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GENETIC VARIABILITY AND CORRELATION STUDIES IN F_6 GENERATION OF WHEAT (*Triticum aestivum* L.)

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ABSTRACT
The present experiment entitled Genetic variability and correlation studies in F6 generation of wheat *(Triticum aestivum L.)* was conducted in *Rabi* 2016-17 at the Field Experimentation Centre of the Department of Genetics and Plant Breeding, SHIATS, Allahabad. The experiment was carried out randomized block design with three replications to obtain information on estimates of variability, heritability and genetic advance and correlation coefficient among 19 genotypes of wheat. Analysis of variance revealed that there were significant differences among genotypes. Based on performance for seed yield per plant and other character taken into consideration cross VTTH-80-14 x WR-1451 followed by HUW-251 x WR-1451 was found to be better than other crosses. Wide range of phenotypic (VP or σ^2p) and genotypic variance (VG or σ^2 g) were observed in the experimental material for all the traits studied. High estimates of genotypic coefficients of variation (GCV) and phenotypic coefficients of variation (PCV) were obtained for yield per plant followed by harvest index, 1000 seeds weight, flag leaf width, biological yield, tillers /plant, spike length suggesting sufficient variability and thus scope for genetic improvement through selecting for these traits. High estimates of heritability were recorded for almost all characters studied. High heritability along with high Genetic advance as present of mean was observed for 1000 seed weight, Seed yield per plant therefore the priority should be given to these characters for improvement of wheat. Grain yield exhibited positive significant correlation with tillers per plant, days to 50% heading, biological yield peducle length and flag leaf length.

KEY WORDS: Variability, heritability, genetic advance, correlation coefficient, F6 Generation of Wheat *(Triticum aestivum L.)*

INTRODUCTION

Wheat is a cereal grass of the *Graminae* (*Poaceae*) family and of the genus *Triticum*, is the world's largest cereal crop. It has been described as the 'King of cereals' because of the acreage it occupies, high productivity and the prominent position it holds in the international food grain trade. The majority of the cultivated wheat varieties belong to three main species of the genus *Triticum*. These are the hexaploid, *T. aestivum* L. (bread wheat), the tetraploid, *T. durum* the diploid, *T. dicoccum*. Globally, *aestivum* wheat is the most important species which covers 90% of the area. Second popular wheat being durum wheat which covers about 9 % of the total area while *T. dicoccum* wheat cover less than 1% of the total area. The central Asia, Near East, Mediterranean and Ethiopian regions are the world's most important centers of diversity of wheat and its related species (Kundu and Nagarajan , 1996; Perrino and Porcedu, 1990).The world acreage under wheat crop is 222.61 million ha with production of 750.49 million -tonnes with an average yield of 3.39 tonnes per hectare. In India, wheat is the second most important crop after rice occupying 30.22 million ha, with production of 93.50 million tonnes with an average productivity of 3.10 tonnes per hectare. (Indian Institute of Wheat and Barley Research, Karnal 2016), Uttar Pradesh, Madhya Pradesh and Punjab are important states from the point of both area and production. Wheat compares well with other cereals in nutritive value. Unlike other cereals, wheat contains a high amount of gluten, the protein that provides the elasticity necessary for excellent bread making. Hard wheat is high in protein (10-17%) and yields a flour rich in gluten, making it particularly suitable for yeast breads. The low-protein (6 to 10%) softer type yields flour lower in gluten and therefore, better suited for tender baked products, such as biscuits, pastries and cakes. *Triticum durum* wheat, although high in gluten, is not suitable for baking, but suitable for semolina, the basis for excellent pasta, such as spaghetti and macroni preparation. Yield being a complex character is a function of several component characters and their interaction with environment. Probing of structure of yield involves assessment relationship among various characters contributing to the yield. Correlation coefficient analysis is a handy technique, which elaborates the degree and extent of relationship among important plant characters and it provides basic criteria for selection and leads to directional model based on yield and its components in the field experiments. Correlation coefficient estimates degree of association of different component traits of yield among themselves and with the yield. The correlation studies between various yields attribute with yield provides a basis for further breeding programmes. Thus, estimates of variability parameters like coefficients of variation and genetic advance are very useful for devising suitable selection strategy for breeding of high yielding wheat genotypes. Selection should be based on yield attributing

