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Effect of different sowing environment on growth and yield of wheat (*Triticum aestivum* L.) Varieties

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Abstract

An experiment entitled "Effect of Different Sowing Environment on Growth and Yield of Wheat (*Triticum aestivum* L.) Varieties" was conducted at research farm, FOA, Main Campus Chatha of SKUAST-Jammu during *kharif* season of 2016-17. The soil of experiment site was sandy clay loam in texture with slightly alkaline in reaction (pH-7.9), medium in organic carbon, low in available nitrogen and medium in available phosphorus and potassium. The treatments consisted of three different sowing dates (4th November, 19th November and 4th December 2016) and three wheat varieties, HD-2967, RSP-561 and RAJ-3077 were taken. The experiments were laid in a randomized complete block design with three replications and spacing of 20 cm. The crop was fertilized with 100 kg N, 50 kg P and 25 kg/ha through urea, diammonium phosphate (DAP) and muriate of potash (MOP) respectively. The data showed significant effects of different sowing time. The highest grain yield was obtained from 4th November planting date 34.4 q ha⁻¹ which was at par with 19th November planting date 31.8 q ha⁻¹. Whereas, among the different varieties, HD-2967 recorded highest grain yield 32.8 q ha⁻¹ which was at par with Raj-3077.

Keywords: Wheat, Yield, Yield attributes, Date of Sowing, Crop Growth Rate (CGR), Relative Growth Rate (RGR)

Introduction

Wheat (*Triticum aestivum* L.) is the world's most outstanding crop that excels all other cereals both in area and production, known as king of cereals. It is also one of the most nutritious cereals and its contribution to human diet puts it in the first rank of plants that feed the world. Wheat is also the predominant *rabi* season crop of north central and upper peninsular region of country. The total area and production of wheat in India is 31.19 million hectares and 95.91 million tonnes, respectively (Anonymous 2013) [2]. In the state of Jammu and Kashmir, wheat occupy an area and production of 290.99 thousand hectares and 5819.5 thousand quintals of wheat respectively (Anonymous, 2014) [3].

Among these, the time of sowing and different varieties are of great significance which determine the proper stand establishment of the growing crop through balancing the plant to plant competition and ultimately affect the yield (Kabesh *et al.*, 2009; Nakano and Morita, 2009) [6, 10]. It has been observed that early sowing gives high yield than late sowing due to longer growing period (Munir *et al.*, 2002; Tanveer *et al.*, 2003) [8, 13] and vigorous growth associated with rapid and uniform seedling emergence (Kirby, 1993) and better combination of leaf size and tiller number (Regan *et al.*, 1992) [11]. Whereas, delay in sowing from 20th November onward decreased the wheat grain yield @ 39 kg ha⁻¹ day⁻¹ (Singh and Uttam, 1994) [12].

Materials and Methods

Therefore, a field study was conducted at the Research Farm of Agrometeorology section, Division of Agronomy, SKUAST-Jammu Chatha during 2016 cropping season to determine the effect of different sowing dates and varieties on plant height, crop growth rate (CGR), relative growth rate (RGR), Number of earheads m⁻², length of spike, weight of spike, 1000-grain weight, grain yield, straw yield, biological yield and harvest index. Three different sowing dates (4th November, 19th November and 4th December 2016) and three wheat varieties, HD-2967, RSP-561 and RAJ-3077 were taken. The experiments were laid in a randomized complete block design with three replications and spacing of 20 cm. The crop was fertilized with 100 kg N, 50 kg P and 25 kg/ha through urea, diammonium phosphate (DAP) and muriate of potash (MOP) respectively. The soil of the experimental plot was sandy clay loam, having low in nitrogen and medium in organic carbon, phosphorous and potassium.

Results and Discussion

Plant height

Height of the crop is mainly controlled by the genetic makeup of a genotype and it can also be affected by the environmental factors (Shahzad *et al.*, 2007) [4]. The data showed that plant height differed significantly by planting time (Table-1). The wheat crop sown on 4th of November produced the tallest plants of 49.3 and 110.6 cm respectively at 60 DAS and at harvest which was at par with crop sown on 19th of November. The earlier sowing resulted in better growth of the grain due to longer growing period Shahzad *et al.* (2007) [4]. Whereas, among different varieties, did not show any positive effect on grain weight.

