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Short Communication

Study of genetic variability and heritability over extended dates of sowing in bread wheat (*Triticum aestivum* L.)

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The genetic variability and heritability of fourteen quantitative characters involving 20 cultivars of wheat were evaluated. All characters showed the considerable amount of variability in all three extended dates of sowing. High phenotypic and genotypic coefficient of variation was observed for grain yield per plant, grain yield per plot, productive tillers per m², grains per spike, Biological yield per plant, harvest index and moderate for plant height, flag leaf length, width and test weight. The high heritability coupled with high genetic advance was observed for the characters plant height, productive tillers, spike length and test weight in all three dates of sowing. Thus these traits could be used effectively for the improvement of high yielding varieties of wheat for early, timely and late sown conditions.

Key Words: Genetic Variability, Heritability, GCV, PCV, Wheat.

Wheat is an important cereal grain for export and domestic consumption in many countries throughout the world. Thus a continuous supply of wheat to exponentially increasing population is a major concern. The modern wheat breeding programmes focus on the improvement of agronomic and grain quality traits. The manipulation of wheat genetics has led to ever increasing gains in yield and grain quality, while decreasing the ability of wheat to survive in the wild or in varying climate especially with adverse conditions. The ultimate aim of any plant breeding programme is to develop cultivars with high potential and consistent performance over diverse environments. In self pollinated crops, the assessment of quantitative variable for genotypic variance, estimates of heritability and genetic advance of yield contributing characters are important for successful hybridization programme to evaluate new cultivars. But the changes in environmental factors often deflect the genotype performance for the economic characters. hence the parent study was initiated with the 20 germplasm collected from Govind Ballabh Pant University of Agriculture and Technology, Pantnagar to find out the extent of variability, heritability, genetic advance and environmental effect on them for fourteen quantitative characters.

Material and methods

The experiment was conducted in Randomized Block Design with three replications of three extended dates of sowing at 25 days interval *viz*., 3 Nov. 07 (Early sown as E_1), 28 Nov. 07, (Timely sown as E_2), 23 Dec.07 (late sown as E_3) during *Rabi* season of 2007-08 at the research farm of Genetics Plant Breeding Department, AAIDU, Allahabad. Twenty varieties of wheat *viz*., PBW 527, PBW 343, PBW 396, PBW 299, PBW 175, PBW 233, PBW 502, VL 804, VL 738, C

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306, UP 2382, UP 2113, UP 1109, UP 2572, UP 2554, UP 2338, UP 262, UP 2565, UP 2425 and WH 896 have been taken for the study in $4m^2$ plot size with 20 cm X 10 cm spacing between and within the rows, respectively. All the recommended agronomic cultural practices were followed. The study based on fourteen quantitative characters *viz*., days to heading, plant height (cm), number of productive tillers (m^{-2}), spike length (cm), flag leaf length (cm), flag leaf width (cm), flag leaf area (cm^2), days to maturity, number of grains per spike, biological yield/plant (q/ha), grain yield/plant (q/ha), harvest Index (%), test weight (gm) and grain yield per plot (q/ha).

The data was recorded on five randomly selected plants and subjected to analysis of variance as suggested by Panse and Sukhatme (1967), coefficient of variability as suggested by Burton (1952), Heritability estimates (Lush, 1949). Genetic Advance and Genetic Gain was calculated by the formula of Robinson, 1949.

Results and Discussion

The genetic variability and heritability of fourteen quantitative characters involving 20 cultivars of wheat were evaluated. All characters showed the considerable amount of variability in all three extended dates of sowing (Table 1). High level of genotypic variability was observed for the productive tillers, days to heading, days to maturity, plant height, flag leaf area and harvest index in 3 Nov. sown indicating the scope of selection for these characters among genotypes. The presence of large amount of variability is might be due to diverse source of material taken as well as the environment that influences the phenotypes.

Table 1. ANOVA for 14 quantitative in wheat genotype sown under three different dates of sowing

S. No	Source of variation		Replications			Treatments			Error		
	d.f.		2			19			38		
	Characters	Environments	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
1	Days to heading		10.06	42.02**	3.60*	127.74**	50.25**	22.28**	24.17	1.23	1.81
2	Days to maturity		25.31**	0.90	9.02**	188.22**	5.65**	14.96**	9.00	1.53	2.18
3	Plant height		50.46	0.34	6.89*	406.44**	313.07**	85.86**	60.17	3.61	3.55
4	Productive tillers per m^2		174.15	616.22**	67.6	5823.62**	1216.43**	2133.32**	794	138.27	180.02
5	Spike length		0.68	0.02	0.00	4.99**	4.18**	3.31**	1.56	0.09	0.08
6	Flag leaf length		2.26	4.23**	0.02	19.23**	22.89**	20.50**	5.18	1.30	0.32
7	Flag leaf width		0.01	0.01	0.01	0.07*	0.03*	0.02*	0.03	0.01	0.00
8	Flag leaf area		9.29	6.84	4.37	128.14**	103.35**	85.23**	14.15	6.79	3.91
9	Grains per spike		0.05	6.40	1.60	5.16**	70.24**	45.95**	50.27	5.61	9.07
10	Biological yield per plant		22.85	11.02**	0.22	60.11**	38.59**	32.67**	25.07	3.44	3.22
11	Grain yield per plant		3.04	1.02	0.05	17.80**	13.11**	6.71**	4.89	1.45	0.69
12	Harvest index		7.27	0.34	0.21	200**	102.51**	108.54**	65.32	3.47	3.81
13	Test weight		2.78	56.02**	0.01	70.27**	46.99**	69.06**	22.43	12.34	0.88
14	Grain yield per plot		0.08**	0.00	0.00	0.14**	0.15**	0.11**	0.03	0.01	0.00

