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Genetic Evaluation of New Developed CMS Based Wheat Hybrids for Agro- Morphological Traits

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Abstract

A study was carried out during Rabi 2016-17 to study the genetic variability, heritability and expected genetic advance for fifteen traits in 36 bread wheat hybrids. Wide range of variation for all the traits were recorded indicating the presence of adequate genetic variability in the material. Genetic coefficient of variation ranged from 4.21 (plant height) to 24.88 (harvest index). High values of heritability were observed for plant height (99.1), 1000 grain weight (99.8), biological yield/plant (99.8), chlorophyll content (99.2) and harvest index (99.2). The traits harvest index, grain yield / plant, number of ears per plant, number of tillers per plant, peduncle length, ear weight, 1000 grain weight, biological yield per plant, number of spikelets per spike showed high heritability and genetic coefficient of variation along with high genetic advance.

Keywords: Genetic advance, heritability, genetic variability

Introduction

Heritability is a parameter which is widely used in the establishment of breeding programs and formation of selection indexes. High genetic advance coupled with high heritability estimates offers the most effective condition for selection. The utility of heritability therefore increases when it is used to calculate genetic advance, which indicates the degree of gain in a character obtained under a particular selection pressure. Thus, genetic advance is yet another important selection parameter that aids breeder in a selection program[1]. Phenotypic and genotypic coefficients of variations, heritability and genetic advance have been used to assess the magnitude of variance in hybrid wheat genotypes. The present study is therefore, aimed at assessing genetic variation, broad sense heritability and expected genetic advance in recently developed bread wheat hybrids.

Materials and Methods

Experimental material consisted of 30 national pool CMS based wheat hybrids along with six checks received from Genetics Division, IARI, New Delhi under testing in CRP on hybrid wheat technology project. The trial was conducted under AICRP on Wheat, Department of Plant breeding and Genetics, JNKVV, Jabalpur during *Rabi* season, 2016-17. The experiment was conducted in three replications under randomized complete block design with six row of 6 m length and 20cm apart. The recommended agronomic practices were followed to raised the healthy plant. Five plants were randomly selected from each genotype per replication for recording the agronomic data and observations on days to heading and days to maturity were recorded on plot basis. The data obtained were subjected to the biometrical analysis that included analysis of variance, heritability, and genetic advance. Genotypic variance (σ^2g), phenotypic variance (σ^2p), genotypic

coefficient of variation (GCV %), phenotypic coefficient of variation (PCV %), broad sense heritability (h^2 (bs)%) and genetic advance in percent mean (GAPM) were estimated. The estimate of GCV and PCV were classified as low, medium and high and the heritability was categorized.

Results and Discussion

Highly significant mean squares due to genotypes for all the traits under study in thirty six wheat hybrids revealed the presence of enough genetic variability in the material under study (Table 1). This result implied that this population of wheat genotypes would respond positively to selection. The wide range of variation observed in all the characters offer scope of selection for development of desirable type of wheat hybrids. The presence of large amount of variability might be due to diverse source of material as well as environmental influence affecting the phenotypes[4, 6, 8, 9].

The results pertaining to mean, range, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense (h^2) and expected genetic advance as percent of mean (GAM) for all the characters studied are furnished in table 2. Variability is essential for wide adaptability and resistance to biotic and abiotic factors and hence, an insight into the magnitude of genetic variability present in a population is of paramount importance to a plant breeder for starting a judicious breeding programme.

The magnitude of genetic variability for days to heading was ranged from 58.67 to 75.67 days with the mean value of 66.45 days, plant height ranged from 92.10 to 108.57 with the mean value of 98.81, grain yield/plant ranged from 12.96 to 32.94g with a mean value of 23.89 and for thousand grain weight 36.72 to 65.40 g with the mean value of 46.48g. Variability of chlorophyll content ranged from 36.36 to 47.45 percent with the mean value of 42.02 percent and for canopy temperature value varied from 16.60 to 23.13 with the mean value of 20.03. Thus, these results indicate the presence of wide range of genetic variability in the material.

Table 1 Analysis of variance for morphological and physiological traits in CMS based wheat hybrids

Source	df	Mean Sums of Squares														
		DFF	DM	PH	PL	EL	EW	NTPP	NEPP	NSPE	TGW	BYPP	HI	GYPP	CC	CT
Replication	2	10.39	10.03	0.22	0.74	0.13	0.08	0.35	0.25	0.45	0.29	8.21	4.15	4.71	0.04	0.96
Treatment	35	59.14 **	159.65 **	52.14 **	22.76 **	1.77 **	1.13 **	4.53 **	4.57 **	9.46 **	143.12 **	152.63 **	437.44 **	77.04 **	26.40 **	8.51 **
Error	70	3.05	2.26	0.15	0.12	0.04	0.04	0.04	0.03	0.04	0.08	0.09	1.18	0.25	0.05	0.06
S.E		1.09	0.87	0.22	0.20	0.13	0.11	0.12	0.11	0.12	0.17	0.18	0.63	0.29	0.13	0.14
C.D 5%		2.85	2.45	0.63	0.56	0.36	0.33	0.33	0.32	0.32	0.48	0.51	1.77	0.82	0.36	0.40
C.D 1%		3.78	3.25	0.84	0.76	0.49	0.43	0.43	0.43	0.43	0.64	0.68	2.35	1.08	0.47	0.53

