Pakistan J. Agric. Res. Vol 23 No. 3-4, 2010.

EFFECT OF PLANTING DATE ON YIELD OF WHEAT GENOTYPES IN SINDH

Zafar Khokhar*, Imtiaz Hussain**, Badruddin Khokhar* and Muhammad Sohail**

ABSTRACT:-Due to reduction in tillering period and increased risk of hot weather during grain filling, late planting results in linear reduction in wheat grain yield. A study was undertaken to determine the effects of planting dates on growth and yield of different wheat genotypes in Sindh. The trial was laid out in RCBD with split plot arrangement having four replications during 2000-01 and 2001-02 at Sakrand, Sindh. Four sowing dates i.e. November 1 and 15, December 1 and 15 were in main plots, whereas six wheat genotypes (V-7001, V-7002, V-7004, MPT-6, Abadgar-93, and Anmol-91) were in sub plots. Because of better tillering, plant growth, growth period, number of grain per unit area and grain weight, November 15 planted wheat had maximum grain yield of 5904 kg ha^{-1}, followed by November 1 and December 1 which gave 5302 and 4948 kg ha^{-1} respectively. Wheat planted on December 15 resulted in minimum grain yield of 4756 kg ha^{-1}. Wheat genotype, V-7002 had significantly ($P \leq 0.05$) higher grain yield of 5578 kg ha^{-1} in comparison with other genotypes. Whereas genotype MPT-6 had grain yield of 5366 kg ha^{-1} that was also significantly higher than other genotypes. However, V-7004 had minimum grain yield of 4716 kg ha^{-1} in comparison with other genotypes. While evaluating performance of different genotypes on different sowing dates, V-7002 resulted in maximum yield on November 15 and late planting. On the other hand, V-7004 had lower yield on all planting dates. Results from the study revealed that maximum grain yield could be achieved with wheat planted in first fortnight of November and any delay in wheat planting might reduce wheat yield.

Key Words: Wheat Genotypes; Planting Date; Yield Components; Pakistan.

INTRODUCTION

Wheat is the main staple food in Pakistan and foremost source of calories in daily diet of the people. The crop is grown on 40% of the cultivable area (about 8.5 million hectare, mha) with average yield between 2500 and 2800 kg ha^{-1} (GoP, 2008), which is quite low in comparison to other major wheat producing countries. In the Sindh province of Pakistan, wheat area is around 0.9 mha with production of 2.47 million tonnes and average wheat yield is around 27 kg ha^{-1} (Government of Sindh, 2006).

Delayed wheat planting is chronic factor limiting crop yield in Sindh. The rice-wheat cropping system in upper Sindh covers around 1.03 m ha area (GoP, 1999), where wheat is planted after rice and faces shortage of irrigation water that results in late planting. In central Sindh, wheat is planted late due to continuous pickings of cotton even up to January. In lower Sindh delayed crushing of sugarcane crop is the reason for delayed wheat planting.

Optimum planting time is one of the important factors that influence the wheat yield appreciably. Planting at inappropriate time may cause drastic reduction in wheat yield. Generally, wheat crop sown during November results in better yield and any delay in sowing reduced tillers, seed index and grain yield that resulted in reduced yield (Ansari et al., 1989). Few other researchers also reported linear reduction in wheat grain yield with delayed planting (Bush et al., 1976; Khan et al., 2001; Nazir et al., 1980). Khan et al. (1989) also observed similar findings. To overcome the adverse effects of late planting, farmers of Sindh are in habit of using high seed rate which in-

*Wheat Research Institute, Sakrand, Sindh, Pakistan.
**Wheat Programme, National Agricultural Research Centre, Islamabad, Pakistan.

creases cost of production and the same time results in decreased number of productive tillers and numbers of grains spike^{-1} (Clement and Colline, 1976).

In Sindh, wheat breeders have developed varieties, which are suitable for wider range of planting (Anwar et al., 2007). These varieties can be categorized as long duration varieties which mature in 140-145 days include Mehran-89, Abadgar-93, Moomal-2002, Imdad-05 and Sarsabz, whereas short duration varieties which mature in 118-120 days include Anmol-91, T.J-83, TD-1, SKD-1.

The objective of this research work was to find out optimum planting date for newly evolved wheat advance lines (V-7001, V-7002, V-7004, MPT-6) in comparison to already established wheat varieties Abadgar-93 (early variety) and Anmol-91 (late variety). At the same time, to identify short duration advance lines to reduce wheat yield losses due to delayed planting.

