World Applied Sciences Journal 8 (Special Issue of Biotechnology & Genetic Engineering): 34-37, 2010
ISSN 1818-4952

Comparative Performance of Wheat Advance Lines for Yield and its Associated Traits

[1]Khalil Ahmed Laghari, [1]Mahboob Ali Sial, [2]M. Afzal Arain, [2]M. Umar Dahot, [3]M. Sher Mangrio and [3]A.J. Pirzada

[1]Nuclear Institute of Agriculture (NIA), Tandojam
[2]Institute of Biotechnology & Genetic Engineering (IBGE) and
[3]Institute of Plant Sciences, University of Sindh, Jamshoro, Pakistan

Abstract: Comparative yield performance studies of fourteen new advance lines of wheat (*Triticum aestivum* L.) were conducted along with two local check varieties (Sarsabz and Khirman). Some morphological (grain yield, plant height, 1000-grain weight, spike length, number of spikelets/spike, number of grains/spike, main spike yield) and phenological data (days to ear emergence, maturity period and grain filling period) were studied. To determine the possible relationship of yield associated traits with grain yield, correlation coefficient studies were also performed. Results revealed that two genotypes BWM-3 and MSH-36 could mature earlier within 126 days than check varieties; hence suitable for late planting. Genotypes showed different response for various agronomic traits. NIA-8/7, MSH-3 and MSH-5 had higher 1000 grain weight (>46.0g) whereas, BWM-3, BWQ-4 and MSH-3 produced significantly higher grain yield (4898, 4897 and 4686 kg/ha respectively) than other entries. Two genotype BWQ-4 and BWS-78 had more number of grains (>70) per spike. Positive correlation of grain yield was observed with 1000-grain weight and main spike yield.

Key words: Wheat · Local check varieties · Morphological · Phonological · Study

INTRODUCTION

Bread wheat (*Triticum aestivum* L.), has got a very unique position among all the cereals being cultivated throughout the world. Wheat is also a major staple leading crop of Pakistan. It is grown over wide range of environments. World wheat production has been recorded 655.8 tons during 2009-10 whereas, in Pakistan 23.8 million tons wheat has been produced in year 2009-10, which showed 9% increase over previous year [1]. This substantial increase in wheat production could be attributed to evolution of number high yielding wheat varieties along with introduction of modern technologies in the field of agriculture sector. This yield can still be increased by extending consideration to small stack holders/small growers in terms of supply of pure, registered seed of newly released high yielding wheat varieties and advance production technology (proper tillage, balanced use of chemical fertilizers, control of weeds etc. and the timely application of irrigation water). There is large gap between yield potential of our modern wheat varieties and yield production which indicated that crop yield can be improved through better crop husbandry [2]. The high yielding wheat varieties with improved traits have been developed throughout the world through different breeding techniques such as conventional breeding (hybridization, selection, introduction of exotic material), mutation breeding and biotechnological techniques. Newly generated breeding material has to be further evaluated in various breeding generations such as segregating generations (F2-F8), then advanced stable lines possess different desired traits related to improved yield are to be selected and evaluated in advanced generations. The selected promising lines are then tested at various locations to conduct genotype x environment interaction studies and evaluate their stability and adaptability over environments. The selected genotypes are further subjected to different analytical techniques such as stability analysis, correlation coefficient analysis, heritability studies and path coefficient analysis techniques to have an accurate inferences and proper know how about upcoming advanced lines. Grain yield is a polygenic trait and is a product of expressions of many genes (number of tillers/plant, 1000-grain weight, spike length, numbers of grains per spike and spikelet etc.). Grain yield is governed by such matric traits and the correlation between different parameters. Several research studies have been carried out on relationship of various yield component and also climatic factors with grain yield and its related traits [3, 4].

Correspoding Author: Khalil Ahmed Laghari, Nuclear Institute of Agriculture (NIA), Tandojam, Pakistan

It has been reported that the selection on the basis of such correlation studies can lead to better selection of genotypes with appropriate grain yields. It is also effective to select the genotypes on basis of performance of yield associated traits [5]. Asfaque *et al.* [6], suggested that the yield in wheat can be improved efficiently on the better performance of its closely related improved yield components. Information on nature and magnitude of variation in a population, association of characters with grain yield and role of environmental influence on expression of these characters are necessary [7]. The correlation study is therefore of interest in connection with genetic cause of correlation through pleitropy where a gene affects two or more trait via linkage [8].

