



Research Article

ESTIMATION OF GENETIC PARAMETERS FOR YIELD AND YIELD CONTRIBUTING CHARACTERS IN F₄ GENERATION OF WHEAT (*Triticum aestivum* L)

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Abstract: Estimation of genetic parameters form the basis for selection criteria and has crucial role in the improvement in yield. The research was conducted in Rabi 2016-17 at the Field Experimentation Centre of Department of Genetics and Plant Breeding comprising 30 genotypes of wheat with three replications in randomized block design to study genetic variability, heritability and genetic advance. Analysis of variance exhibited significant differences among 30 genotypes for the characters studied. The values of PCV were higher than those of GCV indicating apparent variation not only due to genotypes but also due to the influence of environment. The highest value of GCV and PCV was recorded for biological yield. High heritability associated with high genetic advance was observed for plant height determining additive gene action in the expression of these traits. Therefore, these traits can be improved by mass selection based on progeny testing.

Keywords: Genetic variability, PCV, GCV, Heritability, Genetic Advance, Wheat

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Introduction

Wheat (*Triticum aestivum* L.), a self-pollinated crop constitutes about 12% of the total world's production and is important cereal crop in India after rice being grown in *rabi* season. Variability is the most important characteristics and distinctive feature of any population. Plant population with higher variability provides greater opportunity for improvement and the inherited portion of variability is termed as heritability which forms a good index for the transmission of characters from the parents to their offsprings [4] assisting breeders in the selection of elite genotypes from the diverse genetic populations. Genetic advance coupled with heritability forms an important ground for the selection process than heritability alone. Thus, present investigation reveals the estimates of genetic variability, heritability and genetic advance among the 30 genotypes of wheat.

Materials and Methods

The experimental material for the present investigation was received from the Department of genetics and Plant Breeding, SHUATS, Allahabad, U.P. and the research was conducted at the Field Experimentation Centre of Department of Genetics and Plant Breeding, SHUATS, Allahabad with three replications in Randomized Block Design during Rabi 2016-17. One block consisted of 30 lines and five plants were selected from each line of the three replications for recording the observation of thirteen characters viz., days to 50% flowering, plant height, flag leaf length, flag leaf width, leaf sheath length, peduncle length, spike length, number of spikes per plant, number of tillers, biological yield, grain yield per plant, harvest index and 1000 seed weight. The estimation of ANOVA [5], Coefficients of variation [1], Heritability [2] and Genetic advance was done.

Results and Discussion

The mean sum of squares due to genotypes were significant for all the 13 characters suggesting that the genotypes were genetically variable and

considerable amount of variability existed among them as presented in [Table-1] [3]. According to per se performance exhibited wide range of variations for the characters studied i.e. Days to 50% flowering (72.33 to 75.33), Plant height (67.83 to 112.92), Flag leaf length (19.24 to 33.21), Flag leaf width (1.14 to 2.06), Spike length (8.41 to 15.36), Peduncle length (34.14 to 50.04), Leaf sheath length (15.89 to 29.78), number of spikelets (26.60 to 39.40), number of tillers (2.20 to 6.26), Biological yield (6.27 to 20.54), Harvest index (20.24 to 34.20) Grain yield per plant (2.51 to 5.86) and 1000 seed weight (31.16 to 45.75). On the basis of grain yield per plant HUW-510 x PHS-06-22-4 and HUW-510 x PHS-06-22-3 were the best genotypes. In the present study on Phenotypic and Genotypic and Phenotypic Coefficient of Variation it was revealed that the magnitude of PCV was higher than GCV in all the thirteen characters [6]. The present study also revealed that the PCV and GCV was highest for biological yield (31.10%, 28.98%) followed by number of tillers per plant (25.46%, 24.62%), harvest index (24.80%, 14.77%), grain yield per plant (23.46%, 13.57%), leaf sheath length (18.98%, 18.68%), flag leaf width (15.73%, 13.58%), spike length (13.78%, 12.85%), flag leaf length (12.94%, 12.17%), plant height (12.51%, 11.68%), 1000 seed weight (10.20%, 9.48%), peduncle length (10.04%, 9.63%), number of spikelets (9.15%, 8.08%), days to 50% flowering (1.45%, 1.04%). The estimates of PCV and GCV for harvest index as well as grain yield per plant exhibited difference of 10% indicating the influence of environment upon them. Estimates of heritability was recorded for all the thirteen characters. Very high heritability was observed for characters like leaf sheath length (97%), number of tillers (94%), peduncle length (92%), flag leaf length (88%), spike length (87%), biological yield (87%), 1000 seed weight (86%), number of spikelets (78%), flag leaf width (75%). Moderate heritability was observed for days to 50 % flowering (54%), and low heritability was observed for harvest index (35%), grain yield per plant (33%). The highest genetic advance was recorded for plant height (24.67%), leaf sheath length (9.66%), peduncle

