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INTER CORRELATION STUDIES AMONG YIELD AND ITS CONTRIBUTING TRAITS IN BREAD WHEAT GENOTYPES GROWN IN HARYANA, INDIA (*TRITICUM AESTIVUM* L.)

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ABSTRACT

The attainment of maximum crop yield is an important objective in most breeding programmes. Grain yield is a complex trait influenced by a number of yield contributing traits. Information on the association of morpho-agronomic traits with grain yield forms a basis for any successful breeding programme. The present study was conducted to estimate the inter-relationships and interdependence between grain yield and its contributing as well as influencing traits by computing coefficients of simple, partial and multiple correlations analysis for the currently cultivated three bread wheat genotypes in Haryana, namely, HD 2932, HD 2967 and HD 2851.The varieties were evaluated for the traits-shoot height, tiller numbers, grain yield, 1000-grain weight, vegetative dry matter content, reproductive dry matter content, biological yield and harvest index. The results revealed that the grain yield depicts significant positive correlation with shoot height, tiller number, vegetative dry matter content, and reproductive dry matter content and biological yield. Based on the results, it is reasonable to assume that high yield of wheat plants in these genotypes could be obtained by selecting breeding materials with high tiller number, reproductive dry matter content and biological yield.

Keywords: *Triticumaestivum L.*, correlations, grain yield, biological yield.

INTRODUCTION

Wheat, (*Triticumaestivum* L.), an allohexaploid belongs to the family Poaceae. It is accorded a premier place among cereals because of the vast acreage devoted to its cultivation, high nutritive value and its association with some of the earliest and most important civilizations of the world. Wheat is the second most important staple food after rice in India grown on about 29.8 million hectares and generally provides about 50% of the calories and protein requirement to a vast majority of the Indian population.The production of wheat in the country has increased significantly from 75.81 million MT in 2006-07 to an all time record high of 94.88 million MT in 2011-12 [1]. Currently, India is second largest producer of wheat in the world.

To meet the demand of rising population, the major efforts of wheat breeders have been directed towards improving its grain yield. Grain yield is a quantitatively inherited character highly influenced by environmental factors and exhibits a profound genotype-environment interaction [2],[3]. Therefore, direct improvement of yield has not been possible through traditional breeding techniques. Instead traits affecting and influencing yield have been identified and selection has been exerted on those characters which show a close association with grain yield. Yield contributing traits can be identified through morphological and molecular markers [4],[5]. Morphological characters whichcontribute towards grain yield of wheat crop include characters like plant height, leaf area, spike length, number of spikelets/spike,

tiller number and 1000-grain weight [2], [6], [7]. An estimate of this inter-relationship and interdependence between yield and its contributing as well as its influencing traits is important for effective utilization of the genetic stock [2], [8], [9] and [10]. The correlation coefficient analysis is useful in the identification of the characters that are positively correlated with yield [11], [12], [13],[14].The quantification and interpretation of these correlations can result in mistakes on selection strategies, since a high correlation can be the result of a third trait or a group of traits affecting these traits. In this scenario, partial and multiple correlations are the tools available to the plant breeder for better understanding the causes involved in associations between traits [15],[16]. Therefore, an attempt was undertaken to estimate correlations existing between grain yield, its components and other metric traits in three bread wheat genotypes grown in Haryana, India namely,HD 2932, HD 2967 and HD 2851. The information could be used to define the suitable criteria for further yield improvement in these varieties.

MATERIALS AND METHODS

The experimental plot was designed at a private farm in village Galoli, district Yamuna Nagar, Haryana in 2012-2013 main cropping season. Certified seeds of three varieties commonly grown in Haryana, namely, HD 2932, HD 2967 and HD 2851 were sown in a randomized block design having three replications in the first week of November. Each replication had one row of 5 metre length of each one of genotype. Row to row distance was maintained roughly 18-20 cm and plant to plant distance was kept approximately 6cm. Recommended agronomic practices were applied to the experimental material throughout the growing period. Data of randomly selected 10 plants per replication of the three varieties currently cultivated in India, namely, HD 2851, HD 2932 and HD 2967was recorded for the traits shoot height, effective tiller numbers, grain yield, 1000-grain weight, vegetative dry matter content weight, reproductive dry matter content weight and biological yield.The data obtained was subjected to coefficients of simple, partial and multiple correlations analysis according to the method proposed by Falconer [8],[17].

