American-Eurasian J. Agric. & Environ. Sci., 15 (10): 2059-2063, 2015
ISSN 1818-6769

DOI: 10.5829/idosi.aejaes.2015.15.10.12800

Correlation Studies among Productions Traits in Bread Wheat under Rainfed Conditions

[1]Wasif Ullah Khan, [1]Fida Mohammad, [1,2]Fahim Ullah Khan, [1]Faiza Zoha Zafar and [1]Gul Ghuttai

[1]Department of Plant Breeding and Genetics, the University of Agriculture Peshawar, Pakistan
[2] Barani Agricultural Research Station, Kohat, Pakistan

Abstract: In order to study correlation among yield and yield component in bread wheat, an experiment was conducted at new Developmental Research Farm Department of Plant Breeding and Genetics, the University of Agriculture, Peshawar during 2013-2014 cropping season under rainfed conditions. Twenty four genotypes were planted in 6 x 4 alpha lattice designs with three replications. Data were recorded on plant height, tillers m^{-2}, spike length, 1000-grain weight, biological yield, grain yield and harvest index. Analysis of variance revealed significant differences among genotypes for all the traits studied, except for grain yield and harvest index. Correlation analysis revealed significant positive genotypic and phenotypic association of grain yield with plant height, tillers m^{-2}, spike length and biological yield. Moreover, significant positive association of grain yield was observed with grains $spike^{-1}$ and harvest index at phenotypic level only. Strong association of these traits with grain yield suggested that these traits could be safely used as selection criterion for further improvement in yield of wheat.

Key words: Correlations analysis · Genotypic · Phenotypic · Wheat · Yield Components

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereal crop of the world. Wheat is the leading grain crop and ranks first among the cereal crops in the world as well as in Pakistan [1]. Worldwide, wheat has occupied an area of 218.46 million hectares with the total production of 713.18 and average yield of 2900 kg ha^{-1}. Pakistan has a geographical area of 79.61 million hectares of which 19.3 million hectares (25%) are currently under cultivation. In Pakistan, the total area under wheat during 2013-2014 was 9.39 million hectares with total production of 25.29 million tons and average yield of 2797 kg ha^{-1}. In Khyber Pakhtunkhwa, wheat was grown on total area of 0.64 million hectares with total production of 1.15 million tons and average yield of 1810 kg ha^{-1} [2].

Manifestation of wheat yield fluctuates widely as a result of its interaction with environment because grain yield in wheat is a complex inherited character and is the product of several contributing factors affecting yield directly or indirectly. Wheat production can be enhanced through development of improved genotypes capable of producing better yield under various agro climatic conditions and stresses [3].

Genetic resources provide an invaluable gene pool for crop breeding, the majority of accessions in germplasm collections remain uncharacterized and their potential to improve stress adaptation is not quantified [4]. Development of cultivars is based on the genotypic variability present for trait in a population. During the early phase of crop improvement, a plant breeder strives to know whether there is sufficient evidence of genetic variation in the material being tested and which are the characters that can be improved provided with particular selection intensity [5,6].

Genotypic and phenotypic correlations are important in determining the degree to which various yield contributing characters are associated. Several studies identified some useful associations [7-9]. Keeping in view the importance of wheat, the present study was thus designed to determine genotypic and phenotypic correlations among various yield and yield associated traits.

Corresponding Author: Fahim Ullah Khan, Department of Plant Breeding and Genetics, the University of Agriculture Peshawar, Pakistan.

MATERIALS AND METHODS

This study was conducted at new Developmental Farm Department of Plant Breeding and Genetics, the University of Agriculture Peshawar during 2013-2014 cropping season. The experimental material comprised 24 wheat genotypes which were planted in 6x4 Alpha lattice design with three replicates having inter-row spacing of 25 cm. Each plot had six rows of five meter length. Sowing was done on 21st November 2013. The standard dose of fertilizer and recommended cultural practices i.e. land preparation, sowing and hoeing were applied uniformly to all the entries to minimize the environmental variation. At harvest, data were recorded on plant height (cm), tillers m^{-2}(no.), spike length (cm), grains $spike^{-1}$(no.), 1000-grains weight (g), biological yield (kg ha^{-1}), grain yield (kg ha^{-1}) and harvest index (%). Data obtained for each parameter were subject to analysis of variance techniques appropriate for alpha lattice design using computer software IBM-SPSS ver 16.0. Means were separated using LSD test at 5 % level of probability. Pearson correlation coefficient among yield and yield associated traits was determined using computer software IBM-SPSS ver 16.0 following the procedure of Singh and Chaudhery [10].