characters. These characters play important role in the expression of grain yield in plant. The estimates of genetic correlations are important in understanding and manipulating the relative magnitude of desirable component traits in wheat breeding. The estimates of genotypic and phenotypic correlation coefficients of grain yield per plant with its component characters may indicate some interesting relationship, which help in formulating a selection scheme for enhancing the yielding ability of the selected genotypes. Keeping the above fact in view, the present investigation an attempt was made to assess the genetic variability for yield contributing traits in wheat and to estimate the heritability and genetic advance of grain yield.

MATERIALS & METHODS

The experiment was conducted during *Rabi* seasons of 2016–2017 at Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Research Farm in Department of Genetic and Plant breeding. The experiment comprising of 19 genotypes were conducted in a Randomized Block Design (RBD) with three replications. The gross area of experiment was 72 $m^{2.}$ The row to row distance 25 cm and Plant to plant distance 5 cm. the five plant from each of the replication were tagged and observation were taken from these tagged plant at various stages of the crop plant growth. data were recorded for days to 50% heading, days to 50% flowering, flag leaf length, flag leaf width, plant height (cm), number of tillers per plant, spike length (cm), peduncal length (cm), no. of spikelets, days to maturity, yield per plant (g), biological yield (g), harvest index (%), 1000 seed weight (g). Mean value were computed and data were analysis for of variance (Fisher, 1935), coefficient of variation (Burton, 1952), GCV (Genotypic coefficient of variation), PCV (Phenotypic coefficient of variation), Heritability broad sense (Burton and Devane, 1953), Genetic advance (Johnson *et al.*, 1955), Correlation Coefficient analysis (Al Jibouri *et al.*, 1958).

RESULTS & DISCUSSION

The mean sums of squares of 14 different traits are presented in (table 1).

TABLE 1: Analysis of variance for different 14 quantitative characters in 19 genotypes of wheat

S. No	Characters	Mean sum of squares		
		Replications (d.f=2)	Treatments (d.f.=18)	Error (d.f.=36)
1	Date to 50% heading	1.9474	5.2904**	2.7992
2	Date to 50% flowering	3.6491	4.2710**	1.5195
3	Plant height	4.6599	24.6963**	5.0457
4	Tillers / Plant	0.1770	1.8690**	0.1576
5	Flag leaf Length	1.5787	11.7922**	2.5273
6	Flag leaf Width	0.0026	0.1043**	0.0142
7	Spike Length	0.1307	4.0016**	0.5904
8	Peduncle length	4.5439	19.6831**	4.1057
9	No. of Spikelets/ Spike	0.3112	6.9558**	1.6718
10	Days of Maturity	0.9123	19.7505**	3.1715
11.	1000 seed weight (g)	0.5214	104.1686**	2.6939
12	harvest Index	23.0207	208.1217**	17.0818
13	Biological Yield (g)	0.1886	5.7747**	0.7434
14	Yield/ Plant (g)	0.0981	3.6835**	0.1850

** Significant at 1% and 5 % level

TABLE 2: Genetic parameters for 14 quantitative characters of 19 Wheat genotypes

Sr. No.	Characters	Genotypic Variance σ^2g	Phenotypic Variance σ^2p	Genotypic Coefficient of Variation	Phenotypic Coefficient of Variation	Heritability (%) (broad sense)	Genetic advance	Genetic advance as % of mean
1.	Date to 50% heading	0.83	3.63	1.37	2.86	23.88	0.90	1.35
2.	Date to 50% flowering	0.92	2.44	1.28	2.09	38.64	1.21	1.62
3.	Plant height	6.55	11.60	2.64	3.51	56.49	3.96	4.09
4.	Tillers / Plant	0.57	0.73	10.46	11.82	78.36	1.38	19.08
5.	Flag leaf Length	3.09	5.62	7.80	10.52	54.99	2.68	11.92
6.	Flag leaf Width	0.03	0.04	11.98	14.54	67.91	0.29	20.34
7.	Spike Length	1.14	1.73	10.40	12.81	65.82	1.78	17.38
8.	Penduncle length	5.19	9.30	6.48	8.67	55.84	3.51	9.97
9.	No. of Spikelets /Spike	1.76	3.43	7.73	10.79	51.30	1.96	11.40
10.	Days to Maturity	5.53	8.70	1.95	2.44	63.54	3.86	3.20
11.	1000 seed weight	33.82	36.52	13.18	13.70	92.62	11.53	26.13
12.	Biological Yield	1.68	2.42	10.91	13.11	69.29	2.22	18.71
13.	harvest Index	63.68	80.76	17.47	19.67	78.85	14.60	31.95
14.	Yield/ Plant	1.17	1.35	19.96	21.49	86.31	2.07	38.20

