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Investigation of genetic variability and correlation analysis of wheat (*Triticum aestivum* L.) genotypes for grain yield and its Component traits

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Abstract:

The present study was undertaken with 26 wheat genotypes during Rabi 2013-14. To identify the suitable bread wheat genotypes and to assess the magnitude of genetic variability parameters for 12 quantitative traits in wheat (Triticum aestivum L.). Bread wheat genotypes were different significantly for all characters except for flag leaf width, indicating existence of sufficient genetic variability within different genotypes. High estimates of phenotypic coefficient of variation was recorded for grain yield, but moderate phenotypic coefficient of variation was recorded for harvest index, biological yield, number of tillers per plant, test weight and spike length. Moderate genotypic coefficient of variation was recorded for test weight, number of tillers per plant, grain yield and spike length. High heritability along with high genetic advance as percent of mean were recorded for spike length and test weight. Positive and highly significant correlation association were obtained for harvest index, plant height, biological yield and test weight with grain yield at both genotypic as *well as phenotypic levels. These traits should be given emphasis for future bread wheat yield improvement program.*

Key words: Bread wheat, variability, heritability, correlation.

Introduction

Wheat is the most important food crop of India and is a main source of protein and energy. In India, wheat isthe second most important food crop after rice both interms of area and production. Wheat has occupying over 22% of total world area devoted to cereals and it is estimated that 12% of total wheat production **(Directorate of Economics and Statistics Annual Report 2012)** In India, wheat is grown in area of 26.6 million/ha with production of 80 million tons which occupies 26.6% area under cereals with an average production of 27 q/ha and contributing 33% total food grain production in the country **(Directorate of Wheat Research Annual Report 2012)**. However, the demand for wheat is expected to grow and therefore productivity increase is needed. The knowledge about genetic variability, heritability, correlation coefficients and its other parameters help in further improving the grain yield through directed selection of component traits and their interrelationship with yield. The present study was therefore conducted to estimate variability, heritability in wheat for utilization in selection programmes aimed at productivity increase of future genotypes.

Materials and Methods

The experimental material comprised 26 diverse wheat cultivars, grown in a randomized block design in three replications during 2013-14 at Field Experimentation Centre

Department of Genetics and Plant Breeding, SHIATS, Allahabad. Each cultivar was grown in a single row plot of 2 meter length with row to row distance of (30 cm) with an appropriate plant to plant distance of 5-6 centimeter in each plot. Recommended packages and practices were followed to raise healthy crop. The observations were recorded on various quantitative characters *viz.* days to 50 % heading, days to 50 % flowering, days to maturity, plant height, flag leaf length, flag leaf width, spike length, number of tillers per plant, biological yield per plant, harvest index, test weight and grain yield per plant. Five randomly selected competitive plants in each row of each replication for all the characters were recorded for all the characters under study except of days to 50 per cent flowering and days to maturity which were recorded on plot basis. Analysis of Variance to test the significance for each character was carried out as per methodology given by **Panse and Sukhatme (1967).** Genotypic and phenotypic coefficients of variation were calculated by the formula given by **Burton (1952),** heritability in broad sense (h^2) by **Burton and De Vane (1953)** and genetic advance given by **Johnson *et al.* (1955).**Correlation coefficient was worked out as method suggested by **Al-Jibouri *et al.* (1958).**

Results and Discussion

The analysis of variance revealed that the treatments were highly significant for all the characters except flag leaf width and highest value was estimated for plant height followed by biological yield and test weight while, number of tillers per plant was lowest (Table 1). This suggested that the genotypes selected were genetically variable and considerable amount of variability existed among them. Similar findings were reported by **Shankarrao *et al.* (2010) and Kalimullah *et al.* (2012).** Moderate genotypic coefficient of variation (GCV) was observed for test weight (11.66 %) followed by tillers per plant (11.11 %), grain yield (10.95 %) and spike length (10.67 %). On the other hand highest phenotypic coefficient of variation (PCV) was observed for grain yield (23.93%) and moderate PCV value were observed for harvest index (19.39 %), biological yield (17.68%), number of tillers per plant (16.58%) and test weight (13.42%). Similar findings were also reported by **Arya *et al.* (2005)and Ranjana & Kumar (2013).** A close proximity between GCV and PCV could also be noticed for these character indicating them to be less influenced by environment. It may therefore be concluded that selection pressure can be applied in the desired direction on the basis of phenotype to improve such characters. **Kumar and Mishra (2004); Kumar *et al.* (2003), Yadav *et al.* (2003 &2006)** obtained similar results earlier.

