



## Late planting analysis of bread wheat (*Triticum aestivum* L.) for variation and heritability in some quality traits and grain yield

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### Abstract

An experiment was conducted during 2012-13 at Wheat Improvement Project, Seed Breeding Farm, JNKVV, Jabalpur. To draw out information on genetic variability, heritability and genetic advance for yield and quality in 30 promising genotypes of bread wheat under late planting situation. The traits starch content reported low PCV and GCV whereas, yield plant-1 (gm) and sedimentation value exhibited high values of PCV and GCV. The high heritability was observed in all the traits studied except moisture content and high heritability coupled with high genetic advance as a percentage of mean were reported for yield plant-1, wet gluten, sedimentation values and protein content.

**Keywords:** wheat, heritability, genetic advance, PCV, GCV

### Introduction

Among the cultivated cereals, wheat becomes the second major important staple food grain cereal crop after rice in India (FAO, 2007) <sup>[5]</sup>. It is a stable source food with sufficient calories for human diet as compared to other crops (FAO, 2010) <sup>[6]</sup>. Cultivating varieties with high yielding potential and superior quality traits is the demand of present world for ever increasing population. Utilization of conventional breeding techniques for enhancing nutritional superiority of bread wheat becomes an important aspect today for developing high yielding quality wheat produce. Improvement in quality of crop becomes possible by methods of selection and evaluation (Pettersson, 1998) <sup>[15]</sup>. Magnitude of genetic variability present in the plant population decides the efficiency of selection as well as development of an effective plant breeding strategies. Thus the nature of variability present in decides the success of genetic enhancement in any trait. Response to selection for quality depends upon the heritability and genetic variance of the quality traits and unfavorable response with other important traits like yield (Fisher, *et al.*, 1989) <sup>[4]</sup>. Breeding programme designed with effective selection of favorable traits in the breeding materials based on genetic variation of the base population. Prospect of isolating better genotypes is high in the population in which variability is largely due to genetic cause with least environmental cause. In case of traits governed by polygenic gene system, it is often difficult to identify that what proportion of variability is heritable (genotypic) and what proportion is non-heritable (environmental). The primary condition for progress in any breeding program depends upon magnitude and nature of genotypic and environmental variation for various plant characters. Since, it becomes necessary to divide the present variability into its heritable and non-heritable components with the help of suitable genetic parameters such as genotypic coefficient of variation, heritability estimates, and genetic

advance under selection. The predictive role of heritability is to evaluate the reliability of phenotype as a guide to its breeding value. Breeding value, determines how much of the phenotype would be passed onto the next generation (Kovocas, *et al.*, 1997) <sup>[11]</sup>. Genetic progress is a direct relationship between heritability and expected response to selection (genetic advance). Most effective selection condition was offered by high estimate of genetic advance and high heritability (Troccoli, *et al.*, 2000) <sup>[14]</sup>. Under particular selection pressure genetic advance is yet another important selection parameter aided by breeder to define the gain under selection for a particular trait (Sharma, *et al.*, 2002) <sup>[16]</sup>. It is recommend to identify the quality traits of utmost importance, the present research was conducted in a wheat breeding program by studying variability, heritability and genetic advance on grain yield.

### Materials and Methods

An experiment was conducted to study the genetic variability in promising bread wheat genotypes at Wheat Improvement Project, Seed Breeding Farm, Department of Plant Breeding and Genetics, College of Agriculture, JNKVV, Jabalpur (MP), during *rabi* season of 2012-13, under late planting situation. The experiment was laid out in randomized complete block design with three replications. The 30 genotypes of bread wheat were sown in four rows of 2.5 meter length with the row spacing of 20 cm apart to provide uniform plants stand. The recommended packages of practices were followed to raise a good crop stand. The observations were recorded on seed yield per plant (g) and quality parameters like, sedimentation value (ml), hectoliter weight, protein content (%), wet gluten (%), starch content (%) and moisture contents. The analysis of variance was done and Variability for different characters was estimated by Burton (1952) <sup>[3]</sup>. Heritability and expected genetic advance was calculated according to Hanson

(*et al.*, 1956) and Johnson (*et al.*, 1955) respectively.

