GENOTYPIC VARIATION FOR YIELD AND MORPHOLOGICAL TRAITS IN WHEAT

Shahid Ali[*], Syed Mehar Ali Shah[*], Ali Hassnain[*], Zamarud Shah[*], and Iqbal Munir[**]

ABSTRACT

Genetic variability is the main basis of improvement in crops. An experiment comprising fifteen old and new wheat varieties was planted in randomized complete block design with three replications at the Agricultural Research Farm of NWFP Agricultural University, Peshawar during crop season, 2003-2004. Data were recorded on yield and some other morphological traits. Statistical analysis of the data was carried out and means were separated using the least significance difference test. Correlation coefficients were also determined. Analysis of variance revealed that the varieties differed significantly for days to 50% heading, days to 50% anthesis, plant height and grain yield ha^{-1}. However, differences were non-significant for physiological maturity, biological yield and harvest index. Days to 50% anthesis showed significantly positive correlations with days to 50% heading, days to maturity and grain yield. Grain yield also exhibited significantly positive correlation with biological yield.

Keywords: Genetic Variability, Morphological traits, *Triticum aestivum* L., Wheat Genotypes

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereal of the world. It is planted on an area of more than 20 million hectare with a total grain production of 550 million tones (Food and Agricultural Organization, 2003-04). Wheat is the main staple food of the people of Pakistan and the largest grain crop of the country. It contributes 12.5% to the value added agriculture and 3.1% to GDP. It is grown on an area of about 8.07% million hectares with a total grain production of 19.2 million tones and an average yield of 2.4 thousand kg ha^{-1}. In NWFP, it is grown on 0.73 million hectares with the grain production of 1.06 million tones (Agricultural Statistics of Pakistan, 2003-04).

Despite extensive research over the last few decades, the country has yet to achieve the goal of self sufficiency. Further the rapid increase in population also demands an increase in the food production. Development of new varieties with desirable yield and associated traits offers best solution to the problems of low productivity. Genetic variability exists for various yield and yield related traits in wheat (Swati *et al.*, 1997). Also there exists relationship of various yield related traits with grain yield (Tiwari and Rawat, 1993). The objective of this research was to find out genetic variation for yield and morphological traits among the locally adapted wheat varieties.

MATERIALS AND METHODS

The research was carried out at the Agricultural Research Farm of NWFP Agricultural University Peshawar during 2003-04. Fifteen old and new wheat varieties included in the study were C-306, LY-73, Nacozari-76, Chackwal-86, Faisalabad-83, Faisalabad-85, Pirsabak-91, Nowshera-96, UP-262, Rawal-97, Fakhr-e-Sarhad, ARZ, WL-711, Saleem-2K and Pavon-76. Randomized complete block design was used with three replications. Each variety was planted in four rows plot. The row length was 4 m and row to row space of 25 cm were maintained thus making plot size of 4 m^2. Recommended doses of nitrogenous and phosphatic fertilizers were applied. Standard agronomic practices were carried out during the growing season. Days to 50% heading of each plot were counted from date of sowing up to emergence of 50% spike and exposure of peduncle node. Days to 50% anthesis were counted from date of sowing till 50% plants in plot completed anthesis of each plot. Days to maturity of each plot were counted for each genotype from the date of sowing to the date of maturity. Plant height was measured in centimeters from ground level to the highest plant tip excluding awns of 10 randomly selected plants of two central rows in each plot. The bundle weight of each plot was taken with the help of a spring balance. The grain yield of each plot after harvest was recorded with the help of an electronic balance and then the data for this trait was converted in to grain yield ha^{-1}. Harvest index (%) was determined by dividing grain yield on bundle weight and then by multiplying with hundred.

RESULTS AND DISCUSSION

Days to 50% Heading

Highly significant differences ($P<0.01$) were observed among genotypes for days to 50% heading (Table-I). Mean data showed that days to 50% heading ranged from 103-114 days. The variety ARZ showed minimum days (103 days) to 50% heading, whereas Rawal-87 and Fakhr-e-Sarhad took maximum (114 days) days to heading (Table-II). Days to 50% heading showed significantly positive correlations with days to 50% anthesis and grain yield. Correlations of days to 50% heading with other traits were non-significant (Table-III). The result of our study confirms the

[*] Department of Plant Breeding and Genetics, NWFP Agricultural University, Peshawar- Pakistan
[**] Institute of Biotechnology and Genetic Engineering N.W.F.P Agricultural University Peshawar - Pakistan

findings of Mohammad *et al*. (2004), Ihsanullah and Mohammad (2001) and Qureshi *et al.* (1977).

