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Performance of bread wheat (*Triticum aestivum* L.) varieties under different row spacing

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Abstract

A field experiment entitled" Performance of Bread Wheat (*Triticum aestivum* L) Varieties under different Row Spacing" was conducted at Instructional Farm, Rajasthan College of Agriculture, Udaipur during *rabi* 2010-11. The experiment consisted of 12 treatment combinations comprising of four spacing treatments (15.0, 17.5, 20.0 and 22.5 cm) and three varieties (GW 322, GW 366 and HI 1544). The experiment was conducted in factorial randomized block design and it was replicated four times. Results of field experiment revealed that among three wheat varieties grown, variety GW 366 recorded highest dry matter, Relative Growth Rate at 30-60 DAS, Crop Growth Rate at 60-90 DAS, Net Assimilation Rate at 60-90 DAS, number of total tillers, number of effective tillers, number of grains ears^{-1} and test weight. Maximum grain yield (4.77 t ha^{-1}), straw yield (7.87 t ha^{-1}) and biological yield (12.62 t ha^{-1}) were recorded in variety GW 366 which is significantly higher over GW 322 and HI 1544. Variety GW 366 recorded significantly higher net returns (52813 Rs ha^{-1}) and B C ratio (2.84) which was found statistically superior over HI 1544 (49097 Rs ha^{-1} and 2.64) and GW 322 (46350 Rs ha^{-1} and 2.49). Amongst row spacing growing of wheat at 20.0 centimetre row spacing recorded highest dry matter, Relative Growth Rate, Crop Growth Rate, Net Assimilation Rate, total number of tillers, number of effective tillers and test weight over other row spacing. Row spacing of 20.0 centimetre gave significantly higher grain yield (4.85 t ha^{-1}), straw yield (7.80 t ha^{-1}), biological yield (12.65 t ha^{-1}) where as harvest index was maximum under 22.5 centimetre row spacing (38.80). Sowing of wheat at 20.0 centimetre row spacing recorded significantly higher net returns (Rs 53750 ha^{-1}) and BC ratio (2.89) over 15.0 cm and 17.5 centimetre while at par with 22.5 centimetre row spacing.

Key words: Bread wheat, row spacing, varieties, grain yield

Introduction

Wheat is one of the most important cereal crops of India not only in terms of hectarage, but also in terms of its versatility for adoption under wide range of agro climatic conditions and crop growing situations. Our country has witnessed spectacular growth in production and productivity, which has made country not only self sufficient but also for exporting surplus wheat. There is need to further increase in production to fulfill requirement of exploding population, maintenance of adequate buffer stock and to meet out demand for processing industries. The development and recommendation of high yielding adaptable varieties considered to be the first step to generate maximum production. In recent past, wheat varieties developed by plant breeders have high yield potential but all the varieties do not perform well in the same plant spacing. Among various agronomic factors, the inter row spacing of wheat is very important for proper distribution of plants over cultivated area for better utilization of available soil and natural resources. Keeping this in view, the present experiment was framed to be conducted during *rabi* 2010-11.

Material and methods

Field experiment was conducted during *rabi*, 2010-11 at Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur. The experiment consisted of 12 treatment combinations comprising of 4 row spacing (15.0, 17.5, 20.0 and 22.5 cm) and 3 varieties (GW 322, GW 366 and HI 1544). The experiment was laid out in factorial randomized block design with four replications. The experimental soil was sandy clay loam in texture, slightly alkaline in reaction, medium in available nitrogen (427.75 kg ha^{-1}), phosphorus (22.4 kg ha^{-1}) and potassium (671 kg ha^{-1}). The sowing of crop was done on 21.09.2010 using recommended seed rate of 100 kg ha^{-1} using 120 kg N + 60 kg P_2O_5 ha^{-1} were applied through urea and DAP. One third of N and full dose of P were applied as a basal dose. Remaining N were applied through urea in two equal splits at the time of first irrigation and second irrigation. The data pertaining to growth parameters dry matter accumulation (g) 0. 5 m row length, RGR (g g^{-1} day^{-1}), CGR (g m^{-2} day^{-1}), NAR (g dm^{-2} day^{-1}), yield attributes effective tillers (0.5 m row length), ear length (cm), number of grains ear^{-1}, 1000- grain weight (g) and grain, straw and biological yield (t ha^{-1}) along with net returns (Rs ha^{-1}) of the crop were evaluated

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Results and discussion

Effect of varieties: Data presented in Table1 show that dry matter accumulation, RGR, CGR, and NAR were significantly higher in variety GW 366 at later stages of growth as compared to other varieties. RGR and NAR were more due to better assimilatory system and higher

accumulation of assimilates in this variety and these results correlate the findings of Hussain *et al*, 2012 & Jat and Singhi, 2003. Number of grains ear^{-1} (58.19), test weight (51.0 g), yield (4.77 t ha^{-1}) and biological yield (12.62 t ha^{-1}) were significantly higher in GW 366 over GW 322 and HI 1544 (Table 2). Similar findings were also observed by Sardana *et al.* (2001) & Jat and Singhi (2003).

