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Response of wheat (*Triticum aestivum*) to sowing time with varying levels of spacing

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Abstract

A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, and Sardarkrushinagar during *Rabi* season of the year 2017-18 on "Response of wheat (*Triticum aestivum*) to sowing time with varying levels of spacing". Twelve treatments comprising of sowing time and spacings *viz.*, T₁ : 15th November + Broadcasting; T₂ : 15th November + 18 cm between two rows; T₃ : 15th November + 22 cm between two rows; T₄ : 25th November + Broadcasting; T₅ : 25th November + 18 cm between two rows; T₆ : 25th November + 22 cm between two rows; T₇ : 5th December + Broadcasting; T₈ : 5th December + 18 cm between two rows; T₉ : 5th December + 22 cm between two rows; T₁₀ : 15th December + Broadcasting T₁₁ : 15th December + 18 cm between two rows and T₁₂ : 15th December + 22 cm between two rows were tried in strip plot design with four replications. In all cases, The yield and yield attributes of wheat *i.e.* number of earhead per plant (9.5), number of grains per earhead (41.0), grain yield per plant (24 g), grain yield (4523 kg/ha) and straw yield (7203 kg/ha) significantly higher with wheat sown at 25th November over other treatments. In case of spacings number of earhead per plant (9.4), number of grains per earhead (41.0), grain yield per plant (23.5 g), grain yield (4632 kg/ha) and straw yield (7014 kg/ha) were significantly higher with respect to wheat sown with 18 cm between two rows over all other treatments. Interaction effect of sowing time and spacing *i.e.* 25th November + 18 cm between two rows gave significantly higher grain (5291 kg/ha) and straw yield (8649 kg/ha) the other interactions.

Keywords: Wheat, *Triticum aestivum*, sowing time, varying levels, spacing

Introduction

Wheat (*Triticum aestivum*) is one of the most important cereal crops for the majority of world's population and India. It is second most important cereal crop next to rice contributing nearly 35 per cent to the national food and nutritional security. Wheat has been described as "King of cereal or staff of life." It finds a major place in meals of common population in major wheat growing states of India. The cultivation of wheat has also symbolic of green revolution. The proper time of sowing exploit a distinguished effect on growth and eventually on the yield of wheat crop. In general the optimum time for sowing wheat depends upon the genotypes and the temperature, for timely and late sown varieties of long and short duration are preferred, respectively. The high yielding dwarf wheat varieties are most sensitive to date of sowing and hence, optimum time of sowing contributes more towards yield and very early sowing in first week of October resulted in lower yield (Singh *et al.* 1974) [11]. While, delaying the sowing from 15th November to 15th December and up to 15th January resulted in average yield reduction of 18.1 and 52.1 per cent, respectively. (Randhawa and jolly, 1974) [10].

Crop geometry is another important agronomic factor influencing crop production. Crop geometry refers to the shape of the space available for individual plants. It influences crop yield through its influence on light interception, rooting pattern and moisture extraction pattern. Crop geometry is altered by changing inter and intra-row spacing (Planting pattern). Optimum spacing depends on morphological characteristics of the genotypes as well as sowing time. There is limited information is available in this aspect with respect to newly released high yielding variety of wheat *i.e.* GW 451.

Materials and Methods

A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardar krushinagar during *rabi* season of the year 2017-18. The soil of experimental field was loamy sand in texture.

Physical properties of soil: Sand- 84%, Silt- 7.55%, Clay- 7.09%. Chemical Properties of soil: Soil PH- 7.53, EC- 0.17 ds/m, OC- 0.21%, Available N- 154.36 (kg/ha), Available P₂O₅- 36.60 kg/ha, Available K₂O- 288.5 kg/ha.

In all 12 treatment combinations consisting of four levels of Sowing time [15th November (D₁), 25th November (D₂), 5th December (D₃) and 15th December (D₄)] and three levels of spacing [Broadcasting (S₁), 18 cm between two rows (S₂), 22 cm between two rows (S₃)] were tested in Strip plot design with four replications. Crop was fertilized as per treatments. Two hand weeding and one interculturing were carried out during the early crop growth stages. Observations related to yield attributes and yield viz., number of earhead per plant, number of grains per earhead grain yield per plant, grain yield and straw yield. Other interactions.

Results and Discussion

Effect of sowing time

The results given in table 1 revealed that yield and yield attributes were significantly influenced by sowing time treatment 25th November gave significantly higher result in number of ear head per plant, number of grains per ear head grain yield per plant, grain yield and straw yield. This was due to the fact that timely sowing condition of wheat provided better adaptability of weather parameters like, lower gap between minimum and maximum temperature, relative humidity, lower evapotranspiration leading to better availability of soil moisture and nutrients, which in turn favoured to profuse growth in terms of more taller plant and late or very late sowing conditions restricted the growth in terms of shorter plants. The results are in agreement with those reported by Lathwal and Thakral (1999)^[6], Zende *et al.* (2005)^[12], Man (2010)^[8] and Jat Lokesh Kumar *et al.* (2013)^[5]. Further, the results revealed that sowing time treatment. 25th November recorded significantly higher number of earhead per plant (9.5), number of grains per earhead (41.0), grain yield per plant (24.0 g), grain yield(4523 kg/ha) and straw yield(7203 kg/ha). The results are in agreement with those reported by Jat *et al.* (2013)^[4], Md. Parwaizalam *et al.* (2013)^[8] and, Aslani and Mehrvar (2012)^[11].