Phenotypic and genotypic correlation coefficient for all possible comparison is closely equal to each other in each instance. This is due to large number of replications and plant populations within a plot. It reduces the environmental error [9]. Selection of genotypes is made on their genotypic performance, thus genotypic correlation values are important for further analysis [10]. Therefore, breeder has to investigate all such possible effect of these agronomic traits and analytical techniques on final grain yield for effective selection. In present study, possible role of yield associated components in wheat advance lines and correlation among the traits and with final grain yield were investigated to select better high yielding wheat advance lines for future breeding.

MATERIALS AND METHODS

Sixteen wheat advanced genotypes evolved through conventional and mutation breeding techniques were evaluated for their yield and yield associated traits along with 2 local checks Sarsabz and Khirman during rabi season 2007-08 at Nuclear Institute of Agriculture Tando Jam. Experiment was conducted in RCB design with 4 replications, 4 rows/entry and 5m long. Data on phenological basis was recorded on days to heading, days to maturity and grain filling period. At maturity five randomly selected plants per each replication were studied. Morphological data on plant height (cm), spike length (cm), spikelets/spike, number of grains/spike, main spike yield and 1000-grain weight were recorded. Grain yield per plot recorded and were converted into Kg/ha. Analyses of variance were carried out to data according to Steel & Torrie [11]. Phenotypic and genotypic correlations were computed as suggested by Kwon and Torrie [12].

RESULTS AND DISCUSSIONS

The results given in Table-1 showed highly significant differences for all the parameters studied. Mean performance of different yield and yield associated traits of wheat advance lines are given in Table 2a and 2b.

Table 1: Analysis of variance for yield and yield associated traits of wheat advance lines

Characters	Mean square (MS)	F. Ratio (Genotypes)	Standard error
Plant height	322.483	2.459*	5.726
Days to heading	322.717	599.059**	0.405
Days to maturity	75.767	111.331**	0.412
Grain filling period	242.117	254.117**	0.488
1000-grain weight	661606.4	336.702**	0.292
Spike length	115.215	18.293**	0.253
Number of spikelets/spike	4.686	20.128**	0.456
Grains/spike	16.762	4.057**	2.528
Main spike yield	103.69	8.347**	0.119
Grain yield	0.471	4.681**	187.984

Table 2a: Mean of yield and yield associated traits of wheat advance lines

Genotypes	Days to heading	Days to maturity	Grain filling period	1000-grain weight (g)	Grain yield (kg/ha)
BWM-3	72.25h	126.5g	54.25f	40.99de	4898a
NIA-8/7	76.25g	134.0ef	57.75d	49.49a	4638ab
NIA-9/5	88.25c	140.3ab	52.0g	39.66f	4566abc
NIA-10/8	90.0b	140.3ab	50.25h	33.24ij	3723e
NIA- 28/4	82.25f	140.8a	58.50d	36.03h	3936cde
NIA-25/5	95.50a	136.0d	40.50k	33.81i	3670e
ESW-9525	85.50d	139.5b	54.0f	30.11k	3951cde
MSH-17	84.0e	139.8ab	55.75e	38.19g	4024cde
MSH-36	63.0k	127.5g	64.50b	41.42cd	3868de
MSH-22	90.50b	138.0c	47.50i	32.88ij	3956cde
BWQ-4	88.25c	133.0f	44.75j	38.19g	4897a
BWS-78	75.25g	133.5f	58.25d	40.18ef	4463abc
MSH-3	65.0j	135.0de	70.0a	46.56b	4686ab
MSH-5	67.25h	133.0f	65.75b	46.68b	4531abc
Sarsabz	72.75h	134.8e	62.0c	39.67f	4209abc
Khirman	83.0ef	138.3c	55.25ef	41.96c	4182abc

