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Effect of Different Sowing Dates on Growth and Yield of Wheat (*Triticum aestivum* L.) Varieties in District Jhang, Pakistan

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Abstract

In a field experiment at Faisalabad, Pakistan conducted during winter 2005-06, the effect of three sowing dates December 1, 15 and 30 on three wheat cultivars Inqlab-91, AS-2002 and Bhakkar-2002 was studied. Sowing dates and varieties both significantly affected the number of fertile tillers m^{-2}, plant height, number of spikelets per spike, 1000-grain weight and grain yield. In case of sowing dates significantly maximum grain yield (4289.54 kg ha^{-1}) was obtained when crop was sown on 1st December against the minimum grain yield (2109.50 kg ha^{-1}) in case of late sowing i.e. 30th December. Among of varieties Inqlab-91 gave significantly maximum yield (3550.44 kg ha^{-1}) while minimum yield (2932.59 kg ha^{-1}) was obtained by AS-2002.

Key words: Sowing dates, growth, yield, Pakistan.

Introduction

Wheat is the most important cereal crop because it is the staple food of the people of Pakistan and thus occupies a central position in forming agricultural policies and dominates all crops in acreage and production. It contributes 14.4 % to the value added in agriculture and 3.0 % to GDP. In Pakistan wheat was sown on an area of 8.496 million hectares during 2006-2007. The total production of wheat was 23.52 million tons with an average yield of 2769 kg ha^{-1} (Anonymous, 2007). Among various factors responsible for low yield of wheat crop in the country, sowing time and varietal selection are of primary importance. Wheat is sown in winter and it has its own definite requirements for temperature and light for emergence, growth and flowering (Dabre *et al.,* 1993). Too early sowing produces weak plants with poor root system as the temperature is above optimum. Temperature above optimum leads to irregular germination and the embryo frequently dies and the endosperm may undergo decomposition due to activities of bacteria or fungi. Late planting results in poor tillering and crop grow generally slow because of low temperature. In late planting the wheat variety should be short duration that may escape from high temperature at the grain filling stage (Phadnawis and Saini, 1992). Ansary *et al.,* (1989) reported that delay sowing suppressed the yield, caused by reduction in the yield contributing traits like number of tillers, number of grains per spike and grain yield. Rajput and Verma, (1994) observed that normal sowing gave higher grain yield than late sowing. Early sowing always produces higher yield than late sowing. Each day delay in sowing from 20th November decreases grain yield @ 39 kg ha^{-1} per day (Singh and Uttam, 1999). According to Shafiq (2004) early sowing enhanced germination per unit area, plant height, spikelets per spike, grains per spike and 1000-grain weight over late sowing. Many high yielding varieties have been evolved and recommended for general cultivation in the past. These varieties are loosing their yield potential due to changes in various edaphic and environmental conditions. Therefore, continuous selection of high yielding genotypes with mid range of adaptability to edaphic and environmental conditions is very essential to increase yield per hectare. Keeping this in view, the present study was therefore, designed to determine the effect of different sowing dates on growth and yield of wheat (*Triticum aestivum* L.) varieties in district Jhang.

Materials and Methods

A field experiment to evaluate effect of different sowing dates on growth and yield of wheat (*Triticum aestivum* L.) varieties was carried out at the Government Agriculture Farm Jhang, Pakistan during rabi season 2005-06. The experiment comprised three wheat cultivars (Inqlab-91, AS-2002 and Bhakkar-2002) and three sowing dates were December 1, 15 and 30 and was laid out in randomized complete block design with split plot arrangement having three replications and a net plate size of 2.5 m x 7 m. The nitrogen at the rate of 120 kg ha^{-1} and phosphorous at the rate of 90 kg ha^{-1} was applied in the form of urea and DAP, respectively. All the phosphorous and ½ of the nitrogen were applied at the time of sowing and remaining ¼ nitrogen was top dressed with first irrigation and ¼ with second irrigation. The crop was sown with single row hand drill on a well prepared seedbed using a seed rate of 120 kg ha^{-1}. All other agronomic practices were kept normal and uniform for all the treatments. The observation recorded included germination count per unit area

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(m^{-2}), number of fertile tillers (m^{-2}), plant height (cm), number of spikelets per spike, 1000-grain weight and grain yield. The data collected was analysed statistically by using Fisher's analysis of variance techniques and differences among treatment means were compared using least significant difference test at 5% probability level (Steel *et al*., 1997).

