

Original Research Article

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## Study of Genetic Variability in Wheat (*Triticum aestivum* L.)

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### ABSTRACT

#### Keywords

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The present investigation was carried out with the objective to estimate genetic variability involving 65 genotypes (fifteen parents and fifty F<sub>1</sub>s crosses) grown in a randomized block design with three replications at crop research farm Nawabganj. The analysis of variance revealed the significant differences among the treatments for five characters out of eight characters indicating considerable variability among the genotypes for number of grain/spike, grain yield/plant (gm), test weight/1000 grain weight (gm), harvest index (%) and protein content. Variability also reflected based on mean, range, phenotypic coefficient of variation and genotypic coefficient of variation therefore selection of the parents under study based on morphological differences for different characters was validated through ANOVA and other parameters. The range varied from 54.20 to 71.80 for number of grains in parents and 56.60 to 66.06 for number of grains/spike in F<sub>1</sub> generation. Maximum phenotypic coefficient of variation (PCV) of traits grain yield/plant (gm) (36.76) for parents+F<sub>1</sub>s were generally higher than genotypic coefficients of variance (GCV) of traits grain yield/plant (gm) (36.72) indicating the presence of enough genetic variability in the material under study.

### Introduction

Wheat (Allohexaploid 2n=6x=42, AABBDD) belongs to genus *triticum* and family poaceae (old name Gramineae) having haploid genome size of 16GB. Wheat is one of the most important cereal crops grown in different environments due to its versatile nature over the world. At global level, it was

cultivated over 214.79 million ha and production 735.18 million with an average productivity 34.22 quintals per hectare (FAOSTAT, 2018). In India, Wheat has second rank after paddy both in area and production, occupying 29.14 million ha acreage area with production of 102.19 million tones and the productivity of 35.07 quintals per hectare (IIWBR, 2018-19). Wheat is providing global food security and

providing well nutrition for human beings and it is considered as a staple food over worldwide. It has good nutrition value such as protein content 10-12 %. Human have limited resources such as land. So meet the challenge of limited resources, it is a difficult task that breeder will enhance the production in limited areas. Therefore, breeders search that genotype that has genetic variability.

The main aim of plant breeder is, to enhance the crop productivity. Genetic variability is a primary need for plant breeders. If a population have variability, it can be direct utilized for crop improvement, if it not to available in crop than will be created by the several methods such as mutation, crossing over and by the recombination. First choice of any plant breeder is to exploit the variability for crop improvement programme. Exploitation of genetic variability for enhancement of yield in crop need to know the component of genetic variation. Genetic parameters are used to assess the genetic variation in wheat crop.

The nature and magnitude of genetic parameters of component of variation is obtained from analysis of variance that described by the Singh and Chaudhary (1985) and Falconer (1989). Genetic variability is the result of genetic variation that occurred in different individual in a population. Genetic variability, which is due to the genetic differences among individuals within a population, is the main aim of plant breeding programs, because proper management of diversity can produce permanent gain in the performance of plant and can buffer against seasonal fluctuations (Sharma, 1998). Genetic variability among traits is important for breeding and in selecting desirable types. As the breeders are interested in selection of superior lines based on phenotypic performance. The development of high yielding wheat cultivars is the main objective of any wheat breeding programmes in the

world as well as in India. Improvement in crop depend upon the magnitude of genetic variability in economic characters therefore, the evaluation and utilization of genetic variability in desired direction becomes extremely important in any field improvement programme. In this regard, it is necessary to survey the available useful variability and nature of association among the various plant characters in the basic material. Yield is quantitative character and is governed by many genes having smaller effects i.e., polygenes. Thus, we can say that the yield is the final product of yield components. These components may affect the yield directly or indirectly. Therefore, yield can be maximized by improving the yield components provided there is no unfavourable association.

### **Materials and Methods**

The investigating material consisting of 65 genotypes (fifteen parents, fifty F<sub>1</sub>s crosses) was sown in a randomized block design with three replications at crop research farm Nawabganj of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Each parent and F<sub>1</sub> was planted in single row, of 3 meter long plot and 22.5 cm apart and 10 cm Plant to plant distance was maintained.

All the recommended cultural practices were applied to raise good crop. The random sample has been taken to evaluate the genetic variability for eight quantitative traits viz., number of grains/spike, biological yield/plant (gm), grain yield/plant (gm), taste weight/1000 grain weight (gm), harvest index (%), seed hardness, phenol color reaction and protein content. Standard statistical procedures were followed for estimating the analysis of variance and genetic constants i.e. phenotypic and genotypic coefficients of variation.

### **Results and Discussion**

Analysis of variance revealed highly significant differences among the genotypes for all eight characters such as number of grains/spike, biological yield/plant (gm), grain yield/plant (gm), test weight/1000 grain weight (gm), harvest index (%), seed hardness, phenol color reaction and protein content. The result overwhelmed that experimental material have high variability for characters studied. The magnitude of variance for any trait in the population is of great importance to a plant breeder for starting a breeding programme. All results have been given below.

Significant differences have been observed among treatments, parents, parents (lines), parents (testers), parents (Lines Vs Testers) and parents Vs crosses for all the characters except for phenol color reaction in Parents (testers), biological yield/plant (gm), seed hardness in parents (lines Vs testers) and

phenol color reaction in parents (testers), parents (lines Vs testers). Same result is indicated by Cheema *et al.*, (2006), Zecevic *et al.*, (2010) (Table 1).