Table 1: List of the Genotypes used in the experiment.

S.No	Genotypes name	Breeding Centers
1	99172	RARI, Bahawalpur
2	DN-84	ARI, D.I Khan
3	DH-31	BARI, Chakwal
4	09FFJ34	BARS, Fatehjang
5	NRL-0913	NIFA, Peshawar
6	V-11183	WRI, Faisalabad
7	V-12001	WRI, Faisalabad
8	PR-105	CCRI, Pirsabak
9	PR-108	CCRI, Pirsabak
10	PR-109	CCRI, Pirsabak
11	NIA-MB-02	NIA, Tandojam
12	NR-403	NARC, Islamabad
13	NR-407	NARC, Islamabad
14	NR-439	NARC, Islamabad
15	NR-411	NARC, Islamabad
16	NR-402	NARC, Islamabad
17	AUR-0810	PMAS, UAR Rawalpindi
18	AZRC-2	AZRC, Quetta
19	Janbaaz(check)	Janbaaz (check)
20	Pirsabak-05 (check)	Pirsabak-05 (check)
21	NARC-09 (check)	NARC-09 (check)
22	NR-397 (Check)	NR-397 (Check)
23	V07096 (check)	V07096 (check)
24	Dharab-2013 (check)	Dharab-2013 (check)

RESULTS AND DISCUSSIONS

Analysis of Variance: Analysis of variance showed significant differences among wheat bread genotypes for plant height, tillers m^{-2}, spike length, grains $spike^{-1}$, 1000-grain weight and biological yield. Significant differences among wheat genotypes indicate there is sufficient variability among the existing set of genotype to have an effective selection. On the other hand, wheat genotypes exhibited non-significant differences for grain yield and harvest index (Table 2). Non-significant differences among wheat genotypes for grain yield and harvest index could be due to selection of high yielding genotypes for multi locations testing in national uniform wheat yield trail (NUWYT) across the country to be released as potential cultivar for rainfed areas.

The results of current studies are in agreements with the earlier findings of Majumder *et al.* [11] and Ajmal *et al.* [12], they also reported significant difference among studied genotypes for various morphological and yield traits in wheat.

Correlation Analysis

Plant Height with Grain Yield and Yield Related Traits: Plant height revealed significant positive phenotypic and genotypic association with spike length ($r = 0.56^{**}$ and 0.57**), biological yield ($r = 0.70^{**}$ and 0.65^{**}) and grain yield ($r = 0.59^{**}$ and 0.62^{**}). Similarly, plant height had significant positive phenotypic relationship with tillers m^{-2} ($r = 0.27^{*}$) and grains $spike^{-1}$ ($r = 0.30^{**}$) only. On the other hand, plant height exhibited non-significant association with the rest of traits studied (Tables 3 and 4). Positive correlation of grain yield with plant height has been reported by Law *et al.* [16]; Mohtasham *et al.* [17]; Ali *et al.* [18]; Leilah and Al-Khateeb [19]and Jamali *et al.* [20].

Tillers m^{-2} with Grain Yield and Yield Related Traits: Tillers m^{-2} showed significant positive phenotypic and genotypic correlation with biological yield ($r = 0.59^{**}$ and 57^{**}) and grain yield ($r = 0.66^{**}$ and 52^{**}). Similarly, tillers m^{-2} had significant positive association with plant height and grains $spike^{-1}$ ($r = 0.31^{**}$) at phenotypic level only. Moreover, tillers m^{-2} revealed non-significant association with the rest of studied traits (Tables 3 and 4). Similarly, positive correlation tillers m^{-2} with grain yield in different wheat genotype has also been reported by Degewione *et al.* [13]; Khan *et al.* [14]; Zeeshan *et al.* [21] and Beheshtizadeh *et al.* [22].