Results

The yield of crop is always determined by its stand density that is function of its initial germination. The sowing dates significantly affected germination count per unit area. Germination was higher (190.77 m^{-2}) in December 1 sowing which differed significantly from Dec. 15 and December 30 sowing. The seedling in December 30 sowing was significantly lower (147.44 m^{-2}) than sowing date December 1 and December 15. The varieties did not show significant difference for germination count. The interaction between sowing dates and varieties was also non-significant.

The sowing dates significantly affected the tillering. The crop sown on 1st December produced significantly more number of fertile tillers m^{-2} (327.66) while significantly minimum number of fertile tillers m^{-2} (189.55) was obtained when crop was sown on December 30. In case of varieties Inqlab-91 produced significantly maximum number of fertile tillers. The minimum number of fertile tillers was produced by AS-2002 but it was statistically similar to Bhakkar-2002. Interaction between sowing dates and varieties was found to be non significant.

The data on plant height revealed that both the sowing dates and varieties affected the plant height significantly. Significantly maximum plant height (73.76 cm) was obtained when crop was sown on 1st December against the minimum plant height (65.12 cm) in case of 30th December sowing but it was statistically similar to 15th December sowing. Inqlab-91 produced the tallest plants (73.12 cm), whereas the lowest plant height of (64.78 cm) was produced in AS-2002. However, the interaction between sowing dates and varieties was found to be non significant.

Number of grains per spike is an important yield contributing parameter and has a direct effect on the final grain yield of wheat. Data regarding number of grains per spike revealed that sowing dates did not affect number of grains per spike significantly. Among varieties, Bhakkar-2002 produced significantly more number of grains per spike (37.88) followed by Inqlab-91 and AS-2002. The interaction between varieties and sowing dates showed non significant results.

The data regarding 1000-grain weight indicated that 1000-grain weight was significantly affected by sowing times. The crop sown on 1st December produced significantly heavier grains (35.13 g) than that of the crop sown on 15th December (33.8 g) and 30th December (31.88 g). The grain weight decreased significantly with each day delay in sowing. Among the varieties, Inqlab-91 produced maximum 1000-grain weight (34.05 g) which is statistically at par with Bhakkar-2002 (33.64 g). The minimum 1000-grain weight (33.12) was produced by AS-2002. The interaction between varieties and sowing dates was found to be significant. Inqlab-91 produced the heaviest 1000-grain weight (36.22 g) when it was sown on 1st December (S_1V_1). However, minimum1000-grain weight (32.17 g) was produced by Bhakkar-2002 when it was sown on 30th December (S_3V_3) which was statistically at par with Inqlab-91 (32.51) when it was sown on 30th December (S_3V_1).

Grain yield of wheat crop is the result of combined effect of various yield contributing components. It is evident from the data that sowing date affected significantly the grain yield. Significantly maximum grain yield (4289.54 kg ha^{-1}) was obtained when crop was sown on 1st December with minimum grain yield (2109.50 kg ha^{-1}) in case of late sowing i.e. 30th December. The grain yield was significantly affected by various varieties. The variety Inqlab-91 produced significantly maximum yield (3550.44 kg ha^{-1}) followed by Bhakkar-2002 and AS-2002. However the interaction between sowing time and varieties was found to be non-significant.

The straw yield is reflected by growth parameters like total number of tillers**,** leaf area and plant height. The data indicated that planting time significantly affected the straw yield. Significantly higher straw yield (6515.53 kg ha^{-1}) was produced when crop was sown on 1st December which was statistically at par with 15th December sowing against the minimum straw yield (4056.06 kg ha^{-1}) in case of 30th December sowing. The straw yield was also significantly affected by various varieties. Inqlab-91 produced maximum straw yield (5807.21 kg ha^{-1}) against the variety AS-2002 which produced significantly minimum straw yield (4884.79 kg ha^{-1}). However the interaction between sowing time and varieties was found to be non-significant.