RESULTS AND DISCUSSION

The three wheat varieties HD 2851, HD 2932 and HD 2967 present an interesting aspect of the existence of positive and significant correlation among various metric traits in these varieties [Table 1]. Grain yield is positively correlated with shoot height, tiller number, vegetative dry matter content, and reproductive dry matter content and biological yield. Positive correlation of grain yield with shoot height has been reported by other workers [18],[19],[20],[21],[22],[23]. Similarly, positive correlation with tiller number has also been reported in different wheat genotype [6],[10],[15],[24]. Vegetative dry matter content and reproductive dry matter content are positively correlated with tiller number, grain yield and biological yield. Both these traits have insignificant negative correlation with plant height. Biological yield is positively correlated with tiller number, grain yield, and vegetative dry matter content and reproductive dry matter content. Positive correlation between biological yield and grain yield suggest that grain yield can be increased by increasing biological yield as it would help to accumulate more photosynthates to developing grain. This result concurs with the findings of many investigators [25], [26], [27], [28],[29],[30]. Correlation between 1000 grain weight and grain yield is insignificant.Insignificant correlation between grain weight and grain yield has been reported in other bread wheat varieties [31],[32], [33].

Partial correlation also indicates that significant and positive correlation retains between grain yield and shoot height and insignificant correlation persists between grain yield and grain weight even when the influence of various metric traits studied

are partialled out one by one [Table 2]. Likewise the correlation between grain yield and vegetative dry matter content; and grain yield and biological yield stays significant and positive when the influence of shoot height, tiller number and grain weight are partialled out one by one [Table 3]. Significant correlation exists between grain yield and tiller number when the influence of shoot height, grain weight and vegetative dry matter content is partialled out.

Keeping grain yield as the dependent variable and other traits shoot height, tiller number, grain weight, vegetative dry matter content, reproductive dry matter content and biological yield as the independent variable, the coefficient of multiple correlation values are high, positive and significant[Table 3]. This indicates a high dependence of the variance in grain yield over the variances in the above mentioned traits. However, the correlation between grain yield and tiller number is insignificant in association with trait grain weight [Table III]. Thus, these traits appear to have low contribution to the variance in grain yield.

The positive correlation between grain yield and shoot height clearly indicate that increase in grain yield will be accompanied by increase in shoot height.The increase in shoot height is not useful as the partitioning of the resources may lose balance and tilt towards shoot height increments [25],[33]. The positive correlation of grain yield with vegetative dry matter content and biological yield supports this contention. This contention is further supported by the existence of positive correlation among vegetative dry matter content, reproductive dry matter content and biological yield in the three wheat varieties. Partial correlations and multiple correlations also indicate strong dependence of grain yield over shoot height, tiller number, vegetative dry matter content and biological yield.

Vegetative dry matter content and biological yield being exponential components of shoot height and negatively correlated with shoot height, therefore, the correlation studies in HD 2851, HD 2932 and HD 2967 for various metric traits indicate that the increase in grain yield is possible in these varieties through breeding for an increase in effective tiller numbers of wheat genotypes, high reproductive dry matter content, vegetative dry matter content and biological yield.

CONCLUSION

Based on the correlation studies, it is recommended that the increase in grain yield in HD 2851, HD 2932 and HD 2967 is possible through breeding for an increase in effective tiller numbers, high reproductive dry matter content, vegetative dry matter content and biological yield.

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REFERENCES

1. Annual Report (2012 – 13): Directorate of Wheat Research, Karnal - 132001 (India)
2. Drikvand, R., Bihamta, M.R., Najafian,Goodarz., Ebrahami,Asa.(2013). Kernel Quality Association and Path Analysis in Bread Wheat. International Journal of Biology,5 (3): 73-79.
3. Mohammadi, M., Peyman, S., Karimizadeh, R. (2014). Sequential Path Analysis for Determination of Relationship between Yield and Yield Components in Bread Wheat (*Triticumaestivum* L.) Not Sci Biol. 6(1):119-124.
4. Naghavi,M.R., Monfared, S.R., Ahkami, A.H. and Ombidbaksh, M.A.(2009). Genetic variation of durum wheat landraces and cultivars using morphological and protein markers. Int. J. Biol. Life Sci.,1(2): 68-70.

