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STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE FOR YIELD AND YIELD ATTRIBUTING CHARACTERS IN BREAD WHEAT (*Triticum aestivum* L. em. Thell)

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ABSTRACT

The field experiment under present investigation was conducted at Agriculture Research Farm of B.R.D. Post Graduate College (Campus), Deoria (U.P.) during rabi 2017-18 in normal soil, timely sown and irrigated conditions. Total 81genotypes excluding 3 checks were evaluated under Augmented Block Design. Genetic variability, heritability and genetic advance were studied in 81 genotypes of bread Wheat (*Triticum aestivum* L. em. Thell) in Uttar Pradesh to estimate variability parameters for high yield and their attributing traits in 81 germplasm lines of Wheat. The highest heritability per cent in broad sense 92.83 was recorded for plant height followed by days to maturity (85.65). The highest genetic advance 15.8525 was evaluated for plant height followed by 1000 grains weight (10.0861).The highest genetic advance as per cent over mean was recorded for 1000 grains weight (30.2470) followed by peduncle length (23.4155). The results indicate that these traits were governed by additive with epistatic effects for the phenotypic expression of the characters. It indicates that these traits were governed by additive genetic effect which is fixable type and consequently desirable selection will reward for improvement for those traits.

Key words : Genetic advance, heritability, variability, germplasm, yield, breed wheat.

Wheat (*Triticum aestivum* L.) is the world's most famous energy rich cereal crop. It is cultivated throughout the world and used as bread. Wheat is an important member of grass family Poaceae (Graminae). It is one of the most premier cereal crop of worldwide importance which is grown under a wide range of climatic zones. Bread wheat is a polyploid cereal crop with great genetic diversity worldwide. The ultimate goal of most of the breeding programmes is to increase the production per unit area in per unit time. Genetic improvement for quantitative traits depends upon the nature and amount of variability present in the genetic stock and the extent to which the desirable traits heritable. Our mentioned genotype identified as statistically equal to best genotype for economic yield. The genotype showing very high mean performance for various characters may be utilized as donor for improving those characters in a component breeding approach. For effective selection of superior genotype in the germplasm lines, knowledge on genetic parameters like variability, heritability and genetic advance is very much essential. Keeping this in view, the present investigation was under taken to assess the genetic variability, heritability and genetic advance for yield and yield attributing traits in germplasm lines of *rabi* wheat.

MATERIALS AND METHODS

The experimental material of wheat germplasm were considered of 81 germplasm lines collected from Department of Genetics and Plant Breeding, B.H.U. Varanasi, NDUA&T, Ayodhya and CSAUA&T Kanpur, Uttar Pradesh. The experimental field under present investigation is located at 26.5^0N latitude and 83.79^0E longitude and 68 meter (223 feet) above the mean sea level. The climate of district Deoria is semi-arid with hot summer and cold winter. The experiment with 81 genotypes with 3 checks variety of wheat in Augmented Block Design. Two rows of each test genotype was present only once in each block with 3 checks in randomized manner along with the distance of 23 cm between the rows and 5 cm between the plants. The data on days to 50% flowering, flag leaf area, plant height, days to maturity, spike length, number of effective tillers per plant, number of spikelets per spike, peduncle length, biological yield per plant, grain yield per plant, grain yield per spike, number of grains per spike, 1000 grains weight and harvest index were recorded to estimate genetic variability parameters. Genetic variability was measured and subjected to statistical analysis as : Analysis of variance, Heritability (Broad sense), Genetic advance and Genetic advance as per cent over mean; suggested by (1, 2, and 3) respectively.

RESULTS AND DISCUSSION

Variability is the most important characteristic feature of any population. Estimation of genetic variability is an

Table-1 : Analysis of variance for yield and yield attributing traits in 81 germplasm lines of Wheat.

S. No.	Characters	Source of variance		
		Blocks	Checks	Error
		df (8)	df (2)	df (16)
1.	Days to 50% flowering	19.85417	18.11111	10.11114
2.	Flag leaf area (cm^2)	45.39259***	73.78502***	6.68219
3.	Plant height (cm)	135.31135***	2961.862***	4.93066
4.	Days to maturity	17.06250***	0.11111	1.44422
5.	Spike length (cm)	1.72795**	10.33122***	0.29750
6.	No. of spikelets per spike	2.86476**	21.64618***	0.70758
7.	No. of effective tillers per plant	0.68675*	1.31701*	0.21537
8.	Peduncle length (cm)	33.74718***	327.1248***	5.36030
9.	Grains per spike	13.81517	36.09657	19.08812
10.	1000 grain weight (g)	61.64120*	2.92593	17.71765
11.	Biological yield per plant (g)	5.36084	0.87685	8.72204
12.	Grain yield per plant (g)	2.02231	18.24139*	3.95147
13.	Grain yield per spike (g)	0.15583	0.46370	0.19370
14.	Harvest Index (%)	81.33836	157.23900*	37.06065

Table-2 : Estimate of Genetic variability, heritability and genetic advance in 81 germplasm lines of Wheat.