**Table 1:** Estimates of mean, range and different genetic parameters for yield and quality traits of bread wheat genotypes.

Traits	Mean	Range		GCV	PCV	h <sup>2</sup> bs (%)	GA as % of mean
		Min.	Max.				
YP	11.41	7.34	17.86	21.33	25.56	88.70	46.98
SDS	28.61	23.03	36.07	19.95	20.16	98.97	44.21
HW	76.52	73.00	81.00	2.01	4.50	73.20	5.84
PC	10.68	9.67	12.37	6.27	6.33	96.98	12.77
WGC	24.63	19.57	30.40	10.01	10.16	98.00	24.43
SC	66.26	63.20	68.80	2.50	2.65	72.89	4.86
MC	6.92	6.17	7.50	2.23	4.54	39.24	1.08

YP= Yield plant<sup>-1</sup>; SDS= Sedimentation value; HW = Hectoliter weight; PC= Protein content; WGC= Wet gluten content; SC= Starch content; MC= Moisture content

GCV= Genotypic coefficient of variation; PCV= Phenotypic coefficient of variation; h<sup>2</sup>bs= Broad sense heritability; GA = Genetic advance

## Results and Discussion

All the genotypes under the study displayed considerable amount of differences in their mean performance with respect to all the traits studied. The lower value of GCV, PCV, range and genetic advance indicates the attainment of stability of lines in the advanced generation (Table1). The traits viz yield plant-1 (21.33 % & 25.56 %) and sedimentation value (19.95 % & 20.16 %) recorded high values of genotypic and phenotypic coefficient of variation suggesting that these traits are under the influence of genetic control which remains unaltered by environmental conditions. This type of variability is more useful to a plant breeder for exploitation in selection or hybridization. Moderate genotypic and phenotypic were recorded for wet gluten (10.01 % & 10.16%). These results are in accordance with the finding Bilgin, *et al.*, 2010 [2] and Mishra and Shukla, 2013. Low genotypic and phenotypic were recorded for protein content, hectoliter weight, starch content and moisture content (6.27 % & 6.33 %, 2.01 % & 4.50 %, 2.50 % & 2.65 %, 2.23 % & 4.54 %, respectively). This is in accordance with the findings of Jagshoran, 1995, for protien and starch content. High heritability estimated for the traits studied viz., sedimentation value (98.97%), wet gluten (98.00%), protein content (96.98%) yield plant-1 (88.70%), hectoliter weight (73.20%) and starch content (72.89%). This suggests the greater effectiveness of selection and improvement to be expected for the traits with high heritability in future breeding programme as the genetic variance is mostly due to additive gene expression. These results are in accordance with the findings of Jagshoran, 1995, Tazeen, *et al.*, 2009 [13], Mishra and Shukla, 2013 [12] and Hokrani, *et al.*, 2013 [8]. High heritability coupled with high genetic advance as per cent of mean was observed for the characters viz., seed yield per plant (88.70 % & 46.98 %) and quality parameters includes wet gluten (98.00 % & 24.43 %), sedimentation values (98.97 % & 44.21 %) and protein content (96.98% & 12.77 %). This indicates the lesser influence of environment in expression of these characters and prevalence of additive gene action in their inheritance, hence are amenable for simple selection. Ackura, 2009 [1] and Mishra and Shukla, 2013 [12] reported the same estimates for these traits. The high genetic advance over mean coupled with moderate to high heritability suggested the importance of additive gene action for these traits. Hectoliter weight (73.20

% & 5.84 %) and starch content (72.89% & 4.86%) observed to be had high heritability coupled with low genetic advance as per cent over mean, it indicates the presence of non-additive gene action, whereas high heritability exhibited due to favorable influence of environment and selection for such trait may not be rewarding. This was in accordance with findings of Ackura, 2009 [1]. Moderate estimate of heritability along with low genetic advance was recorded for moisture content (39.24 % & 1.08 %).

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