5. Collard, .B.C.Y., Jahufer, M.Z.Z., Brouwer, J.B. and Pang, E.C.K.(2005). An introduction to markers, quantitative trait loci (QTL) mapping and marker-assisted selection for crop improvement: The basic concepts. Euphytica142: 169-196.
6. Degewione,A., Dejen, T. and Sharif, M. (2013).Genetic variability and traits association in bread wheat (*Triticumaestivum* L.) genotypes. International Journal of Agricultural Sciences 1(2): 19-29.
7. Fellahi,Z.,Hannachi,A.,Bouzerzour,H. And Boutekrabt,A.(2013). Correlation between traits and path analysis coefficient for grain yield and other quantitative traits in bread wheat under semi arid conditions. Journal of Agriculture and Sustainability 3(1):16-26 .
8. Falconer D.S. and Mackay T.F.C., 1996, Introduction to quantitative genetics. 4th ed. Benjamin Cummings, England.
9. Kumar,S., Dwivedi,N.K. ,Tyagi,N.K., Kumar,S. (2003). Genetic variability in some metric traits and its contribution to yield in wheat (*Triticumaestivum* L.). Progressive Agric., 3(1-2):152-153.
10. S.J. Khan, Kalimullah.,Irfaq, M., Rahman, H.U. (2012). Genetic variability, correlation and diversity studies in Bread wheat (*Triticumaestivum* L.) germplasm. The Journal of Animal and Plant Sciences, 22(2): 330-333.
11. D. M., Langade.,Shahi, J. P., Srivastava, K., Singh, A., Agarwal, V. K ., Sharma, A. (2013). Appraisal of Genetic Variability and Seasonal Interaction for Yield and Quality Traits in Maize (Zea mays L.), Plant Gene and Trait 4(18) : 95-103.
12. Ahmad S.Q., Khan S., Ghaffar M., and Ahmad F.(2011). Genetic diversity analysis for yield and other parameters in maize (*Zea mays* L.) genotypes, Asian J. Agric. Sci., 3(5):385-388.
13. Mohammadia S.A., Prasanna B.M., and Singh, N.N. (2003). Sequential path model for determining interrelationship among grain yield and related characters in maize, Crop Sci., 43:1690-1697.
14. Maqbool,R., Sajjad,M., Khaliq,I., Aziz-ur-Rehman, Khan,A.S. and Khan, S.H.(2010). Morphological Diversity and Trait Association in bread wheat (*Triticumaestivum* L.) American-Eurasian J.Agric. & Environ. Sci. 8(2):216-224.
15. Muhammad Zeeshan, WaheedArshad, Muhammad Imran Khan, Shiraz Ali, Muhammad Tariq (2014). Character association and casual effects of polygenic traits in spring wheat (*Triticumaestivum* L.) genotypesInternational Journal of Agriculture, Forestry and Fisheries. 2(1): 16-21.
16. Savii G., Nedelea, G.(2012). Estimation of interrelationships among different yield traits in winter wheat: Journal of Horticulture, Forestry and Biotechnology, Volume 16(1), 115-118.
17. Falconer,D.S. (1981). Introduction to quantitative genetics. Longman(London and New York).
18. Law,C. N. , Snape, J. W. and Worland, A. J.(1978). The genetical relationship between height and yield in wheat. Heredity 40, 133–151.
19. Mohtasham,M., Peyman, S., Rahmatollah, K. and Mohammad Kazem, S. (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.
20. Ali, MA., Abbas, A., Awan, SI., Jabran, K., Gardezi, SDA. (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.
21. Leilah, AA. And Al-Khateeb, SA. (2005). Statistical analysis *of wheat yield under drought conditions.J. Arid. Env. 61:483-496.*

22. SaifUllahAjmal, NahidZakir, Muhammad YaqoobMujahid(2009). Estimation of Genetic Parameters and Character Association in WheatJ.Agric.Biol.Sci.1(1):15-18.
23. Jamali,R and Jamali, KD (2008): Correlation and regression studies in semi dwarf wheat(Triticumaestivum L.) Proceedings of the 11th International Wheat Genetics Symposium, Brisbane Australia 675-677.
24. Beheshtizadeh, H., Rezaie, A., Rezaie, A. and Ghandi, A. (2013).Principal component analysis and determination of the selection criteria in bread wheat (TriticumaestivumL.) genotypes.Intl. J. Agri. Crop Sci. Vol., 5 (18), 2024-2027.
25. Bahari,N., Bighdilu, B.B., Karpisheh,L (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. &Env. Sci. Vol. 4, No. 3, p. 303-308.
26. Khan, A., Barma, N. C. D., Hasan, M. M., Alam, M. A. and M. K. Alam (2014). J. Agric. Res., 52(1) p.11-23.
27. 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, Karnal, India.
28. Subhani, G. M., S. Ahmed and M. A. Chowdhury(2000). Correlation and path coefficient analysis in bread wheat under drought stress and normal conditions. Pakistan J. Biolog. Sci. 3 (1): 72-77.
29. Singh, I., A. S. Radhu and Y. Tindal (1997). Harvest index a better selection criterion for yield improvement in bread wheat. Haryana Agril. Univ. J. Res. 7(1): 27-30.
30. Fellahi, Z., Hannachi, A., Bouzerzour, H. and Boutekrabt, A. (2013). Journal of Agriculture and SustainabilityVolume 3, Number 1 , 16-26.
31. MoneimBabuFatih, A.(1986).Genotypic and phenotypic associations of grain yield, grain protein and yield related characteristics in wheat-Agropyron derivatives Hereditus 105: 14I-l53 .
32. Yousaf,A., Atta, B.M., Akhter,J., Monneveux,P. and Lateef, Z.(2008). Genetic Variability, Association and Diversity Studies in Wheat (*Triticumaestivum* L.) Germplasm.*Pak. J. Bot.*, 40(5): 2087-2097.
33. Iftikhar, R., Khaliq I., Ijaz, M. and Rashid, M.A.R.(2012). Association Analysis of Grain Yield and its Components in Spring Wheat (*Triticumaestivum L.*) American-Eurasian J. Agric. & Environ. Sci., 12 (3): 389-392

