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Original Research Article

Studies on Genetic Variability, Heritability and Genetic Advance in some Bread Wheat (*Triticum aestivum* L. em. Thell) Genotypes

Indra Prakash[1], Tarkeshwar[2]*, Ravi Prakash Chaudhary[2], Soni Singh[2], Ashish Srivastava[3] and S.C. Gaur[1]

[1]Department of Genetics and Plant Breeding, Baba Raghav Das P G College, Deoria (U.P.) – 274 001, India
[2]Department of Genetics and Plant Breeding, [3]Department of Agricultural Economics, A.N.D.U.A.T., Kumarganj, Ayodhya (U.P.) – 224 229, India

**Corresponding author*

A B S T R A C T

An experiment was conducted to estimate the genetic variability, heritability and genetic advance at agriculture research farm BRD Post Graduate College, Deoria (UP) during *rabi* 2017-18 in timely sown, irrigated and normal soil conditions. Total 81 genotypes with three checks were evaluated under Augmented Block Design. The variance due to blocks was highly significant for flag leaf area, days to maturity, spike length, peduncle length and grain yield per spike and number of spikelets per spike. The highest variance due to genotypes with highest variance due to phenotypes was observed for plant height followed by 1000 grain weight. Higher values of GCV were noticed for grain yield per spike, biological yield, plant height and spike length while higher values of PCV were also noticed for grain yield per spike, biological yield, plant height and spike length. High estimates of heritability were observed for plant height, days to maturity, peduncle length and spike length. High estimates of genetic advance in per cent over mean was found for 1000 grain weight and plant height. 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.

Keywords

Bread wheat, GCV, PCV, Heritability, Genetic advance

Introduction

Wheat (*T. aestivum* L.) belongs to family *Graminae* (*Poaceae*) which is a large family and constitutes group of a large number of food crops. It is one of the most energy rich cereal crops of the world. It is a *rabi* season, self-pollinated hexapolyploidy cereal crop with a vast genetic divergence throughout the world. Wheat is grown under a wide range of agro-climatic zones as tropical and subtropical regions. It is also called as "King of Cereals" because of acreage it occupies, high productivity and significant position in the world food grain trade. It is the second most important staple food crop for more than 35% of the world population. Breeders have focussed to develop improved varieties in relation to improve yield potential of wheat. In last three decades, India has achieved tremendous increase in area, production and productivity of wheat. Extreme and high adaptation of this crop accompanied by its consumption pattern in human nutrition, it become one of the most important cereal crop in the world next to

rice. Genetic improvement in metric traits depends upon the nature and magnitude of variability present in the available genetic stock and extent to which the desirable traits heritable. To select superior genotypes in a breeding program, a good knowledge of parameters like variability, heritability and genetic advance is very much essential. Keeping this in view, the present study was carried out to reveal the genetic variability, heritability and genetic advance.

Materials and Methods

The experimental materials were comprised of 81 genotypes collected from Department of Genetics and Plant Breeding, ANDUAT, Ayodhya, CSAUAT Kanpur, Institute of Agricultural Sciences, B.H.U. Varanasi, Uttar Pradesh. The experiment was evaluated at the Research Farm, Department of Genetics & Plant Breeding, BRDPG College, Deoria (UP). The experimental field under present investigation is located at 26.5^0 N latitude and 83.79^0 E 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 was conducted with 81 genotypes with 3 checks variety of wheat in Augmented Block Design during *rabi* 2017-18. 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 recommended agronomical and crop protection practices were adopted to raise a good crop. Observation were recorded from five competitive randomly selected plants at maturity stage of the plants for thirteen quantitative traits *viz.*, days to 50% flowering, days to maturity, number of effective tillers per plant, flag leaf area, plant height, spike length, number of spikelets per spike, peduncle length, biological yield per plant, grain yield per plant, grain yield per spike, number of grains per spike and 1000 grains weight were recorded to estimate genetic variability parameters. To measure Genetic variability, the observations were 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 Discussions

The analysis of variance for thirteen characters of 81 cultivars revealed high significant difference among the genotypes. The variance due to blocks was highly significant for flag leaf area, days to maturity, spike length, peduncle length and grain yield per spike and number of spikelets per spike. However, the variance due to checks was highly significant for characters plant height, spike length, and number of spikelets per spike and no. of effective tillers per plant and grains per spike. The variance due to error were highly significant for number of spikelets per spike, 1000 grains weight and grain yield per plant (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 (0.70-3.30). The other parameters with high range of variation were days to 50% flowering (70.33-92.00), plant height (59.94-123.26).