These values alone are not helpful in determining the heritable portion of variation. The proportion of genetic variability which is transmitted from parents to all off spring is reflected by heritability (Lush, 1949). High heritability in broad sense estimated for all characters except for grain filling period and test weight. Among these characters days to 50% flowering showed high heritability (85.93 %) followed by days to heading (85.64%), plant height(85.39%), spike length(82.15%) and test weight(75.53%) . High values indicate that heritability may be due to higher contribution of genetic component. High heritability estimates were also reported by **Firouzian*et al.* (2003)**, **Salim*et al.* (2003)**, **Asif *et al.*(2004)**,**Rasal *et al.* (2008**) and **Shankarrao *et al.* (2010).**

The estimates of heritability are more advantageous when expressed in terms of genetic advance. **Johnson *et al.* (1955)** suggested that without genetic advance the estimate of heritability will not be practical value and emphasized the concurrent use of genetic advance along with heritability. **Hanson (1963)** stated that heritability and genetic advance are two complementary concepts. Based on this consideration, high heritability coupled with high genetic advance as percent of mean were registered for plant height, harvest index, biological yield and grain yield, indicated predominance of additive gene action in the expression of these traits.High heritability along with high genetic advance as percent of mean were recorded in spike length and test weight indicated predominance of additive and non-additive gene action in the expression of these characters. Therefore, these characters can be improved by mass selection and other breeding methods based on progeny testing.

The correlation coefficient analysis revealed that harvest index (0.883**, 0.471**), plant height (0.767**, 0.387**), biological yield (0.674**, 0.598**) and test weight (0.555**, 0.393**) showed positive significant association with grain yield per plant at both genotypic and phenotypic level (Table 3 and 4). Similar results were also reported by **Singh, (2005)** and **Mohsin *et al.* (2009).** The present study revealed that grain yield per plant had strong and positive genotypic correlation with harvest index, flag leaf width, plant height, biological yield, test weight and spike length. These traits were the key contributors to yield per plant suggesting the need of more emphasis on these component characters for increasing the grain yield in wheat. Similar results were also reported by **Ali *et al.* (2008).**

This type of relationship is due to manifold effect of gene(s). It therefore becomes very difficult to partition such effects by selecting particular characters that are so related. Information obtained from correlation study cannot reflect or give complete idea about the contributors of each character. Therefore, it is important to establish the genetic basis of correlation before initiating breeding programme aimed at yield improvement through component traits.

Table 1: Analysis of variance among 26 Wheat genotypes for 12 characters in wheat

S. No.	Characters	Mean sum of squares		
		Replication (d.f = 2)	Treatment (d.f = 25)	Error (d.f = 50)

1	Days to 50% Heading	48.11	66.90**	3.54
2	Days to 50% Flowering	29.32	66.75**	3.45
3	Plant Height	60.18	258.22**	13.92
4	Flag Leaf Width	0.009	0.01	0.009
5	Flag Leaf length	4.02	11.96**	1.80
6	Spike Length	0.23	4.51**	0.30
7	NO. Tillers/ Plant	7.14	3.75**	1.09
8	Days to Maturity	8.11	18.00**	2.96
9	Biological Yield	83.52	28.36*	14.83
10	Test Weight	89.60	54.08**	5.27
11	Harvest Index	527.50	96.78*	53.49
12	Grain Yield / Plant	2.34	8.71*	4.85

* and **Significant at 5% and 1%levels of significance.