Effect of row spacing: A perusal of data presented in Table 1 reveals that at early stages (30 and 60 DAS) 22.5 cm row spacing registered higher dry matter accumulation *i.e.* 5.16 and 30.93 g which were on par with 20.0 cm while at 90 DAS and harvest 20.0cm row spacing registered maximum dry matter accumulation (124.30 and 183.55 g) which were on par with 22.5 cm row spacing and significantly higher over 17.5 and 15.0 cm. This is because under very close row spacing (15.0 and 17.5 cm) competition for light and other resources were more. These findings confirm the findings of Suthar (2006). CGR (4.60, 16.66 g m^{-2} day^{-1}) and NAR (0.29, (1.16 g dm^{-2} day^{-1}) values were higher in 20.0 cm row spacing at 30-60 and 60-90 DAS respectively over other row spacings. Total number of tillers (58.36), effective tillers (50.86), test weight (48.84 g), grain yield (4.85 t ha^{-1}) and straw yield (7.80 t ha^{-1}) were significantly higher in 20.0 cm as compared to 17.5 and 15.0 cm row spacing and were at par with 22.5 cm (Table 2).

Healthy and vigorous ears were observed to produce more number of grains ear^{-1} (Khan *et al.* 1996). The branching or tillering habit is commonly observed and is probably one of the most extensively studied phenomena on an individual plant basis in wheat. Number of effective tillers per area is one of the limiting factors of grain yield (Kakar *et al.* 2001). Spacing had significant effect on 1000-grain weight at wider row spacing. Vigorous and bold seeds were obtained at 20.0 and 22.5 cm row spacing. These results confirm the findings of Bakht, (2007). Grain and biological yield depend upon many factors such as effective tillers, spacing, test weight, ear length *etc.* The greater tiller numbers at the narrow row spacing was likely due to more uniform spatial distribution and less in row plant to plant competition compared with the wider row spacing (Auld *et al.*, 1983). In this study, more biomass was produced at the narrower spacing than 22.5 cm spacing indicating better resource utilization in narrow rows than wider rows. Increased light capture by a canopy has been reported in wheat with narrow row spacing configurations (Andrade *et al.*, 2002).

Table 1 Effect of row spacing and varieties on dry matter accumulation, RGR, CGR and NAR of wheat

Treatment	Dry matter accumulation				RGR		CGR		NAR	
	30 DAS	60 DAS	90 DAS	At harvest	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS
Varieties										
GW 322	3.79	22.97	109.96	169.62	0.0603	0.0525	3.28	15.46	0.21	1.03
GW 366	4.10	29.04	116.73	175.23	0.0658	0.0463	4.43	15.58	0.28	1.09
HI 1544	4.29	30.63	114.26	173.60	0.0659	0.0438	4.68	14.86	0.29	1.01
SEm ±	0.10	0.74	3.49	3.32	0.0011	0.0012	0.16	0.59	0.01	0.04
CD (P = 0.05)	0.28	2.13	NS	NS	0.0031	0.0035	0.45	NS	0.02	NS
Row Spacing (cm)										
15.0	2.88	21.17	91.24	151.32	0.0661	0.0487	3.07	12.45	0.20	0.83
17.5	3.57	27.57	116.68	174.94	0.0675	0.0487	4.26	15.83	0.26	1.08
20.0	4.63	30.53	124.30	183.55	0.0628	0.0467	4.60	16.66	0.29	1.16
22.5	5.16	30.93	122.38	181.46	0.0595	0.0460	4.58	16.25	0.28	1.10
SEm ±	0.11	0.85	4.03	3.83	0.0012	0.0014	0.18	0.69	0.01	0.05
CD (P = 0.05)	0.32	2.46	11.59	11.02	0.0036	NS	0.52	1.98	0.03	0.13

Table 2. Effect of row spacing and varieties on effective tillers, ear length, grains ear^{-1}, test weight and yield of wheat

Treatment	Effective tillers	Ear length	No. of grains ear^{-1}	1000- grain weight	Yield			Net returns
					Grain	Straw	Biological	
Varieties								
GW 322	47.91	9.60	55.38	42.56	4.34	7.16	11.50	46350
GW 366	50.48	9.88	58.19	51.00	4.77	7.87	12.62	52813
HI 1544	48.23	9.81	56.20	48.57	4.54	7.34	11.88	49097
SEm ±	0.75	0.10	0.79	0.40	0.10	0.11	0.28	1262
CD (P = 0.05)	2.17	NS	2.26	1.14	0.29	0.33	0.80	3632
Row Spacing (cm)								
15.0	45.79	9.66	55.50	45.33	4.28	7.16	11.42	45439
17.5	48.29	9.72	56.64	47.58	4.44	7.39	11.83	47864
20.0	50.86	9.97	57.18	48.84	4.85	7.80	12.65	53750
22.5	50.54	9.70	57.04	47.75	4.63	7.47	12.10	50626
SEm ±	0.87	0.12	0.91	0.46	0.11	0.13	0.32	1457
CD (P= 0.05)	2.50	NS	NS	1.31	0.33	0.38	0.92	4193

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