Table 2: Means square for various production traits

Traits	Reps (df=2)	Sub-block(rep) (df=5)	Genotypes (df=23)	Error (df=41)
Plant height	146.02	33.5	91.11*	38.78
Tillers m^{-2}	992.78	1107.9	1262.4*	678.09
Spike length	0.99	2.0	2.11**	0.55
Grains $spike^{-1}$	10.39	39.4	87.9*	35.81
1000-grains weight	20.75	3.48	59.8**	6.5
Biological yield	7283472.2	3707022.5	5382707.9*	3332507
Grain yield	60688.9	576457.6	615506.2^{NS}	369566.4
Harvest index	0.63	16.1	16.5^{NS}	12.6

* and **= Significant and highly significant at 5 and 1% level of probability, where NS= non-significant.

Table 3: Phenotypic correlations coefficient among production traits in bread wheat

Traits	PH	TLR	SPKL	GRNSPK	TGW	BY	HI
PH	1						
TLR	0.27*	1					
SPKL	0.56**	0.06	1				
GRNSPK	0.30**	-0.31**	0.52**	1			
TGW	0.16	-0.22	0.03	-0.21	1		
BY	0.70**	0.59**	0.49**	0.28*	0.08	1	
HI	-0.21	0.13	-0.16	-0.04	0.17	-0.32**	1
GY	0.59**	0.66**	0.41**	0.27*	0.21	0.84**	0.24*

Table 4: Genotypic correlations coefficient among production traits in bread wheat

Tarits	PH	TLR	SPKL	GRNSPK	TGW	BY	HI
PH	1						
TLR	0.16	1					
SPKL	0.57**	-0.04	1				
GRNSPK	0.36	-0.28	0.53**	1			
TGW	0.24	-0.26	0.21	-0.21	1		
BY	0.65**	0.57**	0.56**	0.34	0.18	1	
HI	-0.13	-0.11	-0.29	0.03	0.15	-0.31	
GY	0.62**	0.52**	0.47*	0.38	0.29	0.89**	0.14

Spike Length with Grain Yield and Yield Related Traits: Spike length showed significant positive phenotypic and genotypic correlation with plant height (r = 0.56** and 57**), grains $spike^{-1}$ (r = 0.52 **and 53 **), biological yield (r = 0.49** and 56**) and grain yield (r = 0.41** and 47*). Moreover, spike length showed non-significant association with the rest of studied traits (Table 3 and 4). Similar results were obtained by Majumder *et al.* [11] and Anwar *et al.* [23], who reported that spike length were the most important characters which showed positive association with grain yield.

Grains $spike^{-1}$ with Grain Yield and Yield Related Traits: Grains $spike^{-1}$ revealed significant positive phenotypic and genotypic association with spike length (r = 0.52** and 0.53**) only. Similarly, significant positive phenotypic association with biological yield (r = 0.28**) and grain yield (r = 0.27**) only. On the other hand, grains $spike^{-1}$ exhibited non-significant association with the rest of traits studied (Tables 3 and 4). Similar results were obtained by Baloch *et al.* [24], who reported positive association of grain yield $plant^{-1}$ with grains $spike^{-1}$. Similar results were found by Majumder *et al.* [11] and Anwar *et al.* [23] also reported that grains $spike^{-1}$ were the most important characters which showed positive association with grain yield.

1000-grains Weight with Grain Yield and Yield Related Traits: 1000-grains weight showed non-significant association with all the traits studied (Tables 3 and 4). Non-significant correlation between 1000 grain weight and grain yield has been reported in bread wheat varieties earlier by Fatih [25]; Yousaf *et al.* [26] and Iftikhar *et al.* [27]. In contrast, Baloch *et al.* [24] reported positive association of 1000-grain weight with grain yield and yield associated traits.

Biological Yield with Grain Yield and Yield Related Traits: Biological yield exhibited significant positive phenotypic and genotypic association with plant height ($r = 0.70^{**}$ and 0.65^{**}), tillers m^{-2} ($r = 0.59^{**}$ and 0.57^{**}), spike length ($r = 0.49^{**}$ and 0.56^{**}), grain yield ($r = 0.84^{**}$ and 0.89**). Moreover, significant positive and negative phenotypic association with grains $spike^{-1}$ ($r = 0.28^{*}$) and harvest index ($r = -0.32^{**}$), respectively. On the other hand, biological yield showed non-significant association with the rest of traits studied (Tables 3 and 4). Positive correlation of biological yield with grain yield suggest that grain yield was increased by increasing biological yield as it would help to accumulate more photosynthates to developing grain. This result concurs with the findings of Bahari *et al.* [28]; Chaturvedi and Gupta [29] and Subhani *et al.* [30].