Crop growth rate

Data regarding crop growth rate (CGR) is shown in Table 1. Significant variation was found among sowing dates and varieties with respect to these attributes. Crop sown in 4th November showed significantly maximum crop growth rate (CGR) 2.311 (g/m²/day) at 60-30 DAS and 9.256 (g/m²/day) at 90-60 DAS and lowest was recorded in 4th December. Early

sowing date (4th November) produced the highest CGR values in all the growth stages (Table-1). Crop growth rate increased slowly at early stages of growth and reached the peak at booting to heading stage thereafter, it declined. This was due to the maximum production of dry matter at early stages of plant growth. These results are in accordance with Alam, (2013) [11] who stated that crop growth rate was higher at booting and tillering stages.

Relative Growth rate

Significant variation was found among sowing dates and varieties with respect to these relative growth rate. Crop sown in 4th November showed significantly maximum crop growth rate (CGR) 0.010 (g/g/day) at 60-30 DAS and 0.016 (g/g/day) at 90-60 DAS and lowest was recorded in 4th December. Higher crop growth rate in early sowing was due to long duration to overall improvement and better crop growth rate. Different varieties under research did not significantly for their effect on relative growth rate on 60-30 DAS and 90-60 DAS of wheat crop.

Table 1: Effect of different sowing environments and varieties on Plant height at 60 DAS & at harvest, periodic Crop growth rate (CGR) (g/m²/day) and Relative growth rate (RGR) (g/g/day) at 60-30 DAS and 90-60 DAS.

Treatments	Plant height (cm)		CGR		RGR	
	60 DAS	At harvest	60-30 DAS	90-60 DAS	60-30 DAS	90-60 DAS
D ₁ (04.11.16)	49.3	110.6	2.311	9.256	0.010	0.016
D ₂ (19.11.16)	48.6	108.1	2.167	8.789	0.009	0.015
D ₃ (04.12.16)	42.6	89.6	1.789	8.111	0.008	0.014
Sem ±	1.87	3.87	0.083	0.097	0.0003	0.000
CD at 5%	3.57	10.00	0.176	0.2056	0.0007	0.001
Varieties						
V ₁ (HD-2967)	44.2	99.6	2.111	8.800	0.009	0.016
V ₂ (RSP-561)	46.6	102.7	2.067	8.633	0.008	0.014
V ₃ (RAJ-3077)	47.6	105.9	2.100	8.722	0.008	0.015
Sem ±	1.87	3.87	0.083	0.097	0.0003	0.000
CD at 5%	3.57	N.S	N.S.	N.S.	N.S.	N.S.

Yield attributes

No. of earheads/m²

The economic yield of most of the cereals is determined by the number of tillers. It has the great agronomic importance as this may compensate the difference in number of plants, partially or totally after crop establishment and may allow crop recovery from early frost (Acevedo *et al.*, 1998). It is evident from the data that sowing time had no significant effect on the number of tillers per unit area. However, sowing wheat on 4th November gave the maximum number of tillers (232.2 m⁻²) as compared to the wheat sown on 19th November and 4th December. Different varieties also remained non-significant.

Spike Length

The length of spike plays a vital role in wheat towards the grains spike⁻¹ and finally the yield (Shahzad *et al.*, 2007) [4]. As far as the sowing time is concerned, significant observations were recorded for the spike length. Sowing wheat on 4th November produced the longest (10.2 cm) and statistically at with wheat sown on 19th November (Table-2). Further delay in sowing resulted in shorter spike length.

Waraich *et al.* (1981) [15] reported that earlier planting resulted in better spike development due to longer growing period. Different varieties also remained non-significant.

Spike weight (gm)

As far as the sowing time is concerned, significant observations were recorded for the spike weight. Sowing wheat on 4th November recorded (11.7cm) and statistically at with wheat sown on 19th November (Table-2). Further delay in sowing resulted in reduce spike weight. Different varieties also remained non-significant.

1000-grain weight (g)

Among different sowing dates, the maximum 1000-grain weight (42.9 g) was recorded on 4th November (Table-2). The minimum 1000-grain weight (36.1 g) was noted on 4th December sowing date. The results are in accordance with the findings of Shahzad *et al.* (2007) [4] who also observed that earlier sowing resulted in better development of the grain due to longer growing period. Whereas, among different varieties, did not show any positive effect on test weight.