MATERIALS AND METHODS

The experiment was conducted during *rabi* season of 2000-01 and 2001-02 at Wheat Research Institute, Sakrand, Sindh on clay loam soil. Land was fallow during *kharif* season and was prepared with two plowing and leveling operations. Afterwards soaking irrigation was applied on October 20 and seed bed was prepared with cultivator and rotavator at optimum moisture. A basal dose of 100:84 kg ha^{-1} NP was applied in the form of DAP and urea at the time of sowing and remaining dose of 68 kg ha^{-1} N was applied with first irrigation. The experiment was laid out in RCBD with split plot arrangement having four replications. Four planting dates i.e., November 1 and 15, December 1 and 15 were applied in main plots, whereas six wheat genotypes (V-7001, V-7002, V-7004, MPT-6, Abadgar-93, and Anmol-91) were in sub-plots. Sowing was done with single hand drill at seed rate of 125 kg ha^{-1} with 30 cm inter-row spacing on sub-plots measuring 1.85m x 6.46 m. Study area was canal irrigated. Irrigation was applied at crown root, tillering, booting, anthesis and milky stage with 75 mm irrigation depth. After first irrigation, herbicide Buctril Super was applied to control broad leaf weeds. Data including days to heading, days to maturity, number of tillers plant^{-1}, plant height (cm), spike length (cm), spikelets spike^{-1}, 1000-grain weight (g) and grain yield were recorded. Data were analyzed by using statistical software SAS and means were compared using LSD test.

RESULTS AND DISCUSSION

In both growing seasons, significant differences in all parameters due to planting dates were observed (Table 1). Plant height increased up to November 15 planted wheat, but a decreasing trend was observed in late planted wheat. These results are in agreement with the findings of Khan et al. (1989) who observed that crop planted from November 10 to December 10

Table 1. Effect of planting date on growth and yield of wheat during 2000-01 and 2001-02

Variety	Days to heading	Days to maturity	Plant height (cm)	Tillers plant^{-1} (No)	Spike length (cm)	Grains spike^{-1}	Grain weight spike^{-1} (g)	1000 grain weight (g)	Grain yield (kgha^{-1})
2000-01									
November 01	78 a	134 a	94 b	5.7 a	10.0 bc	39 b	1.76 b	42.3 a	5342 b
November 15	76 a	133 a	97 a	5.9 a	10.7 ab	39 b	1.71 b	41.2 a	6250 a
December 01	71 b	119 b	93 b	3.9 b	10.9 a	38 b	1.71 b	41.9 a	5371 b
December 15	70 c	114 c	89 c	3.4 c	9.3 c	46 a	2.22 a	42.9 a	5307 b
2001-02									
November 01	78 a	135 a	98 b	5.2 b	10.0 bc	45 a	2.22 a	42.4 a	5262 b
November 15	77 a	133 a	100 a	5.5 a	10.7 ab	46 a	2.27 a	42.8 a	5558 a
December 01	72 b	129 b	95 c	4.1 c	10.9 a	43 b	2.04 b	40.3 b	4525 c
December 15	69 c	128 b	88 d	3.5 d	9.3 c	40 c	1.71 c	38.8 c	4193 d

Means followed by same letter do not differ significantly at $P \leq 0.05$

gave significantly tall plants and more grain yield.

Early planted wheat had more time for vegetative growth and heading started after 76-78 days in November planted wheat, whereas, this period reduced to 70- 69 days in mid December sowing (Table 1). In November planted wheat, the maturity was observed 133-135 days, however, maturity was in 114-129 days in December planted wheat (Table 1 and 2). Early planted wheat attained maturity in March when mean temperature is around 25°C (Table 2) and late planted wheat exposed to higher temperature of April. In late planted wheat, time to heading shortens in a curvilinear fashion as temperature increases (Tashiro and Warlaw, 1999; Slafer and Whitechurch, 2001) and grain development period is reduced and crop matures early.

Seeding time had pronounced effect on tillering of wheat plant. Number of tillers plant^{-1} significantly reduced with delayed planting and maximum tillering was observed in November planted wheat. Similar results have been reported by Ansari et al. (1989) and Tunio et al. (1995).

Spike length and grains spike^{-1} were higher in December planted wheat because of the fact that there were less number of spikes per unit area in comparison with early planted wheat. These results are in conformity to those of Habib and Makkey (1979).

Grain weight spike^{-1} and 1000-grain weight were significantly higher in November sown wheat in comparison with that of December sown wheat. Longer grain filling period in early planted wheat and escape from terminal heat stress grain weight improves. The results are in agreement with those reported by Sandhu et al. (1978), Tunio et al. (1995) and Habib and Makkey (1979).

