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Genetic variability for seed yield and its component characters in wheat (*Triticum aestivum* L.) under Allahabad agro-climatic conditions

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Abstract
The present study was undertaken with 30 wheat genotypes during *Rabi* 2014-15 in randomized block design having three replications at Field Experimentation Centre of Department of Genetics and Plant Breeding, Allahabad School of Agriculture, SHIATS to identify the suitable bread wheat genotypes and to assess the magnitude of genetic variability parameters for different quantitative traits in wheat (*Triticum aestivum* L.). The mean performance of genotypic SHBW 131, SHBW 132, SHBW 137, SHBW 153 and SHBW 154 was recorded for, days to maturity, plant height, spike length, 1000 grain weight, and grain yield per plant, respectively. The analysis of variance revealed highly significant differences studied. Twelve traits were included in the study. Number of grains spike, biological yield, harvest index, plant height and number of tillers moderate estimates for PCV & GCV. Number of grains spike, flag leaf width, biological yield /plant and harvest index. High heritability along with high genetic advance as percent of mean was recorded for plant height and harvest index.

Keywords: Wheat, Genetic Advance, Heritability (Broad Sense), Genotypic Variance, Phenotypic Variance, GCV and PCV

Introduction
Wheat (*Triticum aestivum* L.) is one of the most important staple food grains of human race and also the world's most widely cultivated food crop and second most important staple food crop next to rice in India (FAO 2007) [4]. Among the cultivated food cereals, it occupies a pride place. In respect to area and production it occupies the second position, being exceeded only by rice.

In the India sub-continent wheat has been under cultivation from pre historic time. It provides 20 percent of the total food calories of human requirement. It contributes towards food front to the time 36 percent of world population and provides 20 percent of total calorie supply. India stands fourth in both the area and production of wheat in the world. The study of genetic variability and heritability is the pre-requisites for any crop improvement program. Success in recombination breeding depends on the suitable exploitation of genotypes as parents for obtaining high heterotic cross and transgressive segregates heritability and genetic advance are other important selection parameters. The estimates of heritability help the plant breeders in determining the character for which selection would be rewording. The breeders are interested in selection of superior genotypes based on their phenotypic expression. The major function of heritability estimates is to provide to the progeny. Heritability estimates can anticipate improvement by selection of useful characters.

The experiment was conducted during *Rabi* seasons of 2014–2015 at Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad, Research Farm in Department of Genetic and Plant breeding. The experiment comprising of 30 genotypes were conducted in a randomized block design with three replications. Each genotypes was accommodated in a single row two meters length spaced at 25 cm with an approximate plant to plant spacing 4 cm and data were recorded on five randomly selected plants from each treatment and each replication for days to 50% flowering, flag leaf length, flag leaf width, plant height, number of tillers per plant, spike length, days to maturity, number of grains per spike, biological yield per plant, harvest index, test weight and seed yield per plant. Analysis of variance (Table 1) for all characters was carried out using the method of Burli *et al.* (2004) [2] and individual comparison of varietals mean.

Genetic, Coefficient of variation (GCV & PCV) and heritability, genetics advance were calculated to observe the different traits Johnsen *et al*. (1955), Hanson *et al.* (1963) [7] and Burton and Devane (1953) [3].

Results and Discussion
The analyses of variance for different 12 characters are present in Table 1. The result showed significant difference for mean sum of square at 1% level for all the characters except for flag leaf width under study among 30 genotypes. These characters are days to (50%) flowering, flag leaf length (cm), flag leaf width (cm), days to maturity, plant height (cm), number of tillers /plant, spike length (cm), number of grains /spike, biological yield /plant, test weight (1000 grain), harvest index (%), and yield /plant (g). This suggested that the genotype selected for research were quite variable and constant levels of variability are present among them. Thus indicating amply scope for selection of different qualitative characters in wheat improvement.

Estimates of genotypic variance (Vg), phenotypic variance (Vp) were obtained for different characters and are presented in Table 2. A wide range of genotypic variances, was observed for days to 50 % flowering (29.39), flag leaf length (7.39), flag leaf width (0.052), days to maturity (9.23), plant height