Days to 50% Anthesis

Highly significant differences (P<0.01) were observed among the varieties for days to 50% anthesis (Table-I). Mean data showed that days to 50% anthesis ranged from 110-122 days. Minimum days to 50% anthesis (110) were recorded for varieties ARZ and maximum (122) for Pavon-76 (Table-II). Correlations of days to 50% anthesis with days to 50% heading, days to physiological maturity and grain yield were significantly positive. Days to 50% anthesis showed non-significant correlations with all other traits (Table-III). Belay *et al.* (1993) reported similar results.

Days to Physiological Maturity

Non-significant differences (P>0.05) were observed among the varieties for days to physiological maturity (Table-I). Mean data showed that days to physiological maturity ranged between 73 and 109 days. Nacozari took minimum (73) days to physiological maturity whereas LY-73 took maximum (109) days to maturity (Table-II). Correlations of physiological maturity with days to 50% anthesis and biological yield were significantly positive whereas non-significant with all other traits (Table-III). These observations are in conformity to the findings of Mohammad *et al.* (2004) and Mohammad (1999).

Plant Height

Varieties showed significant differences (P<0.05) for plant height (Table-I). Mean data showed that data for plant height ranged from 134-145 cm. Faisalabad-85 exhibited minimum (134 cm) plant height and Nacozari gave maximum (145) plant height (Table-II). These observations are in conformity to the findings of Mohammad *et al.* (2004) and Dautani *et al*. (1997). Significantly positive correlation of plant height was observed with harvest index. Plant height showed non-significant correlations with all other traits (Table-III). These findings in this study are in line with the results of Hanna *et al*. (1997) and Shah *et al.* (2003).

Biological Yield

Mean square showed non-significant differences (p>0.05) among the genotypes for biological yield (Table-I). Biological yield ranged among the genotypes from 2.2 to 4.6 kg. The minimum (2.2 kg) value was recorded for Pavon-76 whereas Rawal-87 gave maximum (4.6 kg) value for this trait (Table-II). Biological yield showed significantly positive correlations with grain yield and days to physiological maturity (Table-III). Baisakh and Nayak (1991), Nedel (1994) and Tiwari and Rawat (1993) also reported similar results.

Grain Yield

Mean square revealed significant differences (P<0.05) among genotypes for grain yield (Table-I). Grain yield ranged among the genotypes between 526 kg for Pavon-76 and 1927 kg for UP-262 (Table-II). Significantly positive correlations of grain yield with days to 50% heading, days to 50% anthesis and biological yield were observed in the present study (Table-III). The average yield of all the varieties is low due to the application of less water. The above results are in confirmation with the findings of Baisakh and Nayak (1991), Nedel (1994) and Tiwari and Rawat (1993).

Harvest Index

Mean square revealed non-significant differences (P>0.05) among genotypes for harvest index (Table-I). Harvest index ranged among genotypes from 9.8 to 27.6. Minimum (9.8) value of harvest index was recorded for WL-711 whereas maximum value (27.6) was recorded for Nacozari-76 (Table-I). Harvest index showed significantly positive correlations with plant height and grain yield (Table-III). Results in this study are contradictory to the findings of Singh and Sharma (1994), which might be due to the differences in genetic material and environment.

CONCLUSION

UP-262 showed superiority for grain yield and its potential for selection can be utilized in breeding programs.

Table I: *Mean square for days to 50% heading (DH), days to 50% anthesis (DA),physiological maturity (DPM), plant height (PH), biological yield (BY), grain yield (GY), and harvest index (HI) of fifteen wheat genotypes during 2003- 04, Peshawar.*

S.O.V	DF	DH	DA	DPM	PH	BY	GY	HI
Replication	2	8.07	5.4	0.022	13.4	0.3	73303865	50.9
Genotypes	14	25.9**	21.9**	13.9^{NS}	128*	0.5^{NS}	150954*	16.3^{NS}
Error	28	8.8	3.9	7.02	63.1	40.6	73070	40.6

NS = Non-Significant

*, ** = significant at p<0.05 and P< 0.01 levels respectively.