The highest variance due to genotypes with highest variance due to phenotypes was observed for plant height followed by 1000 grain weight. Keeping this in mind a plant breeder can select these traits in his breeding program for this area to give farmers high yielding varieties.

Relatively higher values of GCV were noticed for grain yield per spike, biological yield, plant height and spike length while

higher values of PCV were also noticed for grain yield per spike, biological yield, plant height and spike length. The low values of GCV and PCV were recorded for rest of the characters. Difference between GCV and PCV values for the mentioned characters was very broad indicating influence of the environment on the expression of the traits.

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. High estimates of heritability (>75%) were observed for plant height, days to maturity, peduncle length, spike length and moderate heritability (50-75%) was recorded for no. of spikelets per spike, 1000 grain weight and flag leaf area indicating that a plant breeder can concentrate on these traits to exploit effective selection for genetic improvement. Remaining traits showed low heritability (<50%) (Table-2). 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. High estimates of genetic advance in per cent over mean was found for 1000 grain weight and plant height; and the moderate genetic advance in per cent over mean were evaluated for no. of tillers per plant and flag leaf area. Rest of the characters showed low genetic advance in per cent over mean.

Table.1 ANOVA for yield and 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	158.833	60.666	137.339
2	Flag leaf area (cm^2)	660.121**	150.169	372.566
3	Plant height (cm)	35.28452	1263.595**	4739.03
4	Days to maturity	136.50**	0.2222	23.107
5	Spike length (cm)	14.3063**	8.3247**	17.0976
6	No. of spikelets per spike	23.9623*	9.8522**	51.1611**
7	No. of effective tillers per plant	7.2406	0.5362*	4.9303
8	Peduncle length (cm)	269.977**	174.8735	565.1425
9	Grains per spike	110.521	26.739*	350.859
10	1000 grain weight (g)	493.129	33.851	255.481*
11	Biological yield per plant (g)	44.04168	0.320	140.825
12	Grain yield per plant (g)	16.160	4.945	90.921*
13	Grain yield per spike (g)	1.3229**	0.7674	3.2592

**Significant at 5% Probability level, *Significant at 1% Probability level

Table.2 Estimate of Genetic variability, Heritability and Genetic Advance in 81 germplasm lines of Wheat

Characters	Range			Variance						
	Min.	Max.	Mean	$\sigma^2 g$	$\sigma^2 p$	GCV (%)	PCV (%)	h^2 (BS) (%)	GA (%)	GAM
Days to 50% flowering	70.33	92.00	82.61	6.2960	14.8797	3.039	4.673	0.4231	3.3623	4.0728
Flag leaf area (cm^2)	15.77	51.31	31.97	9.9662	33.2517	9.866	5.9523	0.5830	2.3148	7.1488
Plant height (cm)	59.94	123.26	84.79	142.4613	438.650	13.849	18.021	0.2997	3.5603	11.1264
Days to maturity	115	133	125.25	8.6197	10.0639	2.342	2.530	0.8565	5.5973	4.4646
Spike length (cm)	6.77	13.73	10.20	0.3532	1.4219	5.858	11.752	0.2484	0.6103	6.0146
No. of spikelets per spike	11.05	22.05	16.96	-0.1177	3.0799	-2.028	10.376	-0.0382	-0.1381	-0.8167
No. of effective tillers per plant	3.01	6.35	4.77	0.1150	0.4231	7.123	13.664	0.2717	0.3641	7.6481
Peduncle length (cm)	27.71	59.65	40.89	1.9669	37.2883	3.420	14.890	0.0527	0.6635	1.6180
Grains per spike	19.68	46.08	34.25	-5.6193	16.3094	-6.942	11.826	-0.3445	-2.8664	-8.3939
1000grain weight (g)	11.07	56.70	33.56	37.2415	53.2091	18.301	21.875	0.6999	10.5172	31.5400
Biological yield per plant (g)	9.29	31.02	17.47	0.2951	9.0967	3.200	17.770	0.0324	0.2015	1.1874
Grain yield per plant (g)	4.54	14.14	9.34	-1.9212	3.7614	-14.91	20.862	-0.5108	-2.0406	-21.951
Grain yield per spike (g)	0.7	3.30	2.00	0.0192	0.2229	6.951	23.693	0.0861	0.0837	4.2009

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