(345.31), number of tillers /plant (0.57), spike length (6.48), number of grains /spike (122.5), biological yield /plant (26.16), test weight (1000 grain) (15.73), harvest index (67.09), and yield /plant (7.57). Phenotypic variances were observed for days to days to 50 % flowering (33.63), flag leaf length (11.28), flag leaf width (0.182), days to maturity (10.42), plant height (355.07), number of tillers /plant (0.63), spike length (7.82), number of grains /spike (158.98), biological yield /plant (30.31), test weight (1000 grain) (21.35), harvest index (77.65), yield / plant (8.86). Indicating that the genotypes. Similar findings were reported by Ansari *et al.* (2005) [1], Khan *et al.* (2004) [9]. In the present investigation in Table 2. Showed that estimates of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV), indicating that the little influence of environment on the expression of these characters. However, good correspondence was observed between genotypic coefficient of variation and phenotypic coefficient of variation in all the characters. The results are summarized as under: A wide range of phenotypic coefficient of variation (PCV) was observed for all the traits ranged from days to maturity (2.79) to yield /plant (34.82). Higher magnitude of phenotypic coefficient of variation was recorded for yield /plant (34.82), number of grains/spike (32.46), flag leaf width (26.35), biological yield /plant (25.20), harvest index (23.07), while moderate estimates were observed for plant height (19.7), number of tillers plant (16.44), spike length (16.38), flag leaf length (14.87), test weight (1000 grain) (10.53) and low estimates of phenotypic coefficient of variation was observed for days to 50 % flowering (7.40) and days to maturity (2.79). A wide range of genotypic coefficient of variation (GCV) was observed for all the traits ranged from 2.62 (days to maturity) to 32.19 (yield /plant). Higher magnitude genotypic coefficient of variation was recorded for yield /plant (32.19), number of grains /spike (28.49), biological yield /plant (23.41), harvest index (21.45), plant height (19.43), number of tillers /plant (15.71), and moderate magnitude genotypic coefficient of variation was observed spike length (14.92), flag leaf width (14.062), flag leaf length (12.04), while low estimates of genotypic coefficient of variation values was observed for test weight (1000 grain) (9.04), days to 50 % flowering (6.92) and 2.62 (days to maturity). Singh *et al.* (2006) [13], Sharma and Garg (2002) [12]. Heritability and genetic advance are two complementary concepts. High heritability (broad sense) were recorded in plant height (97.25), number of tillers /plant (91.28), days to maturity (88.6), days to 50 % flowering (87.40), harvest index (86.40), biological yield /plant (86.31), yield /plant (85.47), spike length (82.91), number of grains /spike (77.05), test weight (1000 grain) (73.71), flag leaf length (65.53), and low heritability was observed for flag leaf width (28.479). High value indicates that heritability may be due to higher contribution of genotypic component. Thus the traits may be improved by progeny selection. High heritability estimates were reported by Gupta *et al.* (2004) [6], and Mittal and Sethi (2005) [10].

The estimates of expected genetic advance genetic advance revealed that it was high for plant height (37.75), number of grains /spike (20.01), harvest index (15.68), days to 50 % flowering (10.44), biological yield /plant (9.79), test weight (1000 grain) (7.02), yield /plant (5.24), spike length (4.78), flag leaf length (4.53), flag leaf width (0.25), days to maturity (5.89), number of tillers/plant (1.49). Similar finding was reported by Gupta and Verma (2000) [5], Pawar *et al.* (2002) [11], Singh *et al.* (2006) [13].

Table 1: Analysis of Variance for 30 wheat genotypes.

Characters	Mean sum of squares		
	Replications (d.f.=02)	Treatment d.f =29	Error =58
Days to (50%) flowering	1.078	30.807**	4.239
Flag leaf length	10.508	8.691**	3.890
Flag leaf width	0.008	0.095	0.130
Days to maturity	0.544	9.626**	1.188
Plant height	0.878	348.563**	9.763
Number of tillers per plant	0.078	0.592**	0.055
Spike length	4.066	6.927**	1.336
Number of grains per spike	107.244	134.661**	36.486
Biological yield per plant	9.483	27.545**	4.148
Test weight (1000 grain)	4.812	17.605**	5.611
Harvest index	35.063	70.609**	10.560
Yield per plant	3.510	8.002**	1.288

** Significant at 1% levels of significance.

Table 2: Genetic parameters of 12 quantitative characters for 30 wheat genotypes.

Characters	Vg	Vp	GCV	PCV	Heritability (%)	GA	(GA as % of mean)
Days to 50 % flowering	29.39	33.63	6.92	7.40	87.40	10.44	13.32
Flag leaf length	7.39	11.28	12.04	14.87	65.53	4.53	20.08
Flag leaf width	0.052	0.182	14.062	26.350	28.479	0.250	15.459
Days to maturity	9.23	10.42	2.62	2.79	88.60	5.89	5.09
Plant height	345.31	355.07	19.43	19.70	97.25	37.75	39.46
Number of tillers/plant	0.57	0.63	15.71	16.44	91.28	1.49	30.91
Spike length	6.48	7.82	14.92	16.38	82.91	4.78	27.98
Number of grains / spike	122.50	158.98	28.49	32.46	77.05	20.01	51.52
Biological yield/plant	26.16	30.31	23.41	25.20	86.31	9.79	44.81
Test weight (1000 grain)	15.73	21.35	9.04	10.53	73.71	7.02	15.99
Harvest index	67.09	77.65	21.45	23.07	86.40	15.68	41.07
Yield /plant	7.57	8.86	32.19	34.82	85.47	5.24	61.30

VG= Genotypic variance, VP= phenotypic variance, GCV= Genotypic coefficient of variation, PCV= phenotypic coefficient of variation, h^2=heritability (broad sense, and GA= Genetic advance.

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