Table-1 Analysis of variance for different quantitative character in 30 genotypes of wheat

SN	Characters	Mean sum of squares		
		Replication (d.f=2)	Treatment (d.f=29)	Error (d.f=58)
1	Days to 50% flowering	1.63	2.32**	0.55
2	Plant height(cm)	0.34	315.00**	14.67
3	Flag leaf length(cm)	2.80	24.40**	1.01
4	Flag leaf width(cm)	0.01	0.15**	0.01
5	Spike length(cm)	0.27	4.87**	0.23
6	Peduncle length(cm)	0.34	43.64**	1.22
7	Leaf sheath length(cm)	0.30	42.04**	0.48
8	Number of spikelets	2.90	21.89**	1.88
9	Number of productive tillers	0.01	2.95**	0.60
10	Biological yield(g)	2.37	37.47**	1.80
11	Harvest index	93.47	123.09**	46.45
12	Grain yield per plant(g)	0.95	1.36*	0.54
13	1000 Seed weight(g)	0.29	44.08**	2.18

**&*Significant at 1 and 5% level

Table-2 Mean, Range, Variability, Heritability (broad sense), Genetic advance and Genetic advance as per cent of mean for 13 characters in Wheat

Characters	Vg	Vp	GCV	PCV	h ²
Days to 50% flowering	0.59	1.15	1.04	1.45	52
Plant height	100.11	114.79	11.68	12.51	87
Flag leaf length	7.80	8.81	12.17	12.94	88
Flag leaf width	0.05	0.06	13.58	15.73	75
Spike length	1.55	1.78	12.85	13.78	87
Peduncle length	14.14	15.37	9.63	10.04	92
Leaf sheath length	13.85	14.34	18.65	18.98	97
Number of spikelets	6.67	8.55	8.08	9.15	78
Number of productive tillers	0.96	1.03	24.62	24.46	94
Biological yield	11.89	13.69	28.98	31.10	87
Harvest index	25.55	72.00	14.77	24.80	35
Grain yield per plant	0.27	0.82	13.57	23.46	33
1000 Seed weight	13.97	16.15	9.48	10.20	86

Characters	Genetic Advance as % of mean 1%	Genetic Advance (1%)	Per se performance Range minimum and maximum	Mean
Days to 50% flowering	1.97	1.46	72.3-75.33	74.03
Plant height	28.81	24.67	67.83-112.92	85.63
Flag leaf length	30.22	6.93	19.24-33.21	22.94
Flag leaf width	30.97	0.50	1.14-2.06	1.60
Spike length	31.64	3.06	8.41-15.36	9.67
Peduncle length	24.38	9.52	34.14-50.04	30.06
Leaf sheath length	48.39	9.66	15.89-29.78	19.95
Number of spikelets	18.83	6.02	26.60-39.40	31.97
Number of productive tillers	62.86	2.50	2.20-6.26	3.98
Biological yield	71.27	8.48	6.27-20.54	11.90
Harvest index	23.23	7.59	20.24-34.20	34.20
Grain yield per plant	20.73	0.80	2.51-5.86	3.85
1000 Seed weight	23.28	9.17	31.16-45.75	39.40

length (9.52%), 1000 seed weight (9.17), biological yield (8.48%), harvest index (7.95%), flag leaf length (6.93%), number of spikelets (6.02%), spike length (3.06%), number of tillers (2.50%), days to 50% flowering (1.46%), grain yield per plant (0.80%), flag leaf width (0.50%) as presented in [Table-2]. In the present study, high heritability associated with high genetic advance was observed for plant height (87%, 24.67%) determining additive gene action in the expression of these traits [6]. Therefore, these traits can be improved by mass selection and other breeding methods based on progeny testing. It was also observed that grain yield per plant exhibited low genetic advance in association with low heritability which indicated that character was highly influenced by the environment and in this case selection can be ineffective.

Conclusion

Analysis of variance and per se performance confirmed sufficient variability was

present among the 30 genotypes of wheat. Estimates of PCV and GCV revealed that harvest index and grain yield per plant were highly influenced by the environment. High heritability coupled with high genetic advance was observed for plant height indicating the presence of additive genetic effects and improvement for selection of such characters would be rewarding.

Application of research

This research can be beneficial to the breeders because such researches form the basis and selection criteria of different characters that can be used in further breeding programmes and since it also reveals about the environmental effects on the genotypes therefore ultimately it will help breeders to improve the yield that will support country's economy.

Research Category: Genetics and Plant Breeding

Abbreviations: GCV: Genotypic coefficient of variation, PCV: Phenotypic coefficient variation, h²: Heritability, Vg: Genotypic variance, Vp: Phenotypic variance

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