Table 2: Estimates of genetic parameters for 12 quantitative characters in wheat

Characters	**GCV**	**PCV**	**Heritability**	**GA**	**GG=(GA as % of mean)**
Days of 50% heading	6.30	6.80	85.64	9.72	13.31
Days of 50% flowering	5.69	6.14	85.93	9.70	12.02
Flag leaf width	1.74	5.96	4.80	0.19	11.66
Flag leaf length	7.20	8.92	65.19	4.46	17.46
Plant height	9.13	9.88	85.39	19.11	19.34
Spike length	10.67	11.77	82.15	2.56	23.03
No. of tillers	11.11	16.58	44.90	2.75	32.45
Days of maturity	1.90	2.40	62.81	5.53	4.69
Grain yield	10.95	23.93	20.95	4.85	46.84
Biological yield	8.54	17.68	23.30	8.61	34.61
Test Weight	11.66	13.42	75.53	9.08	26.27
Harvest Index	8.94	19.39	21.24	16.13	37.95

Table 3. Correlation coefficient between yield component trait and grain yield in wheat at phenotypic and genotypic levels

No	Character		Days to 50 %Heading	Plant Height	Flag Leaf Length	Flag Leaf Width	Tillers / plant	Spike length	Days to Maturity	Biological Yield	Harvest Index	Test Weight	Grain Yield
1	Days to 50 % Flowering	rp	0.038**	0.169	0.224*	0.080	0.265*	0.316**	0.393**	0.097	-0.124	-0.427**	-0.016
		rg	0.886**.	0.259*	0.385**	0.062	0.522**	0.411**	0.499**	0.397**	-0.306*	-0.493**	0.128
2	Days to 50 %Heading	rp	1000	0.329**	0.217	0.026	0.343**	0.303**	0.488**	0.201	-0.278*	-0.390**	-0.044
		rg	1.000	0.411**	0.339*	-0.034	0.691**	0.391**	0.674**	0.471**	-0.464**	-0.389**	-0.026
3	Plant Height	rp		1.000	0.3102**	0.268*	-0.314**	0.385**	0.400**	0.656**	-0.102	0.287*	0.387**
		rg		1.000	0.515**	0.429**	0.475**	0.396**	0.583**	0.897**	-0.083	0.324*	0.767**
4	Flag Leaf Length	rp			1.000	0.385**	0.005	0.429**	0.152	0.361**	-0.206	-0.004	0.106
		rg			1.000	0.457**	-0.079	0.572**	0.393**	0.467**	-0.423**	-0.016	0.216
5	Flag Leaf Width	rp				1.000	0.035	0.410**	-0.016	0.340**	0.049	0.181	0.271*
		rg				1.000	0.025	0.522	0.164	0.631**	0.099	0.313*	0.794**
6	Tillers / plant	rp					1.000	-0.042	0.316**	0.348**	-0.302**	-0.089	0.074
		rg					1.000	-0.141	0.663**	0.690**	-0.336*	-0.156	0.101
7	Spike length	rp						1.000	-0.017	0.288*	-0.065	-0.056	0.207
		rg						1.000	0.086	0.318*	-0.046	-0.037	0.376**
8	Days to Maturity	rp							1.000	0.241*	-0.368**	-0.230*	-0.121
		rg							1.000	0.685**	-0.732**	-0.312*	0.041
9	Biological Yield	rp								1.000	-0.217	0.288*	0.598**
		rg								1.000	-0.183	0.220	0.674**
10	Harvest Index	rp									1.000	0.245*	0.471**
		rg									1.000	0.457**	0.883**
11	Test Weight	rp										1.000	0.393**
		rg										1.000	0.555**

REFERENCES:

Ali, Y., Babar Manzoor Atta, Javed Akhter, Philippe Monneveux, and Zahid Lateef.2008. "Genetic variability, association and diversity studies in wheat (*Triticum aestivum* L.) Germplasm." *Pak. J. Bot.*, 40(5):2087-2097.

