Effect of sowing dates on growth and yield characters of wheat (*Triticum aestivum L.*)

Abstract

A field experiment was conducted at the Organic Research Farm (HRF), Karguanji, Department of Seed Science and Technology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (U.P.). The experiment was laid out in Factorial Randomized Block Design in three replications involving four varieties viz., RAJ-4079, GW-322, GW-273 and HI-1544 as one factor and sowing dates viz., 15th October, 24th November and 20th December as second factor. The study revealed that, among the sowing dates significant differences were observed. The growth and yield characters were better in respect of 24th November sowing followed by 15th October and 20th December sowing. The variety HI-1544 produced higher seed yield than others, while GW-273 recorded less but stable performance during early as well as late sown conditions.

Keywords: Sowing dates, 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 on growth and yield of wheat, the present study was undertaken.

Materials and Methods

The experiment was laid out during Rabi, 2024-25 at Organic Research Farm (HRF), Karguanji, Department of Seed Science and Technology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (U.P.) in a Factorial Randomized Block Design with three replications. Each plot comprised of 2.40 x 1.8 m2 (Gross) and 2.00 x 0.72 m2 (Net) areas. Spacing – Plant to plant- 5 cm, Row to row- 22.5 cm. All the recommended packages of practices were adopted. The seeds of four wheat varieties viz. RAJ-4079, GW-322, GW-273 and HI-1544 were sown on 15/10/2024 (D1), due to rainfall, sowing is done on 24/11/2024 (D2) instead of 20 Nov. and 20/12/2024 (D3) in flat beds by line sowing in three replications. 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

Field emergence percentage- Amongthe varieties, HI-1544 showed superior emergence as compared to other varieties. The field emergence was significantly superior in sowing date 24th November and 15th October over 20th December (Table 1). The field emergence was slightly less due to sowing on 20th December might be due to fluctuation in mean minimum temperature (7.5°C) during 51 met. Week. Similar results were obtained by Blazich *et al.*(1995) and Akhtar *et al.* (2012). Akmal *et al.* (2011) reported thatearly planting ensures optimum emergence.

Days to 50 % heading-The variety GW-273 was found to be early and took lesser number of days to attend 50 per cent panicle emergence (Table 4.2). While, HI-1544 took more number of days to 50 per cent panicle emergence. Similar observation was recorded by Vibhute (2007) who reported that GW-273 recorded minimum days to first flowering. The sowing done on 24th November required significantly more number of days to 50 per cent heading (64 days) than late sown (Table 2). Sharma (2005) reported that optimum temperature has been required for vegetative growth ranged from 16°C to 22°C.

Days to maturity- The variety GW-273 exhibited the minimum days required to attain physiological maturity (95.00 days) as compared to the other varieties. The 20th December sowing might be affected due to increasing daily maximum temperature from 35.3°C to 36.4°C and minimum 9.2°C to 19.4°C during 12 MW to 13 MW. Similar results were obtained by Dokuyucu et al. (2004).

Number of productive tillers m^{-2} -The number of tillers per m2 was significantly differed in varieties under study. The variety HI-1544 produced significantly more number of tillers per m^2 (235.44). The number of productive tillers m-2 was significantly influenced by the sowing dates. The sowing done on 24th November produced maximum number of tillers m-2 followed by sowing done on 15th October (Table 4). According to Malik et al. (2009b) maximum number of tillers m^{-2} and grain yield were recorded when wheat sown on 30th November whereas minimum tillers m^{-2} and grain yield were recorded on 15th December.

Panicle length- The variety HI-1544 (10.46 cm) recorded highest panicle length than rest of varieties. The panicle length was significantly influenced by the sowing dates. All varieties showed better panicle length in 24th November sowing. Similar results were obtained by Dhiman et al. (1979); Das et al. (1993); Sattar et al. (2010) and Baloch et al.

(2012). They reported that panicle length was significantly reduced due to delayed sowing.

Number of grains per panicle - The study showed higher number of grains in wheat variety HI-1544 (47). While, lowest number of seeds was noticed in GW-273 (43). The number of grains per panicle was significantly superior due to sowing on 24th November and 15th October over 20th December. Similar results were obtained by Dhiman et al. (1979), Das et al. (1993), Sattar et al. (2010) and Baloch et al. (2012).

Grain yield per plot- The grain yield of HI-1544 (1.43 kg) was significantly highest than rest of varieties. However, significantly lowest grain yield per plot (1.30 kg) was noticed in GW-273. Under late sown condition, variety GW-273 had produced significantly higher grain yield per plot (1.40 kg), while in other varieties it was subsequently reduced. The grain yield per plot was significantly superior due to sowing on 24th November (1.43 kg) and 15th October (1.31 kg) over 20th December(1.30 kg). Normal sowing produces more number of tillers, grains spike-1 and grain weight that ultimately boosts up grain yield (Aslani and Mehrvar, 2012).