Table 1: Bivariate correlation matrix for some agronomic traits of the wheat varietiesHD 2932, HD 2967 and HD 2851

Trait	Tiller No.	Grain Yield	Grain weight	Vegetative dry matter content weight	Reproductive dry matter content weight	Biological Yield.
Plant Height	0.12	0.30**	-0.10	0.02	-0.03	-0.01
Tiller No		0.54	0.12	0.38**	0.33**	0.39**
Grain Yield			0.05	0.34**	0.40**	0.39**
Grain weight				0.12	0.09	0.10
Vegetative dry matter content					0.89**	0.95**
Reproductive dry matter content						0.99**

*= Significant at 0.05 level **= at 0.01 level

Table 2: Partial correlation values of grain yield with other metric traits in three wheat varieties HD 2932, HD 2967 and HD 2851

Traits	Partial Correlation Coefficient	Traits	Partial Correlation Coefficient	Traits	Partial Correlation Coefficient	Traits	Partial Correlation Coefficient	Traits	Partial Correlation Coefficient	Traits	Partial Correlation Coefficient
31.2	0.29**	32.1	0.35**	34.1	0.11	35.1	0.43**	36.1	0.02	37.1	0.41**
31.4	0.31**	32.4	0.32**	34.2	0.14	35.2	0.36**	36.2	0.03	37.2	0.36**
31.5	0.31**	32.5	0.34**	34.5	0.01	35.4	0.30**	36.4	0.02	37.4	0.39**
31.6	0.34**	32.6	-0.04	34.6	0.01	35.6	0.23**	36.5	0.11	37.5	0.23**
31.7	0.39**	32.7	0.11	34.7	0.01	35.7	0.11	36.7	0.01	37.6	0.05

*= Significant at 0.05 level **= at 0.01 level

1= Plant Height : 2= Tiller No. : 3=Grain Yield : 4= Grain weight: 5=Vegetative dry matter content: 6=Reproductive dry matter content:8=Biological Yield

Table 3: Multiple correlation values of grain yield with other metric traits in three wheat varieties HD 2932, HD 2967 and HD 2851

Traits	Multiple Correlation Coefficient	Traits	Multiple Correlation Coefficient	Traits	Multiple Correlation Coefficient	Traits	Multiple Correlation Coefficient	Traits	Multiple Correlation Coefficient	Traits	Multiple Correlation Coefficient
3.12	0.32**	3.21	0.32**	3.41	0.31**	3.51	0.45**	3.61	0.41**	3.71	0.49**
3.14	0.31**	3.24	0.14	3.42	0.14	3.52	0.34**	3.62	0.40**	3.72	0.39**
3.15	0.45**	3.25	0.34**	3.45	0.34**	3.54	0.34**	3.64	0.40**	3.74	0.39**
3.16	0.41**	3.26	0.40**	3.46	0.40**	3.56	0.40**	3.65	0.40**	3.75	0.40**
3.17	0.49**	3.27	0.39**	3.47	0.30**	3.57	0.40**	3.67	0.25**	3.76	0.25**

*= Significant at 0.05 level **= at 0.01 level

1= Plant Height : 2= Tiller No. : 3=Grain Yield : 4= Grain weight: 5=Vegetative dry matter content: 6=Reproductive dry matter content:8=Biological Yield