In the present investigation, in general, the mean, range performance and genotypic coefficient of variation and phenotypic coefficient of variation of the parents and F<sub>1</sub>s for all eight characters are presented in Table 2. The variation within parents and F<sub>1</sub>s was found to be significant for all the characters but its magnitude varied from character to character. A wide range of variability was recorded within parents for number of grains/spike (54.20 to 71.80) followed by taste weight/1000 grain weight (42.46 to 55.32), harvest index (36.65 to 62.54), protein content (10.50 to 15.52), biological yield/plant (gm) (7.86 to 21.86), seed hardness (6.73 to 11.03), grain yield per plant (4.53 to 13.66) and phenol color reaction (2.33 to 4.66).

**Table.1** ANOVA of Parents+F<sub>1</sub>s for 8 characters in line × tester cross analysis of wheat (*Triticum aestivum* L.) mean sum of square

Source of variation	d.f.	Number of grains/Spike	Biological yield/Plant (gm)	Grain yield/Plant (gm)	Test weight /1000 grain weight (gm)	Harvest index (%)	Seed hardness	Phenol color reaction	Protein content (%)
Replication	2	1.25	0.04	0.31*	0.33 **	0.67	0.03	0.1	0.04
Treatments	64	21.50**	380.33 **	122.67**	16.26**	105.23**	2.31**	1.23**	1.14**
Parents	14	51.24**	43.57 **	20.85**	30.66**	160.97**	3.78**	1.13**	4.78**
Parents (Line)	9	71.57**	38.35**	13.26**	37.56**	158.89**	4.99**	1.39**	0.05*
Parents (Testers)	4	14.54**	66.20**	41.79**	18.77**	192.59**	2.02**	0.56	13.63**
Parents (L vs. T)	1	15.04**	0.04	5.37**	16.13**	53.13**	0.02	1.11	11.96**
Parents vs. Crosses	1	176.94**	18039.39**	4881.76**	3.24**	155.99**	0.45**	7.46**	4.79**
Error	128	0.83	0.31	0.07	0.06	2.09	0.06	0.50	0.02

**Table.2** Mean, range of parents+F<sub>1</sub>s, genotypic coefficients of variation and phenotypic coefficient of variation for 8 characters derived from line × tester crosses in wheat (*Triticum aestivum* L.)

Characters	General Mean		Range of variation		Coefficient of variation	
	Parent	F <sub>1</sub>	Parents	F <sub>1</sub>	GCV	PCV
Number of grains/ spike	59.33	61.59	54.20 to 71.80	56.60 to 66.06	4.29	4.55
Biological yield/ Plant (gm)	15.82	38.65	7.86 to 21.86	25.20 to 52.26	33.71	33.75
Grain yield/Plant (gm)	8.27	20.14	4.53 to 13.66	12.53 to 31.60	36.72	36.76
Test weight/1000 grain weight (gm)	46.77	46.47	42.46 to 55.32	42.72 to 51.89	4.99	5.02
Harvest index (%)	51.89	49.77	36.65 to 62.54	39.70 to 61.89	11.66	12.01
Seed hardness	9.1	9.22	6.73 to 11.03	7.40 to 10.80	9.41	9.81
Phenol color reaction	3.71	3.15	2.33 to 4.66	2.00 to 4.00	14.70	25.85
Protein content (%)	14.98	15.35	10.50 to 15.52	14.85 to 15.48	4.00	4.13

In F<sub>1</sub> the maximum variation was observed for number of grains/spike (56.60 to 66.06) followed by taste weight/1000 grain weight (42.72 to 51.89), harvest index (39.70 to 61.89), biological yield/plant (gm) (25.20 to 52.26), protein content (14.85 to 15.48), grain yield per plant (12.53 to 31.60), seed hardness (7.40 to 10.80), and phenol color reaction (2.00 to 4.00). In the present investigation, in general, estimates of phenotypic coefficient of variation was found higher than their corresponding genotypic coefficient of variation, indicating that the little influence of environment on the expression of these characters. A wide range of phenotypic coefficient of variation (PCV) was observed for all the traits in Parents+F<sub>1</sub> generation ranged from 4.13 (protein content) to 36.76 (Grain yield/plant), higher magnitude of PCV was recorded 36.76 (Grain yield/plant) followed by 33.75 (biological yield/plant), 25.85(phenol color reaction), 12.01 (harvest index), 9.81 (seed hardness), 5.02 (test weight/1000 grain weight), 4.55 (Number of grains/spike), 4.13 (protein content). Genotypic coefficients of variation (GCV) ranged from 4.00 (protein content) to 36.72 (Grain yield/plant), higher magnitude of GCV was recorded 36.72 (Grain yield/plant) followed by 33.71 (biological yield/plant),

14.70 (phenol color reaction), 11.66 (harvest index), 9.41 (seed hardness), 4.99 (test weight/1000 grain weight), 4.29 (Number of grains/spike), 4.00 (protein content) and 1.38 (Days to maturity). The same result is indicated by Majumder *et al.*, (2008), Bhushan *et al.*, (2013) Kyosev and Desheva, (2015) Arya *et al.*, (2017)

In the present investigation, it was concluded that estimate of the analysis of variance, phenotypic and genotypic coefficient of variation for eight characters in parents and F<sub>1</sub>s reveals sufficient variability for each of traits and thus, ample scope for genetic improvement of these traits through selection. The estimate of phenotypic coefficient of variation was found higher than their corresponding genotypic coefficient of variation, indicating that the little influence of environment on the expression of these characters.

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