Characters	Range			Variance						
	Min.	Max.	Mean	^{2} g	^{2}p	GCV (%)	PCV (%)	h^2 (BS) (%)	GA (%)	GAM
Days to 50% flowering	70.3333	92.0000	82.5555	5.0617	15.1728	2.725	4.718	33.36	2.6769	3.2425
Flag leaf area (cm^2)	12.2463	35.0663	23.9933	10.7983	17.4805	13.696	17.426	61.77	5.3204	22.1745
Plant height (cm)	59.9348	118.155	84.0327	63.7956	68.7263	9.505	9.865	92.83	15.8525	18.8646
Days to maturity	115.000	133.000	125.3703	8.6197	10.0639	2.342	2.530	85.65	5.5973	4.4646
Spike length (cm)	6.7667	13.4600	10.1629	0.9643	1.2618	9.663	11.053	76.42	1.7684	17.4008
No. of spikelets per spike	11.1259	21.9259	16.9086	1.8889	2.5964	8.128	9.530	72.75	2.4148	14.2814
No. of effective tillers per plant	2.8963	6.2963	4.7555	0.1799	0.3953	8.919	13.220	45.51	0.5895	12.3952
Peduncle length (cm)	27.7118	59.6519	41.0091	26.1779	31.5382	12.476	13.694	83.00	9.6025	23.4155
Grains per spike	19.6815	46.0815	34.1481	-3.3239	15.7642	-5.339	11.627	-21.09	-1.7246	-5.0503
1000 grain weight (g)	11.0370	56.7037	33.3456	35.8274	53.5450	17.950	21.944	66.91	10.0861	30.2470
Biological yield per plant (g)	9.3037	27.0370	16.9308	0.4235	9.1456	3.844	17.862	04.63	0.2885	1.7040
Grain yield per plant (g)	4.5630	14.1630	9.2962	-0.5223	3.4292	-7.774	19.920	-15.23	-0.5810	-6.2502
Grain yield per spike (g)	0.6963	3.2963	1.9901	0.0268	0.2205	8.230	23.597	12.16	0.1177	5.9130
Harvest Index (%)	35.4159	79.7249	55.0361	-3.5253	33.5353	-3.412	10.522	-10.51	-1.2541	-2.2786

important prerequisite for realizing response to selection, as the progress in breeding depends upon its amount, nature and magnitude. The breeder should have the capability of distinguishing the genetic and non-genetic components of variation occurring in a population. The analysis of variance revealed that the variance due to blocks was highly significant for most of the characters except days to 50% flowering, grains per spike, biological yield per plant, grain yield per plant, grain yield per spike and Harvest Index; which were non-significant. However, the variance due to checks was highly significant for characters flag leaf area, plant height, spike length, no. of spikelets per spike, no. of effective tillers per plant, peduncle length, grain yield per plant and Harvest Index except days to 50% flowering, days to maturity, grains per spike, 1000 grains weight, biological yield and grain yield per spike; which were non-significant. This indicates presence of substantial amount of genetic variability among the genotypes under study (Table-1).

The character days to maturity (115-133) showed highest range, while the minimum range was observed in case of grain yield per spike (0.6963-3.2963). The other

parameters with high range of variation were days to 50% flowering (70.3333-92.00), plant height (59.9348-118.155) and harvest index (35.4159-79.7249). Hence, a breeder can concentrate more of these traits which can provide him ample scope for selection (Table-2).

The highest variance due togenotypes with highest variance due to phenotypes was observed for plant height i.e. 63.7956 and 68.7263 respectively followed by 1000 grain weight (35.8274 and 53.5450 respectively). Keeping this in mind a plant breeder can select these traits in his breeding programme for this area to give farmers high yielding varieties.

Phenotypic and genotypic variance and phenotypic and genotypic coefficient of variation were computed for 14 characters. The phenotypic and genotypic variances are influenced by unit of measurement of different traits. Therefore, these parameters were made unit free by estimating phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV). As GCV represents the heritable genetic component of the total variation, it would be more appropriate to use this parameter for comparing variability of different characters in the present investigation. Relatively higher values of GCV were noticed for 1000 grains weight, flag leaf area, peduncle length, spike length, plant height, no. of effective tillers per plant, grain yield per spike and no. of spikelets per spike while higher values of PCV were noticed for grain yield per spike, 1000 grains weight, grain yield per plant, biological yield per plant, flag leaf area, peduncle length, no. of effective tillers per plant, grains per spike and spike length. The low values of GCV were recorded for biological yield per plant, days to 50% flowering, days to maturity, harvest index, grains per spike and grain yield per plant along with low PCV values for harvest index, plant height, no. of spikelets per spike, days to 50% flowering and days to maturity. Difference between GCV and PCV values for the mentioned characters was very broad indicating influence of the environment on the expression of the traits (Table-2).

Heritability and genetic advance are important selection parameters. Heritability estimate along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone. The estimate of heritability can be utilized for the prediction of genetic gain, which indicates the genetic improvement that would result from the selection of best individual. Hence, estimate of heritability is an essential pre-requisite for formation of an effective selection method for genetic improvement.High estimates of heritability (>75%) were observed for plant height (92.93%), days to maturity (85.65), peduncle length (83%), spike length (76.42) and moderate heritability (50-75%) was recorded for no. of spikelets per spike (72.75%), 1000 grain weight (66.91%) and flag leaf area (61.77) indicating that a plant breeder can concentrate on these traits to exploit effective selection for genetic improvement. Remaining six traits showed low heritability (<50%) (Table-2).

Genetic advance is the improvement in the mean genotypic value of selected individual over the parental population. High heritability accompanied with high genetic advance indicates that the heritability is due to additive genetic effect and selection may be effective, while high heritability coupled with low genetic advance indicates the predominance of non-additive gene action, while low heritability is exhibited due to influence of environmental interactions rather than genotypic selection for such characters may not be rewarding. High estimates of genetic advance in per cent over mean was found for 1000 grain weight (30.2470) and the moderate genetic advance in per cent over mean were evaluated for peduncle length (23.4155), flag leaf area (22.1735), plant height (18.8646) and spike length (17.4008). Rest of the characters showed low genetic advance in per cent over mean (Table-2).

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