Table 2b: Mean of yield and yield associated traits of wheat advance lines

Genotypes	Plant height (cm)	Spike length (cm)	Spikelet/ spike	Grains/ spike	Main spike yield (g)
BWM-3	106.8bcd	13.07bc	19.15fgh	63.45bcd	2.52def
NIA-8/7	109.3abc	12.26de	21.90bcd	67.20abc	3.21a
NIA-9/5	109.0abc	14.36a	21.63bcd	67.60abc	2.57def
NIA-10/8	117ab	14.43a	22.10bc	65.80abc	2.16gh
NIA- 28/4	96.50cd	12.75bcd	19.45efg	68.60abc	2.63cde
NIA-25/5	104bcd	12.10de	20.50def	60.40cde	2.03h
ESW-9525	105bcd	11.66ef	21.85bcd	66.70abc	2.20fgh
MSH-17	125.5a	13.13bc	23.70a	73.35a	2.78bcd
MSH-36	98.50d	10.78g	15.55i	62.10bcd	2.52def
MSH-22	104.5bcd	13.47b	20.90cd	68.85abc	2.46efg
BWQ-4	105.3bcd	12.12de	21.05cd	73.0a	2.95abc
BWS-78	104.5bcd	12.61cd	20.60de	65.15abc	3.10ab
MSH-3	95.25cd	11.28fg	17.95h	59.65de	2.89abc
MSH-5	93.50cd	11.01fg	18.90gh	53.80e	2.49efg
Sarsabz	106.8bcd	12.68bcd	19.15fgh	62.05bcd	2.54def
Khirman	112abc	13.49b	23.0ab	69.55ab	3.05ab

Table 3: Genotypic and phenotypic variance and heritability of different parameters of wheat advance lines

Characters	Genotypic variance	Phenotypic variance	Genotypic Coefficient variability	Phenotypic Coefficient variability	Heritability (%)
Plant Height	47.831	178.99	6.575	12.719	26.7
Days to heading	98.015	98.671	12.385	12.426	99.3
Days to maturity	18.772	19.452	3.195	3.252	96.5
Grain filling period	60.291	61.244	13.943	14.053	98.4
1000grain weight	28.718	29.06	13.63	13.711	98.8
Spike length	1.107	1.364	8.3690	9.286	81.2
Number of spikelet/spike	3.982	4.815	9.753	10.725	82.7
Grains/spike	19.533	45.091	6.752	10.259	43.3
Main spike yield	0.104	0.16	12.22	15.186	64.7
Grain yield	130063.6	271415.5	8.463	12.225	47.9

Table 4: Genotypic and Phenotypic correlation among yield and yield associated traits of wheat advance lines

Characters	Cor.	PH	D.H	D.M.	G.F.P	G.Y	T.K.W	S.L.	Spkt./spike	G. Sp	M. Sp.Y
Plant Height	G	--	0.706**	0.601*	-0.571*	-0.123	-0.280	0.981*	1.123**	0.966*	0.162
Days to heading	G	--	--	0.667**	-0.907*	-0.435	-0.717**	0.627**	0.730**	0.643**	-0.361
Days to maturity	G	--	--	---	-0.291**	-0.514*	-0.485**	0.551*	0.690**	0.489*	-0.179
Grain filling period	G	---	---	---	---	0.270*	0.649**	-0.496*	-0.551*	-0.551*	0.358
Grain yield	G	---	---	---	----	---	0.726**	-0.138*	-0.096*	-0.002*	0.755**
1000-grain weight	G	---	---	---	----	----	----	-0.364*	-0.297*	-0.415*	0.709**
Spike length	G	---	---	---	---	---	---	---	0.630**	0.531*	-0.084**
Number of spikelet	G	---	---	---	---	---	---	----	----	0.676**	0.112*
Grains/spike	G	---	---	---	---	---	---	----	-----	----	0.270**
Main spike yield	G	---	---	---	---	---	---	---	---	---	----

Whereas: PH=Plant height, DH= Days to heading, DM= Days to maturity, G.F.P= Grain filling period, TKW= 1000 grain weight, S.L=Spike length, SPKLT/SPK= Spikelets per spike G.SP=Grains/spike, M. Sp.Y= Main spike yield and G.Y= Grain yield.