** Significant at 1% and 5 % level

TABLE 3: Eestimates of genotypic correlation of different yield its component with grain yield per plant in 19 wheat genotypes

Sr. No	Character	Days to Heading	Days to 50 % Flowering	Plant Height cm	Tillers/ Plant	Flag Leaf Length	Flag Leaf Width	Spike Length	Peduncle Length	No. of Spikelets	Days to Maturity	Biological Yield	1000 Seed Weight	Harvest Index %	Grain Yield Per Plant
1.	Days to Heading	1.00	0.70**	0.08	0.22	-0.09	-0.26	0.29	0.48**	-0.02	-0.24	0.44**	0.41**	0.14	0.44**
2.	Days to 50 % Flowering		1.00	-0.03	0.12	-0.09	-0.43	0.05	0.43**	-0.11	-0.39	0.56**	0.30*	-0.05	0.25
3.	Plant Height cm			1.00	0.05	-0.33	-0.09	-0.33	-0.13	-0.38	-0.29	-0.31	-0.18	-0.09	-0.24
4.	Tillers/ Plant				1.00	0.59**	0.15	0.00	0.01	-0.25	0.03	0.42**	0.28	0.52**	0.65**
5.	Flag Leaf Length					1.00	0.45**	0.34*	-0.15	-0.01	0.45**	0.07	0.09	0.32*	0.35**
6.	Flag Leaf Width						1.00	0.21	0.19	0.24	0.48**	-0.32	-0.13	0.27	0.07
7.	Spike Length							1.00	0.22	0.53**	0.54**	-0.07	-0.17	0.04	0.05
8.	Peduncle Length								1.00	0.40**	-0.23	0.20	0.29	0.32*	0.39**
9.	No. of Spikelets									1.00	0.13	-0.28	-0.05	0.41**	0.24
10.	Days to Maturity										1.00	0.03	0.11	0.11	0.16
11.	Biological Yield											1.00	0.39**	-0.11	0.41**
12.	1000 Seed Weight												1.00	0.63	0.79
13.	Harvest Index %													1.00	0.87
14.	Grain Yield Per Plant														1.00

** Significant at 1% and 5 % level

TABLE 4: Estimates of phenotypic correlation of different yield and its component with grain yield per plant in 19 wheat genotype

Sr. No	Character	Days to Heading	Days to 50 % flowering	Plant Height cm	Tillers/ Plant	Flag Leaf Length	Flag Leaf Width	Spike Length	Peduncle Length	No. of Spikelets	Days to Maturity	Biological Yield	1000 Seed Weight	Harvest Index %	Grain Yield Per Plant
1.	Days to Heading	1.00	0.40**	0.15	-0.00	0.01	-0.08	0.06	0.24	-0.06	-0.12	0.33*	0.18	-0.03	0.12
2.	Days to 50 % Flowering		1.00	0.13	0.01	-0.07	-0.14	0.08	0.13	-0.12	-0.29	0.30*	0.19	-0.05	0.10
3.	Plant Height cm			1.00	0.06	-0.13	0.01	-0.15	-0.04	-0.3	-0.17	-0.15	-0.18	-0.12	-0.23
4.	Tillers/ Plant				1.00	0.30*	0.13	0.04	0.01	-0.12	0.07	0.31*	0.21	0.46**	0.62**
5.	Flag Leaf Length					1.00	0.32*	0.13	0.00	0.02	0.27	0.01	0.07	0.20	0.22
6.	Flag Leaf Width						1.00	0.16	0.13	0.08	0.39	-0.23	-0.08	0.16	0.04
7.	Spike Length							1.00	-0.02	0.25	0.28	-0.05	-0.16	0.04	0.03
8.	Peduncle Length								1.00	0.14	-0.11	0.06	0.21	0.21	0.26*
9.	No. of Spikelets									1.00	-0.00	-0.14	-0.06	0.44**	0.35**
10.	Days to Maturity										1.00	0.00	0.17	0.01	0.11
11.	Biological Yield											1.00	0.30	-0.17	0.32
12.	1000 Seed Weight												1.00	0.55**	0.72**
13.	Harvest Index %													1.00	0.83**
14.	Grain Yield Per Plant														1.00