Arya, V.D., Pawar, I.S. and Lamba, R.A.S. 2005. "Genetic variability, correlation and Path analysis for yield and quality traits in bread wheat." *Haryana Journal of Agriculture Research,* 35(1): 59-63.

Asif, M., Mujahid, M.Y., Kisana N.S., Mustafa, S.Z. and Ahmad, I. 2004. "Heritability, genetic variability and path coefficient of some traits in spring wheat." *Sarhad Journal of Agriculture* 20: 87-91.

Baranwal, D.K., Mishra, V.K., Vishwakarama, M.K., Yadav, P.S. and Arun, B. 2012. "Studies on genetic variability, correlation and path analysis for yield and yield contributing traits in wheat (*Triticum. aestivum* L. em Thell)." *Plant Archives*, 99-104.

Burton, G.W. and Vane de E.H. 1953. "Estimating heritability in tall fescue (Festuca arundinacea L.) from replicated clonal material." *Agronomy of Journal* 45: 478-481.

Degewione, A., Takele Dejene, and Mohammed Sharif. 2013. "Genetic variability and traits association in bread wheat (*Triticum aestivum* L.) genotypes." *International Research Journal of Agricultural Science* 1(2):19-29.

Directorate of Economics and Statistics Annual Report. 2012.

Directorate of Wheat Research Annual Report. 2012.

Firouzian, A., Khan, A.S. and Ali, Z. 2003. "Genetic variability and inheritance of grain yield and its components in wheat." *Pakistan Journal of Agriculture Science* 40(3-4): 176-179.

Kalimullah, S.J., Khan, M., Irfaq, H. and Rahman, H.U. 2012. "Genetic variability, correlation and diversity studies in bread wheat *(Tiriticm aestivum* L.) Germplasm." *The journal of Animal &plant Science* 22(2):330-333.

Kumar, B., Singh, C. M. and Jaiswal, K. K. 2013. "Genetic variability, association and diversity studies in bread wheat (*Triticum aestivum* L.)." *The Bioscan: an international quarterly journal of life science* 8(1):143-147.

Kumar, P. and Mishra, Y. 2004. "Genetic variability in wheat (*Triticum aestivum* L.) Biodiversity, sustainable utilization of biological resources." *Proceeding of national conference* 144-149.

Mohsin, T., Khan, N and Naqvi, F. N. 2009. "Heritability, phenotypic correlation and path coefficient studies for some agronomic characters in synthetic elite lines of wheat." *Journal of Food, Agriculture & Environment.* 7 (3&4): 278 – 282.

Panse, V.G. and Sukhatme, P.V. 1967. *Statistical Methods of Agricultural Workers.* 2nd Endorsement, ICAR Publication, New Delhi, India, pp: 381.

Ranjana and Suresh, Kumar. 2013. "Study of genetic variability and heritability over extended dates of sowing in bread wheat (*Triticum aestivum* L.)." *Research in Plant Biology* 3(10):33-36.

Shankarrao, B.S., Mukherjee, S. Pal, A.K. and De, D.K. 2010. "Estimation of variability for yield parameters in Bread Wheat (*Triticum aestivum* L.) grown in Gangetic West Bengal." *Electronic Journal of Plant Breeding* 1(4): 764-768.

Singh, S.K. 2005. "Character association and path coefficient analysis for floral characters in wheat (Triticum aestivum L.)" *Crop Improvement* 32(2): 124-129.

Tripathi, S.N., Shailesh Marker, Praveen Pandey, Jaiswal K.K. and Tiwari D.K. 2011. "Relationship between some morphological and physiological traits with grain yield in bread wheat (*Triticumaestivum* L.em.Thell.).” *Trends in Applied Science Research* 6(9): 1037-1045.

Yadav, R. K., Khan, P. and Singh P. 2003. Heritability and genetic advance in common wheat (*Triticum aestivum* L.). *Farm Science Journal* 12 (3): 163-164.