

## Selection Parameters in Wheat Accessions Based on Various Morpho-Physiological Traits

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### ABSTRACT

*Wheat (Aestivum sativum L.) cultivated on diverse climatic conditions over the nations. The knowledge of genetic parameters viz., heritability and genetic advance among characters under selection is very useful for predicting genetic progress in breeding programme and developing efficient breeding strategies. The mean sum of squares due to genotypes were highly significant for plant height, number of earheads per plant, number of grains per earhead, days to maturity and grain yield (kg/ha) whereas biological yield per plot (g) and harvest index (%) showed non-significant differences. GCV accounted for a major portion of PCV for all the characters studied. The perusal of data revealed highest phenotypic and genotypic coefficients of variation for number of earheads per plant followed by number of grains per earhead, grain yield per plot (g), days to maturity, plant height, harvest index (%) and biological yield. In the present study heritability, was high (greater than 80%) for all studied characters except for biological yield and harvest index [showed moderate heritability (<40%)]. The moderate genetic advance(>10% but <20%) was observed for plant height, number of seeds per earhead, days to maturity and seed yield indicated that these characters are governed by non-additive genes and heterosis breeding for improvement of these characters may be useful. The characters namely; plant height, number of earheads per plant, number of seeds per earhead, days to maturity and grain yield per plot (g) showed high heritability accompanied with moderate genetic advance indicated the non-additive type of gene action.*

**Keywords:** *Wheat, genetic variability, GCV, PCV, heritability, genetic advance, plant height (cm), earheads per plant, days to maturity, grain yield, harvest index (%).*

### INTRODUCTION

Wheat is a widely adaptable crop that can be grown in climates ranging from temperate to tropical and cold northern parts. In addition it can be cultivated anywhere from land on sea

level to an altitude of up to 3300 meters. Places with a cool, moist weather for most part of the year followed by a short, dry and warm spell is most suited for wheat cultivation.

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Under the botanical classification wheat crop belongs to genus *Triticum*. Wheat (*Triticum aestivum* L.), a cereal grass of Poaceae family and of the genus *Triticum*, is the world's largest cereal crop. It has been described as the 'King of Cereals' because of the acreage it occupies, high productivity and the prominent position it holds in the food grain trade. It occupies an inimitable position in human life as it is the major source of food and energy with a large number of end use products. Globally, India has the largest area under wheat cultivation and is the second largest producer after China.

Nationally, wheat is the second most important food crop after rice. It is cultivated extensively in North-eastern and Central zones. India has reported a record production of 107.59 million tonnes wheat from an area of 29.55 million hectare during the crop season 2019-20 with a productivity of 35.08 q/ha (ICAR-IIWBR, 2020). In Madhya Pradesh, 37.19 million tonnes wheat was produced on an area of 10.21 million hectares with average productivity of 36.41 q/ha (2019-20.pdf (mp.gov.in). The extent of genetic variability has been considered as a key factor which is an essential pre-requisite for a successful hybridization aimed at developing promising strains. The selection of parents becomes more complicated if the improvement is to be achieved for a quantitative and/or polygenetically controlled complex character like grain yield. In this regard, information on nature and magnitude of genetic variability is of immense value for starting any systematic breeding programme in crops. The presence of considerable genetic variability in the base material ensures better chances of evolving desired plant types. The knowledge of genetic parameters viz., heritability and genetic advance among characters under selection is very useful for predicting genetic progress in breeding programme and developing efficient breeding strategies. The present study is an attempt to measure the extent of genetic variability among different morphological and physiological traits in wheat accessions under normal sown irrigated conditions.

## MATERIALS AND METHODS

The present study was conducted at crop cafeteria research site of RVSKVV, Krishi Vigyan Kendra, Ujjain [Madhya Pradesh] which is located at latitude of 23° 10' N, longitude of 75° 47' E and at an altitude of 494 meters above mean sea. The experimental material consisted of 35 wheat accessions along with check variety namely HI 1544 grown in randomized block design (RBD) with 3 replications during rabi 2019-20. The experiment was planted on 18th November and kept under normal agronomic care from sowing to maturity. Each accession was planted in four rows of 3.0 m length with inter-row and inter-plant distances of 22.5 and 10 cm, respectively. The experiment was conducted under optimum input conditions (120 kg N, 60 kg P<sub>2</sub>O<sub>5</sub>, 30 kg K<sub>2</sub>O and 25 kg ZnSO<sub>4</sub> per hectare based on soil testing reports). Observations were recorded at specific stage on five randomly selected plants per accession per replication for the different morphological traits viz., plant height (cm), earheads per plant, number of grains per earhead, days to maturity, grain yield per plot (g), biological yield per plot (g) and harvest index (%). The mean performance of each accession was recorded and employed for statistical analysis. Analysis of variance to test the significance for each character was carried out as per methodology advocated by Fisher (1925) and described by Panse and Sukhatme (1967). Phenotypic coefficient of variability (PCV) and Genotypic coefficient of variability (GCV) were calculated by the formula given by Burton (1952), heritability in broad sense ( $h^2_{bs}$ ) was calculated by using the formula suggested by Hanson et al. (1956) and genetic advance that is the expected genetic gain was calculated by using the procedure given by Johnson et al. (1955).