** Significant at 1% and 5 % level

High significant differences for all characters under study among the 19 wheat genotypes were found in analysis of variance at 1% and 5% significant level. Phenotypic variance was higher than genotypic variance for all the yield and yield contributing characters indicates the influence of environmental factors on these traits**.** A wide range of phenotypic coefficient of variation (PCV) was observed for all the traits ranged from days to 50% flowering (2.09) to yield/ plant (21.49) Higher magnitude of PCV was recorded for yield per plant (21.49), harvest index (19.67), flag leaf width(14.56), 1000 seeds weight (13.70), biological yield (13.11) , spike length (12.81), tillers /plant (11.82), No. of spikelets /spike (10.79), flag leaf length (10.52), peduncle length (8.67), plant height (3.51), days to heading (2.86), days to maturity (2.44), days to 50% flowering (2.86).

A wide range of genotypic coefficient of variation (GCV) was observed for all the traits ranged from days to 50% flowering (1.28) to yield per plant (19.96) (Table-2).high heritability was observed for traits 1000 seeds weight (93%),yield per plant (86%), harvest index (79%), tillers /plant (78%), biological yield (69%), flag leaf width(68%), spike length (66%), days to maturity (64%), peduncle length (56%), plant height (56%), flag leaf length (55%), No. of spikelets /spike (51%), days to 50% flowering (38%), days to 50% heading (23%),(Table-2). The high genetic advance was observed for harvest index(14.60) followed by1000 seeds weight (11.53), plant height (3.96),days to maturity (3.86), peduncle length (3.51), flag leaf length (2.68),biological yield (2.22),yield per plant (2.07),No. of spikelets /spike (1.96), spike length (1.78), tillers /plant (1.38), days to 50% flowering (121) ,date of heading (0.90), flag leaf width (0.29),(Table-2). Genetic advance as per cent of mean was recorded for yield per plant (38.20), harvest index (31.95), 1000 seeds weight (26.13),flag leaf width(20.34),), tillers /plant (19.08), biological yield (18.71), spike length (17.38), flag leaf length (11.92), No. of spikelets /spike (11.40), peduncle length (9.97),plant height (4.09),days to maturity (3.20), days to 50% flowering (1.62) , days to 50% heading (1.35), (Table-2). The Genotypic correlation coefficient for Grain yield per plant showed the positive significant genotypic association with tillers per plant (0.65**), days to 50% heading (0.44**), biological yield (0.41**), peduncle length (0.39**), flag leaf length (0.35**). The correlation show negative non significant association with plant height (-0.24). (Table-3.1).Phenotypic correlation coefficient for Grain yield per plant showed the positive significant phenotypic association with harvest index (0.83**), tillers per plant (0.62**), no. of spikelets (0.35**), Biological yield (0.32*) .while it showed negative significant phenotypic association with plant height (-0.23).

CONCLUSION

It is concluded from the present study that all the 19 genotypes of Wheat showed significant differences among them. Based on performance for seed yield per plant and other character taken into consideration cross VTTH-80-14 x WR-1451 followed by HUW-251 x WR-1451 was found to be better than other crosses. High heritability along with high Genetic advance as percent of mean was observed for 1000 seed weight, Seed yield per plant therefore the priority should be gavie to these characters for improvement of wheat.

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