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HERITABILITY, GENETIC VARIABILITY AND GENETIC ADVANCE OF SOME TRAITS IN HYBRID WHEAT

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Abstract

A field experiment was conducted during *rabi* season of 2009-10 at Jabalpur. Estimation of heritability, genetic variability and genetic advance in hybrid wheat (*Triticum aestivum* L.) for yield and yield contributing characters for 130 hybrid cross combination. The analysis of variance for 17 different characters on yield and its contributing traits showed that the mean source due to treatments were found significant for all the characters under study indicated the presence of sufficient variability in the material.

***Key words*:** Hybrid wheat, heritability in wheat, yield.

Introduction

Wheat is the second most important food crop next to rice consumed by nearly 35% of the world population and providing 20% of the total food calories. It belongs to the genus *Triticum* of the family Poaceae and its origin is to be Middle East region of Asia. The presence of genetic variability is pre requisite that aims at genetic improvement of any crop whereas heritability is important parameters for the success of breeding programme. Grain yield, which is the most important component of wheat crop is a complex character and is a final product of several contributing factors and their interactions. The effectiveness of the selection of both yield, which is quantitative character and the yield components depend on the genetic variability and heritability. It is necessary to specify the components that establish the phonotypical variation in order to predict the genetic variation and heritability based on the variation.

Materials and Methods

The present investigation entitled "Identification of maintainer and restorer lines in F_1 hybrids combination from CMS source in wheat" was carried out during the *Rabi* season, 2009-10. The experiment was carried out under Wheat Improvement Project, Department of Plant Breeding and Genetics at College of Agriculture, J.N.K.V.V., Jabalpur (M.P.), India.

The experimental material consists of 130 F_1's wheat hybrids (10 Cytoplasmic male sterile and 13 varieties of wheat used as testers). Crosses were made during (2008-09) under the wheat project for development of wheat hybrids. These 130 F_1's were planted in a Randomized Complete Block Design with two replications. Each plot was accommodated in a single row of 1.5 m length, with row to row distance of 23 cm. The data were subjected to analysis of variance (ANOVA) using.

Analysis of variance

The data on quantitative characters were statistically analyzed on the basis of model described by Cochran and Cox (1950) for randomized complete block design. In order to test the significance of treatments critical difference was computed as per method given by Fisher and Yates (1963).

$$Y_{ij} = \mu + b_i + t_j + e_{ij}$$

Results and Discussion

The analysis of variance for 17 different characters on yield and its contributing traits showed that the mean source due to treatments were found significant for all the characters under study indicated the presence of sufficient variability in the material.

The perusals of data for day to flower initiation in

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Table 1 : F_1's cross combination included in study.