Discussion

Decrease in germination count m^{-2} in case of late sowing is the result of temperature fluctuation. As the sowing delayed, the temperature falls this cannot fulfill the temperature requirement for seed germination. These results are in line with those of Razzaq *et al.,* (1986) they reported that late sowing results in less germination count m^{-2}. Differences in germination count m^{-2} among varieties might be attributed to their genetic diversity. These results are in accordance with those of Aslam *et al*., (2003).

Less number of tillers in late sowing was the result of less germination count per unit area which occurs due to low temperature. In case of delayed sowing the temperature was not according to the tillering requirement which results in less number of tillers m^{-2}. Differences in number of tillers m^{-2} among varieties might be attributed to their genetic diversity. These results are in accordance with those of Aslam *et al*., (2003), Khaliq (2004) and Shah *et al*., (2006).

Decrease in plant height in late sowing was due to shorter growing period. Early sown crop may have enjoyed the better environmental conditions especially the temperature and solar radiation which resulted to tallest plants. These results are in line with those reported by Shahzad *et al*., (2002). Differences in plant height among varieties might be attributed to their genetic diversity. These results are similar to those of Ahmad (1991).

Less number of grains per spike in late sowing was due to less production of photosynthates due to shorter growing period. These results are in line with those of Shahzad *et al*., (2002). Differences in number of grains per spike among varieties might be attributed to their genetic variability. These results are in line with those reported by Haider (2004).

The early sowing resulted in better development of the grains due to longer growing period. These findings are strongly supported by those of Spink *et al*., (2000) and Shahzad *et al*., (2002) who had also reported decreased 1000-grain weight with delay in sowing. Differences in 1000-grain weight among varieties might be attributed to their genetic diversity. These results are in line with those of Shahzad *et al*., (2002).

Lower grain yield in late sowing was mainly due to lower germination count m^{-2}, less number of tillers m^{-2}, less number of grains per spike and lower 1000-grain weight. These results are in accordance with those of Spink *et al.,* (2000) and Aslam *et al.,* (2003). They also reported that late sowing results in less grain yield per hectare. Higher grain yield in Inqlab-91 was mainly due to higher number of tillers and higher 1000-grain weight. These results are similar to Shahzad *et al.,* (2002).

Higher straw yield in early sowing was mainly due to higher germination count m^{-2}, more number of tillers m^{-2} and more plant height. These results are in line with those of Donaldson *et al.,* (2001). They reported that early sowing resulted in higher straw yield due to more number of tillers. Higher straw yield in Inqlab-91 can be attributed to more number of tillers m^{-2} and more plant height. These results are in line with those of Matuz and Aziz (1990).

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Table 1 Effect of sowing date on growth and Yield of Wheat Varieties.

Treatments	Germination count (m^{-2})	No. of fertile tillers (m^{-2})	Plant height (cm)	No. of grains per spike	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
Sowing dates						
S_1= 1st Dec.	190.77 a	327.66a	73.76a	38.35	4289.54 a	6515.53 a
S_2= 15th Dec.	173.33 b	269.55b	68.54b	37.08	3316.97 b	5469.58 ab
S_3= 30th Dec.	147.44 c	184.55c	65.12b	34.48	2109.50 c	4056.06 b
LSD	10.78	5.61	3.485	NS	169.34	310.36
Varieties						
V_1= Inqlab-91	174.0	266.33a	73.12a	36.51b	3550.44 a	5807.21 a
V_2= AS-2002	166.11	255.11b	64.78c	35.53b	2932.59 c	4884.79c
V_3= Bhakkar-2002	171.44	260.33b	69.52b	37.88a	3232.98 b	5349.18b
LSD	NS	5.394	2.60	1.352	122.56	196.11

Table 2 Effect of sowing date on 1000-grain weight of wheat varieties

Treatments	S_1	S_2	S_3	Means
V_1	36.22 a	33.41 cd	32.51 de	34.05 a
V_2	34.70 b	33.71 bc	33.71 bc	33.12 b
V_3	34.48 bc	34.29 bc	32.17 e	33.64 ab
Means	35.13 a	33.80 b	31.88 c	

LSD value (S) = 1.05
LSD value (V) = 0.678
LSD value (S x V) = 1.175

S_1 = 1st December
S_2 = 15th December
S_3 = 30th December
V_1 = Inqlab-91
V_2 = AS-2002
V_3 = Bhakkar-2002