Because of better tillering, growth period, number of grain per unit area and grain weight, November 15 planted wheat had maximum grain yield of 5904 kg ha^{-1}, followed by November 1 and December 1 which gave 5302 and 4948 kg ha^{-1} grain yield, respectively. Wheat planted on December 15 resulted in minimum grain yield of 4756 kg ha^{-1}. This demonstrated that two weeks delay in sowing beyond November 15 resulted in 16% reduction in grain yield. The results were in line with Ansari et al. (1989), Khan et al. (1989), Sandhu et al., (1978), Khan and Salim (1981), Tunio et al., (1995) and Khalifa (1970).

Wheat Cultivars Performance

Wheat genotype V-7004 completed its heading and maturity in 69 and 118, respectively and its plant height was 84 cm (Table 3) that supported the point that this could be the short season genotype. Remaining wheat genotypes could be classified as full season genotypes.

Wheat varieties Abadgar and Anmol as well as advance line MPT-6 had better tillering in comparison with other genotypes (Table 3). Spike length and spikelets spike^{-1} were significantly higher in V-7004 in comparison with the rest of the genetic material. Grains spike^{-1} and grain weight spike^{-1} were higher with genotype MPT-6 followed by V-7002. It was further noted that 1000 grain weight differed significantly among different genotypes. Genotype V-7004 had maximum 1000grain weight (42.6

Table 2. Air temperature (°C) during wheat growing season at Sakrand

Month	2000-01			2001-02		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
October	21.1	37.4	29.3	22.0	36.0	29.0
November	15.5	29.4	22.5	16.0	31.1	23.5
December	10.6	25.7	18.2	11.8	26.7	19.2
January	8.2	23.4	15.8	8.5	23.9	16.2
February	11.3	27.3	19.3	10.9	25.5	18.2
March	16.9	32.9	24.9	17.2	33.1	25.1
April	22.3	38.5	30.4	24.5	40.0	32.2

Table 3. Performance of different wheat cultivars during 2000-01 and 2001-02

Genotypes	Heading days (No)	Maturity days (No)	Plant height (cm)	Tillers plant^{-1} (No)	Spike length (cm)	Spikelets spike^{-1} (No)	Grain spike^{-1} (No)	Grain weight spike^{-1} (g)	1000 grain weight(g)	Grain yield (kg ha^{-1})
2000-01										
Abadgar-93	77 a	134 a	102 a	4.8 a	9.8 b	17.6 ab	38 b	1.72 ab	42.8 ab	5450 b
V-7001	77 a	131 b	96 b	4.4 b	10.0 b	17.3 ab	39 ab	1.66 b	41.0 b	5481 b
V-7002	71 c	126 c	92 c	4.6 ab	9.9 b	15.9 c	41 ab	1.79 ab	41.5 b	6131 a
V-7004	69 d	114 d	83 d	4.7 ab	11.2 a	17.9 a	43 a	1.85 ab	45.2 a	5142 b
MPT-6	76 b	132 a	95 bc	4.8 a	10.3 b	17.1 b	42 ab	1.94 a	39.7 b	5736 ab
Anmol 91	70 cd	114 d	92 c	5.0 a	10.0 b	16.1 c	42 ab	1.81 ab	42.2 ab	5462 b
2001-02										
Abadgar-93	79 a*	138 a	104 a	4.9 a	10.3 b	18.6 a	44 b	2.12 a	40.8 bc	5069 a
V-7001	78 a	137 ab	96 c	4.4 b	10.0 b	17.6 b	41 d	1.83 b	39.8 c	5050 a
V-7002	74 b	134 b	98 b	4.5 b	10.1 b	18.5 a	45 a	2.21 a	42.8 a	5025 a
V-7004	69 c	122 c	84 e	4.2 c	10.8 a	18.6 a	42 c	1.81 b	39.7 c	4304 b
MPT-6	76 ab	138 a	93 d	4.6 b	10.1 b	17.4 b	45 a	2.20 a	41.4 b	4960 a
Anmol 91	69 c	119 c	96 c	4.8 a	9.94 b	16.5 c	44 ab	2.20 a	41.9 ab	4900 a

Means followed by same letter do not differ significantly ($P \leq 0.05$)

g), followed by V-7002 (42.2 g). Wheat cultivars, V-7002 had significantly higher grain yield of 5578 kg ha^{-1} in comparison with other genotypes. Whereas, genotype MPT-6 had grain yield of 5366 kg ha^{-1} that was also significantly higher than other genotypes. However, V-7004 had minimum grain yield of 4716 kg ha^{-1} in comparison with other genotypes. While evaluating performance of different genotypes on different sowing dates, V-7002 resulted in maximum yield on November 15 and late planting (Figure 1). On the other hand, V-7004 had lower yield on all planting dates.