S. no.	JWH-1 × Testers	S. no.	JWH-4 × Testers
1.	JWH-1 x HI – 1531	1.	JWH-4 x GW-366
2.	JWH-1 x Lok-1	2.	JWH-4 x WH-147
3.	JWH-1 x GW-366	3.	JWH-4 x JW-3020
4.	JWH-1 x HI-1544	4.	JWH-4 x Lok-1
5.	JWH-1 x JW-3211	5.	JWH-4 x HI-1544
6.	JWH-1 x GW-273	6.	JWH-4 x GW-322
7.	JWH-1 xWH-147	7.	JWH-4 x HI-1531
8.	JWH-1 x JW-3020	8.	JWH-4 x JW-3211
9.	JWH-1 x DBW-17	9.	JWH-4 x DBW-17
10.	JWH-1 x JW-3173	10.	JWH-4 x JW-3269
11.	JWH-1 x GW-322	11.	JWH-4 x JW-3173
12.	JWH-1 x PBW-343	12.	JWH-4 x GW-273
13.	JWH-1 x MP-3269	13.	JWH-4 x PBW-343
	JWH-5 x Testers		**JWH-8 x Testers**
1.	JWH-5 x Lok-1	1	JWH-8 x JW-3211
2.	JWH-5 x GW-366	2	JWH-8 x GW-322
3.	JWH-5 x JW-3211	3	JWH-8 x PBW-343
4.	JWH-5 x HI-1531	4	JWH-8 x JW-366
5.	JWH-5 x JW-3173	5	JWH-8 x DBW-17
6.	JWH-5 x JW-3269	6	JWH-8 x JW-3173
7.	JWH-5 x GW-273	7	JWH-8 x Lok-1
8.	JWH-5 x HI-1544	8	JWH-8 x HI-1544
9.	JWH-5 x GW-322	9	JWH-8 x WH-147
10.	JWH-5 x JW-3020	10	JWH-8 x JW-3269
11.	JWH-5 x WH-147	11	JWH-8 x JW-3020
12.	JWH-5 x DBW-17	12	JWH-8 x HI-1531
13.	JWH-5 x PBW-343	13	JWH-8 x GW-273
	JWH-10 x Testers		**JWH-14 x Testers**
1.	JWH-10 x DBW-17	1.	JWH-14 x JW-3173
2.	JWH-10 x WH-147	2.	JWH-14 x PBW-343
3.	JWH-10 x Lok-1	3.	JWH-14 x GW-366
4.	JWH-10 x GW-322	4.	JWH-14 x JW-3269
5.	JWH-10 x HI-1544	5.	JWH-14 x HI-1544
6.	JWH-10 x HI-1531	6.	JWH-14 x JW-3211
7.	JWH-10 x JW-3020	7.	JWH-14 x Lok-1
8.	JWH-10 x GW-273	8.	JWH-14 x HI-1531
9.	JWH-10 x GW-366	9.	JWH-14 x GW-273
10.	JWH-10 x JW-3211	10.	JWH-14 x JW-3020
11.	JWH-10 x JW-3173	11.	JWH-14 x GW-322
12.	JWH-10 x PBW-343	12.	JWH-14 x WH-147
13.	JWH-10 x JW-3269	13.	JWH-14 x DBW-17
	JWH-16 x Testers		**JWH-17 x Testers**
1.	JWH-16 x JW-3020	1	JWH-17 x HI-1531
2.	JWH-16 x DBW-17	2	JWH-17 x GW-322
3.	JWH-16 x Lok-1	3	JWH-17 x PBW-343
4.	JWH-16 x JW-3269	4	JWH-17 x JW-3173
5.	JWH-16 x HI-1544	5	JWH-17 x Lok-1
6.	JWH-16 x JW-3211	6	JWH-17 x JW-3020
7.	JWH-16 x HI-1531	7	JWH-17 x DBW-17
8.	JWH-16 x WH-147	8	JWH-17 x JW-3269
9.	JWH-16 x GW-366	9	JWH-17 x JW-3211
10.	JWH-16 x PBW-343	10	JWH-17 x GW-366
11.	JWH-16 x GW-322	11	JWH-17 x WH-147
12.	JWH-16 x GW-273	12	JWH-17 x GW-273
13.	JWH-16 x JW-3173	13	JWH-17 x HI-1544
	JWH-20 x Testers		**JWH-23 x Testers**
1.	JWH-20 x HI-1531	1.	JWH-23 x GW-322
2.	JWH-20 x GW-322	2.	JWH-23 x JW-3211
3.	JWH-20 x PBW-343	3.	JWH-23 x HI-1544
4.	JWH-20 x JW-3173	4.	JWH-23 x Lok-1
5.	JWH-20 x Lok-1	5.	JWH-23 x JW-3269
6.	JWH-20 x JW-3020	6.	JWH-23 x GW-273
7.	JWH-20 x DBW-17	7.	JWH-23 x PBW-343
8.	JWH-20 x JW-3269	8.	JWH-23 x JW-3020
9.	JWH-20 x JW-3211	9.	JWH-23 x DBW-17
10.	JWH-20 x GW-366	10.	JWH-23 x JW-3173
11.	JWH-20 x WH-147	11.	JWH-23 x HI-1531
12.	JWH-20 x GW-273	12.	JWH-23 x GW-366
13.	JWH-20 x HI-1544	13.	JWH-23 x WH-147

various F1's ranged from 59 to 76 with an average performance of 63.68 which indicated that there was sufficient time for pollen dispersal for production of hybrids in wheat. The perusals of data for day to flower initiation in various F1's ranged from 59 to 76 with an average performance of 63.68 which indicated that there was sufficient time for pollen dispersal for production of hybrids in wheat. Similarly days to 50% flowering recorded a minimum value of 64 and maximum of 87 with a mean of 72.31 which showed the fitness of hybrid in seed production. The range of maturity also expressed (97-123 days) the suitability of duration, which is recommended for irrigated timely and late sown condition of wheat in central zone. The observation recorded on tillers per plant (4.6-41.3) with an average of 16.69 in F1's indicated that ability of lines towards higher production.The values exhibited for yield per plant (89.46-89.42 g) and kernel weight (39.56 – 45.22 g), also indicated the potential hybrid. The other traits contributing towards yield viz., spike density, spike length, flag leaf width, number of spikelets per spike, flag leaf length were have the similar trends to enhance the yield and potentiality of hybrids. Heritability (broad sense) is a measure of proportion of phenotypic variation contributed by genotypic

Table 2 : Genetic parameters or variation of hybrid wheat and its components.