Harvest Index with Grain Yield and Yield Related Traits: Harvest index revealed significant negative phenotypic association with biological yield ($r = -0.32^{**}$) only. On the other hand, harvest index exhibited non-significant association with the rest of traits studied (Tables 3 and 4). Significantly positive association between harvest index and grain yield and other yield related traits has been reported earlier by Majumder *et al.* [11]; Yousaf *et al.* [15]; Leilah and Al-Khateeb [19] and Singh *et al.* [31].

CONCLUSIONS

Significant differences were observed among genotypes for most the traits studied, indicating there is sufficient variability to have an effective selection. Furthermore, grain yield had significant positive associations with all the traits studied except 1000-grain weight, suggesting that these traits could be used as indirect selection criteria for further improvement in grain yield of wheat.

REFERENCES

1. Khan, I., F. Mohammad and F.U. Khan, 2015. Estimation of genetic parameters of yield and yield related traits in wheat genotypes under rainfed conditions. Int. J. Environ., 4(2): 193-205.
2. Agriculture Statistics of Pakistan, Ministry of food (2014-15), Agriculture and Livestock Islamabad, Pakistan.
3. Khan, F.U., M. Khan, S.G. Khattak, Z. Iqbal, Z. Saleem, J. Iqbal and N. Muhammad, Evaluation of advance bread wheat lines in preliminary wheat yield trial. Pure Appl. Bio., 4(3): 384-388.
4. Zafar, F.Z., F. Mohammad, F.U. Khan, G. Ghuttai and W.U. Khan, Genetic divergence among wheat breeding lines for production traits. Pure Appl. Bio., 4(3): 427-433.
5. Jan, S., F. Mohammad and F.U. Khan, 2015. Genetic potential and heritability estimates of yield traits F3 segregating populations of bread wheat. Int. J. Environ., 4(2): 106-115.
6. Zeeshan, M., W. Arshad and S. Ali, 2013. Genetic diversity and trait association among some yield parameters of wheat elite lines genotypes under rainfed conditions. J. Ren, Agric., 1(2): 23-26.
7. Ahmad, M., F. Mohammad, K. Maqbool, A. Azim and S. Iqbal, 2003. Genetic variability and traits correlation in wheat. Sarhad J. Agric., 19(3): 347-351.
8. Baloch, M.J., E. Baloch, W.A. Jatoi and N.F. Veesar, 2013. Correlations and heritability estimates of yield and yield attributing traits in wheat (*Triticum aestivum* L.). Pak. J. Agric., 29(2): 96-105.
9. Khan, F.U., Raziuddin and I.A. Khalil, 2013. Correlation and factorwise contribution of various traits related to yield in rapeseed (*Brassica napus* L.). American-Eurasian J. Agric. Environ. Sci., 13(1): 101-104.
10. Singh, R.K. and B.D. Chaudhery, 1997. Biometrical Methods in Quantitative Genetic Analysis. Kalyani Pub., N. Delhi, India.
11. Majumder, D.A.N., A.K.M. Shamsuddi, M.A. Kabir and L. Hassan, 2008. Genetic variability, correlated response and path analysis of yield and yield contributing traits of spring wheat. J. Bangladesh. Agric. Uni., 6(2): 227-234.
12. Ajmal, S.U., N. Zakir and M.Y. Mujahid, 2009. Estimation of genetic parameters and character association in wheat. J. Agric. Biol. Sci., 1(1): 15-18.
13. Degewione, A., T. Dejen and M. Sharif, 2013. Genetic variability and traits association in bread wheat (*Triticum aestivum* L.) genotypes. Int. J. Agric. Sci., 1(2): 19-29.
14. Khan, S.J., Kalimullah, M. Irfaq and H.U. Rahman, 2012. Genetic variability, correlation and diversity studies in bread wheat (*Triticum aestivum* L.) germplasm. J. Animal Plant Sci., 22(2): 330-333.
15. Yousaf, A., B.M. Atta, J. Akhter, P. Monneveux and Z. Lateef, 2008. Genetic variability, association and diversity studies in wheat (*Triticum aestivum* L.) germplasm. Pak. J. Bot., 40(5): 2087-2097.
16. Law, C.N., J.W. Snape and A.J. Worland, 1978. The genetical relationship between height and yield in wheat. Heredity, 40: 133-151.