Table-1. Effect of varieties, sowing dates and their interaction on field emergence (%)

Varieties / Sowing dates	V1 RAJ-4079	V2 GW-322	V3 GW-273	V4 HI-1544	Mean
D1 15 Oct	92.70 (74.32)	89.00 (70.63)	88.90 (70.54)	93.67 (75.43)	91.07 (72.61)
D2 24 Nov	94.33 (76.22)	91.43 (72.98)	89.00 (70.63)	95.83 (78.22)	92.65 (74.27)
D3 20 Dec	87.67 (69.44)	90.00 (71.57)	92.67 (74.29)	89.13 (70.75)	89.87 (71.44)
Mean	91.57 (73.12)	90.14 (71.70)	90.19 (71.75)	92.88 (74.52)	91.19 (76.22)
	Variety		Sowing dates		Interaction
S.E. ±	0.74		0.64		1.27
C.D. at 5%	2.12		1.84		3.67

Note: The given values in parenthesis are arc sign values.

Table-2. Effect of varieties, sowing dates and their Interaction on days to 50 % heading

Varieties / Sowing dates	V1 Raj-4079	V2 GW-322	V3 GW-273	V4 HI-1544	Mean
D1 15 Oct	62.00	60.00	59.00	65.00	61.50
D2 24 Nov	65.00	63.00	61.00	66.00	63.75
D3 20 Dec	59.00	58.00	56.00	59.00	58.00
Mean	62.00	60.33	58.67	63.33	61.08
	Variety		Sowing dates		Interaction
S.E. ±	0.90		0.78		1.55

C.D. at 5%	2.59	2.23	4.43

Table-3. Effect of varieties, sowing dates and their interactions on days to maturity

Varieties / Sowing dates	V1 RAJ-4079	V2 GW-322	V3 GW-273	V4 HI-1544	Mean
D1 15 Oct	112.00	96.00	95.00	105.00	102.33
D2 24 Nov	120.00	108.00	98.00	115.00	110.25
D3 20 Dec	105.00	98.00	92.00	102.00	99.25
Mean	112.33	100.67	95.00	107.33	103.83
	Variety	Sowing dates	Interaction		
S.E. ±	1.33	1.14	2.30		
C.D. at 5%	3.82	3.30	6.55		

Table-4. Effect of varieties, sowing dates and their interaction on number of productive tillers (m^{-2})

Varieties / Sowing dates	V1 RAJ-4079	V2 GW-322	V3 GW-273	V4 HI-1544	Mean
D1 15 Oct	236.00	227.00	212.67	246.33	230.50
D2 24 Nov	250.00	234.00	220.00	266.33	242.58
D3 20 Dec	183.00	218.33	225.67	191.33	204.50
Mean	223.00	226.33	219.44	235.44	226.06
	Variety	Sowing dates	Interaction		
S.E. ±	3.90	3.38	6.77		
C.D. at 5%	11.25	9.74	19.49		

Table-5. Effect of varieties, sowing dates and their interactions on panicle length

Varieties / Sowing dates	V1 RAJ-4079	V2 GW-322	V3 GW-273	V4 HI-1544	Mean
D1 15 Oct	10.13	8.77	8.57	10.57	9.51
D2 24 Nov	11.20	10.00	9.40	12.13	10.68
D3 20 Dec	8.50	9.20	9.50	8.67	8.97
Mean	9.94	9.32	9.16	10.46	9.64
	Variety	Sowing dates	Interaction		

S.E. ±	0.26	0.23	0.45
C.D. at 5%	0.75	0.65	1.30

Table-6. Effect of varieties, sowing dates and their interaction on number of grains panicle^{-1}

Varieties / Sowing dates	V1 RAJ-4079	V2 GW-322	V3 GW-273	V4 HI-1544	Mean
D1 15 Oct	46.00	42.00	40.00	50.00	44.50
D2 24 Nov	52.00	48.00	43.33	54.33	49.42
D3 20 Dec	36.00	42.00	45.00	36.33	39.83
Mean	44.67	44.00	42.78	46.89	44.58
	Variety	Sowing dates	Interaction		
S.E. ±	0.88	0.76	1.51		
C.D. at 5%	2.52	2.19	4.37		

Table-7. Effect of varieties, sowing dates and their interactions on yield per plot (kg)

Varieties / Sowing dates	V1 RAJ-4079	V2 GW-322	V3 GW-273	V4 HI-1544	Mean
D1 15 Oct	1.35	1.26	1.18	1.44	1.31
D2 24 Nov	1.46	1.38	1.30	1.62	1.44
D3 20 Dec	1.25	1.33	1.40	1.23	1.30
Mean	1.35	1.32	1.30	1.43	1.35
	Variety	Sowing dates	Interaction		
S.E. ±	0.032	0.028	0.056		
C.D. at 5%	0.093	0.080	0.16		

Conclusion

The study conclusively indicated that was growth and yield characters were better in 24th November sowing date followed by 15th October and 20th December sowing. Seed yield was noted higher in normal sowing than late sown conditions. The variety HI-1544 produced significantly higher seed yield than others, while GW-273 recorded stable performance during early as well as late sown conditions.

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