Table 2: Effect of different sowing environments and varieties on No. of earheads/m², Spike length (cm), Spike weight (gm) and test weight (gm).

Treatments	No. of earheads/m ²	Spike length (cm)	Spike wt. (gm)	Test weight (gm)
Date of Sowing				
D ₁ (04.11.16)	232.2	10.2	11.7	42.9
D ₂ (19.11.16)	229.8	9.2	11.3	42.4
D ₃ (04.12.16)	226.7	8.3	10.0	41.1
Sem ±	3.03	0.2872	11	42.1
CD at 5%	N.S.	0.6089	0.84	0.62
Varieties				
V ₁ (HD-2967)	230.8	9.33	11.4	42.4
V ₂ (RSP-561)	227.6	9.1	10.9	41.7
V ₃ (RAJ-3077)	225.3	9.2	10.7	42.3
Sem ±	3.03	0.2872	11	42.1
CD at 5%	N.S.	N.S.	NS	NS

Yield

Grain yield (q ha⁻¹)

The data showed significant effects of different sowing time. The highest grain yield was obtained from 4th November planting date 34.4 q ha⁻¹ which was at par with 19th November planting date 31.8 q ha⁻¹ while 4th December produced the lowest grain yield of 26.3 q ha⁻¹ (Table-2). Shahzad *et al.* (2007) [4] also obtained lower grain yield with delay in sowing due to shorter duration of growth and development and delayed emergence of seedlings caused by low temperature and early maturity due to high temperature during reproductive stage particularly the grain filling process leads to reduced number of effective tillers in case of late sown crop (Tripathi, 2003) [14]. Whereas, among the different varieties, HD-2967 recorded highest grain yield 32.8 q ha⁻¹ which was at par with Raj-3077 and lowest was recorded in RSP-561.

Straw yield (q ha⁻¹)

Sowing dates and varieties both significantly affected the date of sowing and varieties. The highest straw yield was recorded from 4th November sowing date 103.6 q ha⁻¹ which was at par with 19th November sowing date 93.1 q ha⁻¹ and lowest staw yield was recorded in 4th December sowing date (Table-2). Shahzad *et al.* (2007) [4] also obtained lower grain yield with

delay in sowing due to shorter duration of growth and development.

Biological Yield (q ha⁻¹)

The maximum biological yield (112.96 q ha⁻¹) was recorded in crop sown on 4th November, which was significantly higher which was at par with 19th November sowing. The lowest biological yield was reported from 4th December. However, a value of dry matter partitioning was gradually increased from first observation till the end of physiological maturity of the crop. Environmental conditions during this time favour proper seed germination and thus lead to healthy crop stand that reduces the chances of insect pests attack and healthy crop growth (Mushtaq and Saleem, 2012) [9]. Whereas, among different varieties, did not show significant effect on biological yield.

Harvest Index (%)

The maximum harvest index 0.33 % was recorded from 4th November sown and minimum harvest index was reported from the crop sown on 19th November sown and in case of varieties 0.32 % were reported from both HD-2967 and RAJ-3077. These results are in accordance with (Mushtaq and Saleem, 2012) [9].

Table 3: Effect of different sowing environments and varieties on Seed yield, Biomass (q ha⁻¹)

Treatments	Seed yield	Biomass (q ha ⁻¹)	Biological Yield (q ha ⁻¹)	Harvest Index (%)
Date of Sowing				
D ₁ (04.11.16)	34.4	103.6	112.96	0.33
D ₂ (19.11.16)	31.8	93.1	98.93	0.30
D ₃ (04.12.16)	26.3	75.4	82.82	0.32
Sem ±	1.12	3.87	5.02	-
CD at 5%	2.90	11.00	12.58	-
Varieties				
V ₁ (HD-2967)	32.85	94.3	102.86	0.32
V ₂ (RSP-561)	27.93	83.5	90.92	0.31
V ₃ (RAJ-3077)	31.70	94.2	100.92	0.32
Sem ±	1.12	3.87	5.02	-
CD at 5%	2.90	11.00	NS	-

Conclusion

The results revealed that the date of sowing of wheat crop between 4th November to 19th November produces higher yield under subtropical region of Jammu. Whereas, among the varieties the higher yield was recorded in HD-2967 as compare to RAJ-3077 and RSP-561 as its yield attributes was significant higher than other varieties.

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