## RESULTS AND DISCUSSION

The pool of thirty five accessions and one check variety was, assessed for estimation of genetic divergence present among these lines. The mean sum of squares for different traits studied has been presented in Table 1. The

results shown in table 1 disclosed that mean sum of squares due to genotypes were highly significant for plant height, number of earheads per plant, number of grains per earhead, days to maturity and grain yield (kg/ha) indicating that there is huge genetic variability present and having the ample scope for improvement through these traits that leads to the seed yield improvement whereas biological yield per plot (g) and harvest index (%) showed non-significant differences. Hence, the prevalence of enough genetic variability in the material for selection and improvement. The basic material, therefore, offers positive opportunities for investigation furtherance of the aforesaid objectives. The existence of significant variability has also been reported by Kumari et al. (2017) and Suresh et al. (2018) for morphological traits and by Sharma et al. (2018) and Sangwan et al. (2018) for physiological traits in wheat.

The value of different parameters of genetic variability are presented in table 2. The values of coefficient of variation indicated that all the characters studied have ample scope of improvement owing to its significant variability depicting through CV. In general, the results revealed wide range for all the traits under investigation. The estimates of PCV are marginally higher for plant height, number of earheads per plants, number of seeds per earhead, days to maturity and grain yield indicated that the expression of these traits are least influenced by environment which are confirmed by its higher value heritability whereas only two characters namely biological yield and harvest index shown a great difference between PCV and GCV disclosed that the expression of these traits are greatly influenced by environment which is again depicted through its moderate value of heritability. GCV accounted for a major portion of PCV for all the characters studied, indicating that the genotypes were reflected by the phenotype and selection based on phenotypic performance could prove to be effective for these characters. The perusal of data revealed highest phenotypic and genotypic coefficients of variation for number

of earheads per plant followed by number of grains per earhead, grain yield per plot (g), days to maturity, plant height, harvest index (%) and biological yield, indicating availability of sufficient genetic variability and thus exhibited scope for genetic improvement through selection. However, harvest index (%) and biological yield exhibited least phenotypic and genotypic coefficients of variation. Similar findings were also reported by Nukasani et al. (2013), Parnaliya et al. (2015), Ali and Abdulla (2016), Arya et al. (2017), Meles et al. (2017), Neeru et al. (2017) and Rathwa et al. (2018) in wheat.

Heritability determines the extent of genetic control of a given trait and its transmission to its progeny and, hence has bearing on the selection efficiency of trait concerned. Heritability is the percentage of phenotypic variance that is attributed to genetic variance. The estimates of heritability are more advantageous when expressed in terms of genetic advance. Johnson et al. (1955) advocated that for selection to be effective, heritability and genetic advance should be considered together. If heritability of a character is very high e.g., 0.8 or more, selection for the character should be fairly easy because there would be a close correspondence between genotype and phenotype. But for a character with low heritability, say less than 0.4, selection may be considerably difficult or virtually impractical due to the confusing effect of the environment. In the present study heritability, was high (greater than 80%) for all studied characters except for biological yield and harvest index. High heritability indicates that the influence of environment in the expression of trait is minimal. These findings confirm with the results obtained by Kumari et al. (2017), Neeru et al. (2017), Rathwa et al. (2018) and Suresh et al. (2018). Hence, Any of these characters can, therefore, be used for selection. The selection for improvement of these characters may not be useful because broad sense heritability is based on total genetic variance which includes both fixable (additive) and non-fixable (dominance and epistatic)

variances. In the present study, biological yield and harvest index showed moderate heritability (<40%). The comparatively lower heritability for these two traits, in this study, may be due to the fact that biological yield and harvest index are a low heritable characters which that is controlled by many genes. The progress in selection for these characters in wheat is general slow.

The moderate genetic advance(>10% but <20%) was observed for plant height, number of seeds per earhead, days to maturity and seed yield indicated that these characters are governed by non-additive genes and heterosis breeding for improvement of these characters may be useful.

Heritability and genetic advance are the important selection parameters. The expected genetic advance that was low for

number of earheads per plant may be compensated by their high heritability. Ali et al. (2002), Najeeb et al. (2009) found that high heritability may not always linked with high genetic advance. Since high value heritability does not always indicate a high genetic gain, heritability is recommended to be considered in association with genetic advance to predict the effect of selecting superior crops genotypes. The characters namely; plant height, number of earheads per plant, number of seeds per earhead, days to maturity and grain yield per plot (g) showed high heritability accompanied with moderate genetic advance indicated the non-additive type of gene action. The high heritability is being exhibited due to favourable influence of environment rather than genotype and selection for these traits may not be rewarding.