S. no.	Characters	Range		Mean	PCV (%)	GCV (%)	H^2b (%)	GA	GA as % of mean
		Min.	Max.						
1.	Days to flower initiation	59	76	63.68	28.25	28.19	99.54	36.9	57.93
2.	Days to 50% flowering	64	87	72.31	27.95	27.89	99.56	41.45	57.33
3.	Days to maturity	97	123	103.86	27.64	27.62	99.89	59.08	56.87
4.	Number of tillers/plant	4.6	41.3	16.69	56.71	56.69	99.6	19.49	116.7
5.	Number of effective tillers/plant	0.40	36	8.85	92.16	91.87	99.38	16.70	188.6
6.	Number of spikelet/spike	15.4	25.2	20.28	29.21	29.19	99.86	12.18	60.09
7.	Spike length	9.2	16.11	11.97	30.01	29.97	99.68	7.37	61.63
8.	Spike density	1.21	2.4	1.59	30.59	30.46	99.12	0.99	62.47
9.	Number of grain/spike	1.0	67	27.38	93.59	93.57	99.96	52.77	192.72
10.	Number of sterile spikelet	0	24.8	9.72	103.82	103.80	99.96	20.78	213.79
11.	Number of fertile spikelet/spike	0.1	25.2	10.56	92.12	92.08	99.3	20.03	189.63
12.	Sterility percentage	0	100	43.62	102.40	102.38	99.97	91.99	210.8
13.	Fertility percentage	0	100	49.43	91.26	91.25	99.97	92.91	187.94
14.	Flag leaf length	25.2	41.2	29.65	29.22	29.21	99.96	17.34	60.17
15.	Flag leaf width	1.5	2.8	2.06	29.84	29.55	98.02	1.24	60.26
16	1000 grain weight	17.2	49.6	31.20	45.22	39.56	76.51	22.24	71.28
17.	Yield/plant	0.1	34.1	11.91	89.46	89.42	99.91	21.94	184.14

variation for a given traits. The success of improvement of particular traits depends on the relationship between the phenotype and genotype. This relationship is very well judged through heritability estimates. Classes of broad sense (%) heritability was classified high (>70%), medium (50-70%) and low (<50%), similarly genetic advance was also classified high (>35%), medium (25-35%) and low (<25%). The results from heritability indicated high for all most all the characters under study.Genetic advance is the mean genotypic value of the selected genotypes over the base population. Genetic advance in many populations would depend upon its genetic make up. High heritability alone does not ascertain any desirable gain from selection unless sufficient genetic advance attribute to additive gene action is percent. Since estimates of heritability in broad sense include contribution from additive as well as non-additive gene effect.

They were of limited importance. However, high heritability coupled with high genetic advances as percentage of mean are considered significant (Ramanujam and Trimalachar, 1974). High heritability coupled with genetic advance as percentage of mean were observed for many characters like number of tillers per plant, number of effective tiller per plant, number of grains per spike, spike length, number of sterile spikelet, number of fertile spikelets per spike, sterility percentage, fertility percentage and yield per plant. It indicated the presence of additive gene action for expression of these characters. The above finding for spike length was reported Randhawa *et al*. (1975) and for grain yield per plant was agreement with the finding of Yadav and Mishra (1993), Amin *et al*. (1996) and Mandal and Sarkar (1996). The highest phenotypic and genotypic coefficient variation were recorded for number of sterile spikelets per spike followed by sterility percentage, number of grain per spike, number of effective tillers, number of fertile spikelets per spike, fertility percentage, yield per plant and number of tiller per plant. While, it was recorded moderate for kernel weight, spike density, spike length, flag leaf width, number of spikelet per spike, days to flower initiation, days to maturity. The estimates of phenotypic and genotypic coefficient variation suggested that sufficient variation present in the material.

Table 3 : Analysis of variance for yield and its contributing traits in hybrid wheat.