Genotypes were categorized in three groups as regards their flowering time viz., early, mid and late heading. Three genotypes MSH-36, MSH-3 and MSH-5 headed earlier than rest of the genotypes and took 63, 65 and 67.25 days respectively to ear emergence. Jamali and Jamali, [13] had also reported negative correlation of plant height with grain yield in two varieties (WL-711 and H.D2009), its positive correlation can reduce the yield due to increase in plant height. Wang *et al.*, [14] observed positive correlation of grains/spike, main spike yield and 100 grains weight. We have also found positive correlation of 1000 grain weight and main spike yield with grain yield. Days to maturity, spike length, spikelet per spike and grains per spike had shown negative genotypic correlations with grain yield. Time to heading also showed negative genotypic correlation with grain yield. Singh *et al.*, [15] had observed negative correlation of days to heading and days to maturity with grain yield. Days to heading possesses positive genotypic correlation with days to maturity, grains/spike, spike length and spikelet per spike. It indicated negative correlation with other traits. Days to maturity was positively correlated with grains/spike, spike length and spikelet/ spike, where as it was negatively correlated with 1000 grain weight and grain filling period. Significant positive correlation of 1000 grain weight and main spike yield was observed with grain filling period. 1000 grain weight showed positive association with main spike yield (0.709**) and grain yield (0.726**). Spike length had positive correlation with spikelet per spike (0.630**) where as spikelet per spike had positive correlation with grains/spike and main spike yield (0.676*8 and 0.112* respectively). Grains per spike showed positive correlation with main spike yield (0.270*).

CONCLUSION

Present study showed that yield can be improved by improving yield associated traits (1000-grain weight, main spike yield, grains per spike and grain filling period). Grain yield had strong positive correlation with 1000-grain weight, main spike yield and grain filling period. The information generated by this research will be helpful for the breeders to select high yielding genotypes which possess some specific traits.

REFERENCES

1. Anonymous, 2009. Farming Outlook. June 2009, 2: 9.
2. Anonymous, 2009. Food Outlook. Global Market Analysis June 2009, p: 13-14.
3. Kneževic, M., L. Ranogajec and D. Šamota, 2008. Effects of soil tillage and herbicides on weeds and winter wheat yields. Cereal Research Communications, 36(Suppl.): 1403-1406.
4. Yousaf, A., B.M. Atta, J. Akhtar, P. Monneveux and Z. lateef, 2008. Genetic variability, association and diversity studies in wheat (*Triticum aestivum* L.) germplasm. Pak. J. Bot., 40(5): 2087-2093.
5. Majid S.A., R.Asghar and G. Murtaza. 2007. Yield stability analysis conferring adaptation of wheat per- and post-anthesis drought conditions. Pak. J. Bot., 39(5): 1623-1637.
6. Ashfaq, M., A.S. Khan and Z. Ali. 2003. Association of morphological traits with grain yield in wheat (*Triticum aestivum* L.). Int. J. Agric. Biol., 5: 264-267.
7. Yagdi, K., 2009. Path coefficient analysis of some yield components in Durum wheat (*Triticum durum* Dest.) Pak. J. Bot., 41(2): 745-751.
8. Muhammad., M., M.A. Chaudry and T.A. Malik, 2007. Corrleation studies among yield and its components in bread wheat under drought conditions. Int. J. Agric. Biol., 9(2): 287-290.
9. Dewey, D.R. and K.H. Lu. 1959. A correlation and path coefficient analysis of components crested wheat grass seed production. Agron. J., 51: 515-518.
10. Tila, M., M. Amin, F.E. Subhan M.I. Kham and A.J. Khan, 2008. Identification of traits in bread wheat genotypes (*Triticum aestivum* L.) contributing to grain yield through correlation and path coefficient analysis. Pak. J. Bot., 40(6): 2393-2402.
11. Steel, R.G.D. and J.H. Torrie, 1981. Principles and procedures of statistics. McGraw Hill Int. Book Company. Inc., New York. USA.
12. Kwon, S.H. and J.H. Torrie, 1964. Heritability and inter-relationship among traits of two soybean population. Crop Sci., 4:196-198.
13. Jamali, R. and K.D. Jamali, 2008. 11^{th} internat.Wheat Genetics Symposium. Proceedings of 11^{th} international Wheat Genetics Symposium 24-29 August 2008, Brisbane, QLD, Australia, 2: 275-277.
14. Wang, S., Z.C. Xu, R.S. Xie and Z.H. Zhang, 1991. Comparison on the inheritance of main traits in wheat grown in south and north areas. Acta Agriculture Universitatis Henanensis, China, **25: 125:133.**
15. Singh, K.N., S.P. Singh and G.S. Singh, 1995. Relationship of physiological attributes with yield components of bread wheat (*Triticum aestivum* L) under rainfed condition. Agric.Sci. Digest (Karnal) India, 15: 11-4.