It is thus concluded that wheat grain yield and yield components of advanced wheat lines were affected significantly by different planting dates in Sindh. Wheat line V-7004 attained maturity in 118 days can be classified as early maturing, short

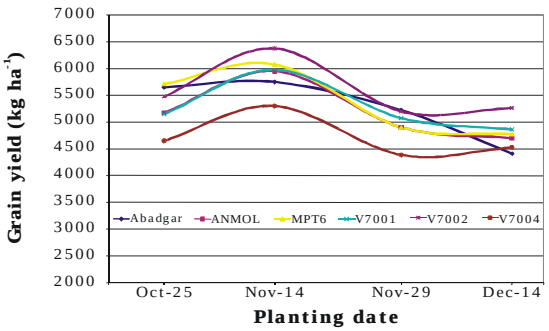

Figure 1. Effect of different planting dates on yield of different wheat genotypes

duration wheat genotype like Anmol 91, T.J-83, TD-1 and SKD-1. However, remaining wheat lines could be classified as full season genotypes similar to Moomal-2002 and Imdad-05. Maximum wheat grain yield could be achieved with planting of crop during the first fortnight of November. Delaying planting of wheat beyond mid November could reduce grain yield.

LITERATURE CITED

Anwar, J. Khan, S. B. Rasul, I. Zulkiffal, M. and Hussain, M. 2007. Effect of sowing dates on yield and yield components in wheat using stability analysis. Int'l. J. Agric. Biol. 9(1):129-132.

Ansari, A. H. Khushk, A. M. Sethar, M. A. Arian, A. N. and Memon, M. Y. 1989. Effect of sowing dates on the growth and yield of wheat cultivars. Pakistan J. Sci. & Indus. Res. 32(1):39-42.

Bush, R. H. Hammond, J. and Frohberg, R. C. 1976. Stability and performance of hard red spring wheat bulks for grain yield. Crop Sci. 16:256-259.

Clement, E. L. and Colline, F. C. 1976. Effect of plant density and planting date on wheat. Avkanaus Farm Res. 25(5):6.

Government of Pakistan. 2008. Agricultural Statistics of Pakistan (2007-08). Ministry of Food, Agriculture and Livestock, Islamabad, Pakistan.

Government of Pakistan. 1999. Agricultural

Statistics of Pakistan. Ministry of Food, Agriculture and Livestock. Islamabad, Pakistan.

Government of Sindh. 2006. Development Statistics, Bureau of Statistics, Karachi

Habib, M. A. and Makkey, M. 1979. Effect of seeding rates and sowing dates on the yield of wheat grown in the central region of Saudi Arabia. Field Crop Abstr. 34:202.

Khan, N. A. Qayyum, S. M. Ansari, A. H Kalwar, M. A. and Kalwar, M. N. 1989. Effect of different planting dates on the growth and yield of wheat (*Triticum aestivum* L.) Pakistan J. Agric. Engg. Vet. Sci. 4(102):7-13.

Khan, A. and Salim, A. 1981. Grain yield as influenced by seeding dates in wheat in NWFP. Pakistan J. Agric. Res. 7 (1): 14-18.

Khan, M. A. Anwar, J. Sattar, A. and Akhtar, M. A. 2001. Effect of seed rate on wheat yield under different sowing dates and row spacing. J. Agric. Res. 39: 223-230.

Khalifa, M. A. 1970. Effect of sowing dates, nitrogen and seed rate on wheat field in Sudan. Gezira. Exper. Agric. 6: 143-148.

Nazir, M. S. Khan, A. Ali, G. and Akhtar, M. 1980. Relationship between growing periods and yield components of three short duration wheat genotypes. J. Agric. Res. 18: 141-145.

Sandhu, H. S. Dhillon, S. S. and Gill, G. S. 1978. Response of timely sown and late sown wheat to different level of nitrogen. Field Crop Abstr. 33: 197.

Slafer, G. A. and Whitechurch, E. M. 2001. Manipulating wheat development to improve adaptation. In: Reynolds, M. P. Ortiz-Monasterio, J. I. and Nab, A. Mc. (eds.) Application of physiology in wheat breeding. Mexico, D.F. CIMMYT. p. 160-170.

Tashiro, T. and Wardlaw, I. F. 1999. The response of high temperature shock and humidity changes prior to and during the early stages of grain development in wheat. Aust. J. Plant Physiol. 17: 551-561.

Tunio, K. L. Qayyum, S. M. Ansari, A. H. Rajput, A. Q. and Mahar, K. A. 1995. Effect of different sowing dates on the growth and yield of wheat cultivars. Pakistan J. Agric. Engg. Vet. Sci. 11(1-2): 13-17.