17. Mohtasham, M., S. Peyman, K. Rahmatollah and S.M. Kazem, 2012. Relationships between grain yield and yield components in bread wheat under different water availability (dryland and supplemental irrigation conditions). Not. Bot. Horti. Agrobo., 40(1): 195-200.
18. Ali, M.A., A. Abbas, S.I. Awan, K. Jabran and S.D.A. Gardezi, 2011. Correlated response of various morpho-physiological characters with grain yield in sorghum landraces at different growth phases. J. Animal Plant Sci., 21(4): 671-679.
19. Leilah, A.A. and S.A. Al-Khateeb, 2005. Statistical analysis of wheat yield under drought conditions. J. Arid Eniron., 61: 483-496.
20. Jamali, R. and K.D. Jamali, 2008. Correlation and regression studies in semi dwarf wheat (*Triticum aestivum* L.) Proceedings of the 11th Int'l Wheat Genetics Symposium, Brisbane Australia, pp: 675-677.
21. Zeeshan, M., W. Arshad, M.I. Khan, S. Ali and M. Tariq, 2014. Character association and casual effects of polygenic traits in spring wheat (*Triticum aestivum* L.) genotypes. Int. J. Agric. Forestry Fisheries, 2(1): 16-21.
22. Beheshtizadeh, H., A. Rezaie and A. Ghandi, 2013. Principal component analysis and determination of the selection criteria in bread wheat (*Triticum aestivum* L.) genotypes. Int. J. Agric. Crop Sci., 5(18): 2024-2027.
23. Anwar, J., M.A. Ali, M. Hussain, W. Sabir, M.A. Khan, M. Zulkiffal and M. Abdullah, 2008. Assessment of yield criteria in bread wheat through correlation and path analysis. J. Animal Plant Sci., 19(4): 185-188.
24. Baloch, M.J., J. Dunwell, M. Dennet, Zia-ul-hassan, I. Rajpar, W.A. Jatoi and N.F. Veesar, 2012. Evaluating spring wheat cultivars for drought tolerance through yield and physiological parameters at booting and anthesis. Afr. J. Biotech, 11: 11559-11565.
25. Fatih, M.B.A., 1986. Genotypic and phenotypic associations of grain yield, grain protein and yield related characteristics in wheat-Agropyron derivatives. Hereditus, 105: 141- l53.
26. Yousaf, A., B.M. Atta, J. Akhter, P. Monneveux and Z. Lateef, 2008. Genetic variability, association and diversity studies in wheat (*Triticum aestivum* L.) germplasm. Pak. J. Bot., 40(5): 2087-2097.
27. Iftikhar, R., I. Khaliq, M. Ijaz and M.A.R. Rashid, 2012. Association analysis of grain yield and its components in spring wheat (*Triticum aestivum* L.) American-Eurasian J. Agric. Environ. Sci., 12(3): 389-392.
28. Bahari, N., B.B. Bighdilu and L. Karpisheh, 2014. Studying the correlation and analyzing the path coefficient between grain weight and the traits related to remobilization of assimilates in bread wheat genotypes. J. Bio. Environ. Sci., 4(3): 303-308.
29. Chaturvedi, B.K. and R.R. Gupta, 1995. Selection parameters for some grain and quality attributes in spring wheat (*T. aestivum* L.). Agric. Sci. Digest, 15(4): 186-190.
30. Subhani, G.M., S. Ahmed and M.A. Chowdhury, 2000. Correlation and path coefficient analysis in bread wheat under drought stress and normal conditions. Pak. J. Biol. Sci., 3(1): 72-77.
31. Singh, I., A.S. Radhu and Y. Tindal, 1997. Harvest index a better selection criterion for yield improvement in bread wheat. Haryana Agric. Uni. J. Res., 7(1): 27-30.