DFF- Days to 50 % flowering, DM- Days to Maturity, PH- Plant height, PL- Peduncle length, EL- Ear length, EW- Ear weight, NTPP- No. of tillers/plant, NEPP- No. of ears /plant, NSPE- No. of spikelets/ spike, TGW- 1000 grain weight, BYPP- Biological yield/plant, HI- Harvest Index (%),GYPP- Grain yield/plant, CC- Chlorophyll content, CT- Canopy temperature

Table 2 Genetic parameters for yield attributing traits in CMS based wheat hybrids

Traits	Mean	Range		Coefficient of variation		h^2(b) (%)	Genetic Advance	Genetic Advance as % of Mean
		Min.	Max.	GCV (%)	PCV (%)			
Days to 50 % flowering	66.45	58.67	75.67	6.50	7.02	86.00	8.26	12.43
Days to Maturity	115.65	102.33	129.67	6.26	6.39	95.9	14.61	12.63
Plant height	98.81	92.10	108.57	4.21	4.23	99.1	8.54	8.64
Peduncle length	15.56	9.20	20.63	17.64	17.79	98.4	5.61	36.06
Ear length	10.45	9.00	12.03	7.25	7.57	91.8	1.49	14.32
Ear weight	3.31	2.27	4.27	18.27	19.25	90.1	1.18	35.72
No. of tillers/plant	6.85	4.70	9.56	17.84	18.08	97.4	2.49	36.27
No. of ears /plant	6.56	4.46	9.33	18.73	18.97	97.4	2.50	38.08
No. of spikelets/ spike	15.99	12.93	19.16	11.08	11.16	98.6	3.62	22.66
1000 grain weight	46.48	36.72	65.40	14.85	14.87	99.8	14.21	30.57
Biological yield	50.11	37.27	63.25	14.23	14.24	99.8	14.67	29.28
Harvest Index (%)	48.46	24.76	82.79	24.88	24.98	99.2	24.74	51.05
Grain yield/plant	23.89	12.96	32.94	21.18	21.28	99.0	10.37	43.41
Chlorophyll content	42.02	37.36	47.45	7.05	7.07	99.4	6.09	14.49
Canopy temperature	20.03	16.60	23.13	8.38	8.47	97.9	3.42	17.08

In present investigation (table 2) the high estimates of genotypic co-efficient of variation were observed for harvest index (24.88%), grain yield/plant (21.28%), number of ears/plant (18.73%), ear weight (18.27%), number of tillers/plant (17.84 %) and peduncle length (17.64%) and moderate to low genotypic coefficient of variation for other traits. Similar results were also observed by many other investigators[2, 3, 5, 7].

The result of genotypic and phenotypic coefficient of variation revealed that harvest index and grain yield per plot exhibited highest genotypic and phenotypic coefficient of variation.

The lowest GCV and PCV were recorded for plant height (4.21 % and 4.23 %), days to maturity (6.26 % and 6.39%) and days to 50 % flowering (6.50 % and 7.02 %) respectively, indicating difficulty of improvement for these traits through selection (Table 2). The PCV values were higher than GCV values for all the traits which reflect the influence of environment in expression of traits.

All the traits viz. biological yield per plant and 1000 grain weight (99.8%), chlorophyll content (99.4%), harvest index (99.2%), plant height (99.1%), grain yield/plant (99.0%), number of spikelets per spike (98.6%), peduncle length (98.4%), canopy temperature (97.9%), number of effective tillers per plant and number of ears per plant (97.4%), days to maturity (95.9 %), ear length (91.8%), ear weight (90.1%) and days to 50% heading (86.0%) exhibited high heritabilty. It indicates that the heritability is most likely due to additive gene effect and selection may be effective.

High heritability accompanied with high genetic advance as percent of mean was exhibited by harvest index, grain yield per plant, number of ears per plant, number of effective tillers per plant, peduncle length, ear weight, 1000 grain weight, biological yield per plant, number of spikelets per spike and canopy

temperature. The high heritability coupled with moderate genetic advance was recorded for chlorophyll content, ear length, days to maturity and days to 50% flowering. Whereas, high heritability coupled with low genetic advance was observed for plant height. High heritability with high or moderate genetic advance indicated predominance of additive gene action for controlling these characters. Thus, simple selection can be practiced to improve these characters.

Harvest index (51.05%), grain yield per plant (43.41%), number of ears per plant (38.08%), number of effective tillers per plant (36.27%), peduncle length (36.06%),ear weight (35.72%), 1000 grain weight (30.57%), biological yield per plant (29.28%) and number of spikelets per spike (22.66%) showed high genetic advance, and the remaining characters canopy temperature (17.08%), chlorophyll content (14.49%), ear length (14.32%), days to maturity (12.63) and days to 50% flowering (12.43) showed moderate estimate of genetic advance as percent of mean[7].

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