Source of variation	Degree of freedom	Mean sum of square																
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}
Replication	(r-1) (2-1) =1	0.31	0.18	21.0	0.1	0.86	0.01	0.03	0.002	0.40	0.01	0.01	0.05	0.006	0.03	0.01	19.94	0.211
Treatment	(t-1) (130-1) =129	646.2	815.4	1647.7	179.1	132.78	70.16	25.7	0.47	1313.4	203.7	189.4	3990.4	4070.6	150.12	0.75	351.63	227.29
Error	(r-1) (t-1) =129	1.5	1.7	0.89	0.03	0.41	0.05	0.04	0.002	0.28	0.04	0.06	0.62	0.64	0.02	0.007	46.78	0.10
SE difference		1.2	1.3	0.94	0.18	0.64	0.22	0.20	0.04	0.53	0.21	0.25	0.79	0.80	0.17	0.08	6.83	0.31
CD at 5%		**2.4**	**2.6**	**1.8**	**0.37**	**1.27**	**0.44**	**0.40**	**0.08**	**1.06**	**0.41**	**0.51**	**1.5**	**1.5**	**0.33**	**0.17**	**13.53**	**0.62**
ECV %		**1.92**	**1.85**	**0.90**	**1.13**	**7.25**	**1.01**	**1.70**	**2.86**	**1.9**	**2.17**	**2.45**	**1.8**	**1.6**	**0.57**	**4.19**	**21.91**	**2.66**

X_1 = Days to flower initiation
X_2 = Days to 50% flowering
X_3 = Days to maturity
X_4 = No. of tillers/plant
X_5 = No. of effective tillers
X_6 = No. of spikelet/spike
X_7 = Spike length
X_8 = Spike density
X_9 = No. of grains/spike
X_{10} = No. of sterile spikelet/spike
X_{11} = No. of fertile spikelet/spike
X_{12} = Sterility percentage
X_{13} = Fertility percentage
X_{14} = Flag leaf percentage
X_{15} = Flag leaf width
X_{16} = 1000 grain weight
X_{17} = Yield/plant

References

Chaturvedi, B. K. and R. R. Gupta (1995). Selection parameters for some grain and quality attributes in spring wheat (*Triticum aestivum* L.). *Agric. Sci. Digest Karnal*, **15(4)** : 186-190.

Mehta, B., S. K. Sharma and O. P. Luthra (1997). Genetic architecture of harvest index and yield component characters in wheat. *Ann. Bio.* Ludhiana, **13(1)** : 37-40.

Moghaddam, M., B. Ehdaie and J. G. Waines (1997). Genetic variation and interrelationship of agronomic traits in land races of bread wheat from South Western Iran. *J. Genet. Bread*., **52(1)** : 73-81.

Randhawa, A. S., A. S. Minhas and Satnam Singh (1975). Genetic variability and correlation studies in bread wheat (*Triticum aestivum* L.). *J. Res. Punjab Agri. Univ.*, **12(3)** : 213-217.

Sharma, D. J. and R. K. Yadav (1995). Genetic variability and association of some yield components in winter x spring nursery wheat. *Advances Pl. Sci*., **8(1)** : 95-99.

Shukla, R. S., Y. Mishra and C. B. Singh (2000). Variability and association in bread wheat under rainfed condition. *Crop Res*. (Hissar), **19(3)** : 512-515.

Singh, S. K. and R. M. Singh (2001). Variability and character association among floral traits and yield in Bread wheat (*Triticum aestivum*). *Indian J. Plant Genet. Resour*., **14(2)** : 199-201.

Singh, S. K., D. Singh, R. Chatrath and B. Mishra (2008). Prospects of hybrid wheat research in India. *J. Wheat Res*., **2(1)** : 7-19.

Singh, S. P., P. B. Jha and D. N. Singh (2001). Genetic variability for polygenic traits in late sown wheat genotypes. *Ann. Agric. Res*., **22(1)** : 34-36.

Singh, S. P., P. B. Jha and D. N. Singh (2001). Genetic variability for polygenic traits in late sown wheat genotypes. *Ann. Agric. Res*., **22(1)** : 34-36.

Yadav, R. K. and P. K. Mishra (1993). Genetic analysis of wheat varieties for yield and its components under rainfed conditions. *Agric. Sci. Digest* (Karnal), **13(1)** : 6-8.