Table II. *Mean value for days to 50% heading (DH), days to 50% anthesis (DA), days to physiological maturity (DPM), plant height (PH) cm, biological yield (BY) kg, grain yield (GY) kg, and harvest index (HI) of fifteen wheat genotypes during 2003-04, Peshawar.*

Entries	DH	DA	DPM	PH(cm)	BY(kg)	GY(kg)	HI
C-306	109bcd	117c	86	141de	3.7	1393bcd	18
LY-73	107def	111fg	109	144ab	4.0	1365bcd	17
Nacozari	104gh	113e	73	145a	3.0	1659ab	27.6
Chakwal-86	110bc	119b	69	139f	3.5	1366bcd	19.5
Faisalabad-83	111b	118bc	87	137g	3.5	1394bcd	20
Faisalabad-85	105fgh	111fg	87	134h	3.6	954de	13.2
Pirsabak-91	108cde	115d	83	140ef	3.6	1108cd	15.0
Nowshehra-96	105fgh	113e	90	142d	4.3	1889a	22
UP-262	105fgh	112ef	102	137g	4.5	1927a	21.4
Rawal-87	114a	121ef	96	142cd	4.6	1603ab	17.4
Fakhr-e-Sarhad	114a	117c	100	143bc	4.0	1670ab	21
ARZ	103h	110g	95	136g	3.5	1678ab	24
WL-711	106efg	112ef	89	137g	3.25	1637ab	9.8
Saleem-2K	106efg	113e	83	140f	3.2	1543abc	24.1
Pavon-76	114a	122a	82	142ef	2.2	526e	12
LSD	5	2.2	-	13.3	-	475	-

Means with same letters are not significantly different.

Table III. *Correlation coefficients among days to 50% heading (DH), plant height (PH), days to 50% anthesis (DA), days to physiological maturity (DPM), biological yield (BY), grain yield (GY), and harvest index (HI) of fifteen wheat genotypes during 2003-04, Peshawar.*

	DH	PH	DA	DPM	BY	GY	HI
DH	-	0.008	0.90**	0.32	0.037	0.38*	0.32
PH	-	-	0.31	0.004	0.01	0.09	0.72**
DA	-	-	-	0.62**	0.17	0.78**	0.22
DPM	-	-	-	-	0.61*	0.32	0.081
BY	-	-	-	-	-	0.63*	0.18
GY	-	-	-	-	-	-	0.60*

*, ** = significant at $p<0.05$ and $P< 0.01$ levels respectively

REFERENCES

Agric. Statistics of Pakistan. 2003-04. Govt of Pakistan, Ministry of Food, Agric. and Livestock Div. (Econ. Wing), Islamabad.

Baisakh, B. and S.K. Nayak. 1991. Genotypic variability and correlation studies of yield contributing characters in wheat. Environ. Ecol. 9(3): 694-696.

Belay, G., T.Tesemma and D. Mitiku. 1993. Variability and correlation studies in *durum* wheat in Alem-tena, Ethiopia. Rachis. 12:(1-2): 38-41.

Dautani, M.A., H.K. Ahmad and M. Sadiq. 1997. Performance of different wheat varieties under agro climatic conditions of Dera Ismail Khan. Int'l. J. Trop. Agric. 8(6): 527-532.

Food and Agric. Org. 2003-04. World wheat corn and rice production courtesy FAO.

Hanna, N.S., S.R.S. Sabray and M.M.A. Alem. 1999. Derivation of different height near isogenic lines for bread wheat cultivars Sakha 69. Annals Agric. Sci., 44(2): 561-571.

Ihsanaullah and F. Muhammad. 2001. Correlation of yield and associated traits in spring wheat. Sarhad J. Agric. 17(1): 97-100.

Mohammad, A.I.S. 1999. Promising durum wheat genotypes under normal and stress growing conditions in northern Sudan. Rachis. 18(2): 64-66

Mohammad, F., S.M.A. Shah, M.S. Swati, T. Shahzad and S. Iqbal. 2004. Genotypic variability for yield and morphological traits in bread wheat. Sarhad J. Agric. 20(1): 67-69.

Nedel, J.L. 1994. Genetic improvement in grain yield of wheat cultivars released between 1940 and 1992. Assuit J. Agric. Sci. 29(10): 1565-1570.

Quresh, Z., A.D. Khan and P. Shah. 1977. Correlation of days to heading with grain yield, tillers and height in wheat (*Triticum aestivum* L.) under field condition. Frontier J. Agric. Res. 4: 7-11.

Shah, S.M.A., F. Mohammad, M.S. Swati and S. Iqbal. 2003. Genotypic variability for yield associated traits in bread wheat. Sarhad J. Agric. 19(4): 535-538.

Sing, I. and S.K. Sharma. 1994. Inter-relation ship of harvest index and other traits in wheat. Haryana Agric. Univ. J. Res. 24(1): 33-38.

Swati, Z.A., R. Ahmad, S. Hassan and S. Khan. 1997. Stability of yield and its components in wheat (*Triticum aestivum* L). Sarhad J. Agric. 8(2):110-117.

Tiwari, V.N. and G.S. Rawat. 1993. Variability and correlation studies between grain yield and its component in segregating of *aestivum* wheat. Int'l. J. Trop. 8(1): 19-24.