid hills of Himachal Pradesh that wheat can be preferably sown on 9th November with seed rate of 125 kg/ha for better productivity.

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Conflict of Interest. None.

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