**Table1: Mean Sum Square of different characters of wheat during rabi 2019-20**

Source of Variation of Freedom	Degree	Plant Ht(cm)	Earheads/plant	Seeds/earhead	Days to Maturity	Biological Yield(g/Plot)	Harvest Index (%)	Grain Yield(Kg/ha)
Rep.	2	0.34	0.60	0.42	2.78	142506.25	0.72	281483.57
Treat.	35	78.30**	15.23**	76.08**	184.11**	223982.34**	28.45**	802591.97**
Error	70	0.51	0.10	0.03	0.78	136006.25	13.73	65964.07
Total	71	39.11	7.63	37.55	91.61	248518.76	27.59	468608.04

\*, \*\*Significant at 5 % and 1% level, respectively

**Table2: Genetic parameters of different attributed of wheat during Rabi 2019-20**

Character	Mean	CV (%)	Range	GCV (%)	PCV (%)	h <sup>2</sup> bs (%)	Genetic Advance	GA (as % of mean)
Plant Ht(cm)	88.9	6.99	72.2-98.3	7.00	7.10	98.7	12.8	20.00
Earheads/plant	13.1	20.88	7.4-18.5	20.90	21.10	98.6	5.6	6.60
Seeds/earhead	43.1	14.12	28.3-60.0	14.30	14.30	99.9	12.7	57.10
Days to Maturity	114.5	8.30	98.5-133.5	8.40	8.40	99.2	19.6	64.10
Biological Yield(g/Plot)	3659	13.53	2740-4330	5.70	11.60	24.4	21.36	38.70
Harvest Index(%)	45.1	11.55	39.1-55.6	6.00	10.20	34.9	3.3	24.80
Grain Yield(Kg/ha)	5464	12.44	4133.3-6766.6	<b>11.10</b>	12.10	84.8	11.51	

Table3: Mean value of different attributes of wheat during Rabi 2019-20

SN	Entry Name	Plant Ht(cm)	Earheads/plant	Seeds/earhead	Days to Maturity	Biological Yield (g/Plot)	Harvest Index (%)	Grain Yield (Kg/ha)
1	GS 1007	94.0	7.4	40.3	101.5	3850	48.81	6200
2	GS 2031	95.8	9.5	42.1	114.5	3550	46.79	5533
3	GS 3018	88.5	16.7	28.3	131.5	4080	45.77	6200
4	GS 4028	92.2	13.5	40.1	112.5	3550	46.76	5533
5	GS 4049	86.2	10.1	42.4	109.5	3620	48.92	5900
6	GS 6005	75.8	13.5	41.1	133.0	3910	46.20	6000
7	GS 6006	92.0	16.3	36.2	113.5	3490	39.54	4600
8	GS 6018	84.9	12.1	36.2	106.5	2740	46.02	4133
9	GS 6044	86.1	12.9	42.1	105.0	3790	44.61	5633
10	GS 7028	89.8	9.6	40.5	118.0	3300	44.05	4833
11	GS 7042	80.9	13.9	56.1	101.5	3530	49.06	5767
12	GS 9036	72.2	17.1	42.1	118.0	3780	50.26	6333
13	GS 9057	79.4	11.3	60.0	133.5	3320	43.91	4833
14	1ST CWYT-614	82.8	11.1	45.5	115.0	3510	47.56	5467
15	1ST CWYT-626	84.8	12.1	42.8	113.5	3440	47.15	5400
16	1ST CWYT-630	82.7	13.5	45.6	118.5	3800	45.04	5700
17	1ST CWYT-637	94.3	12.2	40.3	116.0	4330	39.30	5667
18	1ST CWYT-644	98.3	16.9	47.6	126.5	3090	46.21	4633
19	39TH ESWYT-103	93.6	9.5	45.5	114.5	4320	49.67	6767
20	39TH ESWYT-112	91.9	10.1	42.1	115.5	3830	44.78	5700
21	39TH ESWYT-118	91.3	13.0	46.1	115.0	3370	43.05	4800
22	39TH ESWYT-130	92.4	9.1	51.8	128.0	4120	42.51	5867
23	39TH ESWYT-143	94.2	11.1	43.1	120.0	3630	55.57	6333
24	26TH SAWYT-303	91.6	13.2	42.9	98.5	3860	44.06	5633
25	26TH SAWYT-309	91.6	16.1	29.1	110.0	4260	41.77	5933
26	26TH SAWYT-313	90.3	18.5	43.8	101.0	3250	42.27	4567
27	26TH SAWYT-315	92.0	12.6	44.1	104.5	3570	49.08	5833
28	26TH SAWYT-318	93.1	12.0	39.1	110.0	3680	39.37	4767
29	26TH SAWYT-323	90.9	12.3	40.2	105.5	3720	49.95	6167
30	9TH HPYT-416	93.5	13.2	51.8	108.5	3570	40.89	4867
31	9TH HPYT-432	96.3	14.2	47.9	101.5	3760	39.10	4900
32	9TH HPYT-446	94.8	16.9	43.9	120.5	3830	40.49	5167
33	17TH HTWYT-5	89.6	14.9	44.1	113.0	3580	46.63	5567
34	17TH HTWYT-20	91.5	13.4	43.4	132.0	3820	44.52	5667
35	17TH HTWYT-36	86.1	15.3	48.1	124.0	3620	45.85	5533
36	FILLER	75.5	18.5	35.9	112.0	3255	39.78	4283

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