Effect of spacings

The results given in table 1 revealed that yield and yield attributes were significantly influenced by sowing time treatment. 25th November gave significantly higher result in number of ear head per plant, number of grains per ear head, grain yield per plant, grain yield and straw yield. This was mainly due to the fact that closour spacing (18 cm × 18 cm) could not compensate the increase in plant population and productive tillers resulting in increase in number of ear head per unit area. The results are in agreement with those reported by Hussain *et al.* (2012)^[3] and Bhunia *et al.* (2014)^[2]. Further, the results revealed that spacings treatment 18 cm between two rows recorded significantly higher number of earhead per plant (9.4), number of grains per earhead (41.0), grain yield per plant (23.5 g), grain yield(4632 kg/ha) and straw yield(7014 kg/ha). The results are in agreement with those reported by Hussain *et al.* (2012)^[3], Bhunia *et al.* (2014)^[2], Ogunlele *et al.* (2000) and Kumar *et al.* (2013)^[5].

Interaction effect

In the case of grain yield and straw yield (Table 1) D × S interaction effect was found to be significant. Interaction effect of sowing time (25th November) and spacing (18 cm between two rows) gave higher yield (5291 kg/ha) and straw yield (8649 kg/ha).

Economics

Effect of sowing time

The data on economics of different levels of sowing time are presented in Table 2. Treatment 25th November sowing time was found superior by recording the higher values of net realization (₹66007/ha) and benefit: cost ratio (2.85).

Effect of spacings

The data on economics of different spacings are presented in Table 2 Treatment 18 cm between two rows was found superior by recording the highest values of net realization (67013 ₹/ha) and benefit: cost ratio (3.01) over other treatments.

Table 1: Effect of inorganic fertilizers and foliar spray on yield attributes, yield and quality characters of wheat

Treatments	Number of ear head per plant	Number of grains per ear head	Grain yield per plant (g/plant)	Grain yield (kg/ha)	Straw yield (kg/ha)
Sowing time (D)					
D ₁ : 15 th November	8.6	39.2	21.1	4336	6323
D ₂ : 25 th November	9.5	41.0	24.0	4523	7203
D ₂ : 5 th December	7.7	34.8	19.5	3962	5859
D ₂ : 15 th December	7.5	33.2	18.7	3739	5609
S.Em.±	0.4	1.9	0.7	146.6	229.7
C.D. at 5%	1.2	6.0	2.4	469	734
C. V. (%)	15.3	13.1	12.3	12.2	12.7
Spacings (S)					
S ₁ : Broadcasting	7.2	38.0	17.8	3517	5351
S ₂ : 18 cm between two rows	9.4	41.0	23.5	4632	7014
S ₃ : 22 cm between two rows	8.8	40.5	21.1	4271	6381
S.Em.±	0.2	1.5	0.6	110.1	184.1
C.D. at 5%	0.7	5.1	1.9	381	637
C. V. (%)	9.4	11.7	10.6	10.6	11.7
Interaction (N × F)					
S.Em.±	0.5	2.2	0.7	138.1	156.1
C.D. at 5%	NS	NS	NS	410	463
C.V. (%)	10.9	8.6	6.7	6.6	5.0

Table 1 (a): Interaction effect of sowing time and spacings on grain yield (kg/ha) of wheat

Treatments	S ₁ : Broadcasting	S ₂ : 18 cm between two rows	S ₃ : 22 cm between two rows
D ₁ : 15 th November	3582	4988	4348
D ₂ : 25 th November	3672	5291	4741
D ₃ : 5 th December	3536	4228	4077
D ₄ : 15 th December	3279	4021	3918
S.Em.±	138.1		
C.D. at 5%	410		
C. V. (%)	6.6		

Table 1 (b): Interaction effect of sowing time and spacings on straw yield (kg/ha) of wheat

Treatments	S ₁ : Broadcasting	S ₂ : 18 cm between two rows	S ₃ : 22 cm between two rows
D ₁ : 15 th November	5508	7032	6429
D ₂ : 25 th November	5604	8649	7356
D ₃ : 5 th December	5373	6293	5912
D ₄ : 15 th December	4918	6081	5828
S.Em.±	156.1		
C.D. at 5%	463		
C. V. (%)	5.0		

Table 2: Economics of different treatment combinations of spacing and sowing date

Sr. No.	Treatment Combinations	Yield (kg/ha)		Cost of cultivation (₹/ha)	Gross realization (₹/ha) Total	Net realization (₹/ha)	Benefit : Cost Ratio (BCR)
		Grain	Straw				
1.	D ₁ S ₁	3582	5508	35676	80037	44361	2.24
2.	D ₁ S ₂	4988	7032	35676	109858	74182	3.08
3.	D ₁ S ₃	4348	6429	35676	96510	60834	2.71
4.	D ₂ S ₁	3672	5604	35676	81942	46266	2.30
5.	D ₂ S ₂	5291	8649	35676	119506	83830	3.35
6.	D ₂ S ₃	4741	7356	35676	106098	70422	2.97
7.	D ₃ S ₁	3536	5373	36751	78848	42097	2.15
8.	D ₃ S ₂	4228	6393	36751	94200	57449	2.56
9.	D ₃ S ₃	4077	5912	36751	90204	53453	2.45
10.	D ₄ S ₁	3279	4918	36751	72956	36205	1.99
11.	D ₄ S ₂	4021	6081	36751	89591	52840	2.44
12.	D ₄ S ₃	3918	5828	36751	87053	50302	2.37

Note: Cost of seed @ ₹18.33/kg.

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