*,** significant at 5% and 1% level, respectively.

The genotypic coefficients of variation (GCV) for all the characters studied were less than the phenotypic coefficients of variation (PCV). The high GCV and PCV were obtained for grain yield per plot, grain yield per plant and productive tillers per m^2. The difference between GCV and PCV were high for these traits in E_1, E_3 and least in E_2 indicating high amount of variation and role of the environment on the expression of these characters in E_1, E_3 environment (Table 2). While narrow difference in E_2 indicates less environmental effect due to favorable environment the maximum favoring genes for characters would have expressed thus corresponding to variation due to genetic

factors and revealing scope for direct selection or hybridization (Diwedi *et al.*, 2002). Moderate value of GCV and PCV was observed for flag leaf length, width, plant height and test weight. Though the gcv, measure to compare genetic variability, alone is not sufficient for determination of amount of heritable variability. The heritable portion of variation is thus required to be found out with the help of heritability estimates (Johanson *et al.*, 1955). The high heritability coupled with high genetic advance were observed for the characters productive tillers, spike length, test weight, plant height in all three dates of sowing followed by plant height, indicating the additive gene effect for all these characters (Table 3). Thus, selection may be effective for the improvement of wheat for early, timely and late sown conditions.

Table 2: Estimates of GCV, ECV and PCV for 14 quantitative in wheat genotype sown under three different dates of sowing

S.No.	Genetic parameters		GCV %			ECV %			PCV %		
	Characters	Environments	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
1	Days to heading		6.62	5.90	4.28	5.54	1.32	1.80	8.63	6.05	4.64
2	Days to maturity		5.83	1.18	2.34	2.26	1.01	1.37	6.25	1.55	2.71
3	Plant height		10.32	10.54	7.27	7.45	1.61	2.13	12.73	10.66	7.58
4	Productive tillers per m^2		18.51	8.72	15.81	12.73	4.41	6.78	22.47	9.77	17.20
5	Spike length		10.78	13.24	12.48	12.59	2.87	2.88	16.58	13.55	12.81
6	Flag leaf length		10.54	14.98	17.47	11.10	5.2	3.14	15.30	15.86	17.75
7	Flag leaf width		7.26	5.21	6.67	11.01	7.63	3.97	13.19	9.23	7.76
8	Flag leaf area		18.21	18.47	21.41	11.11	6.93	6.64	21.34	19.73	22.42
9	Grains per spike		18.06	12.06	10.26	15.33	5.02	7.19	23.69	13.07	12.53
10	Biological yield per plant		12.01	14.17	16.07	17.60	6.27	7.52	21.31	15.50	17.74
11	Grain yield per plant		15.96	18.66	17.92	17.01	9.32	8.58	23.33	20.86	19.87
12	Harvest index		14.41	16.06	17.67	1.38	4.24	4.77	22.57	16.57	18.31
13	Test weight		9.07	10.89	18.13	10.76	9.91	2.91	14.07	14.25	18.36
14	Grain yield per plot		11.90	17.04	23.89	12.31	8.58	7.12	17.13	19.08	24.93

Table 3: Estimates of Heritability, Genetic advance and Genetic gain for 14 quantitative in wheat genotype sown under three different dates of sowing

S.No.	Genetic parameters		Hertability %			Genetic advance			Genetic gain		
	Characters	Environments	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
1	Days to heading		58	95	85	11.89	12.75	7.78	13.40	15.2	10.41
2	Days to maturity		86	57	74	19.02	2.87	5.76	14.35	2.36	5.35
3	Plant height		65	97	92	22.99	32.46	16.24	22.09	27.5	18.43
4	Productive tillers per m^2		67	79	84	89.04	54.68	75.81	40.25	20.54	38.35
5	Spike length		42	95	94	1.83	3.68	2.26	18.51	34.17	32.12
6	Flag leaf length		47	89	96	3.93	8.19	8.25	19.61	37.38	45.39
7	Flag leaf width		30	31	73	0.17	0.13	0.24	10.56	7.75	15.12
8	Flag leaf area		72	87	92	13.89	17.17	16.07	41.04	45.65	54.00
9	Grains per spike		58	85	67	16.82	13.85	9.28	36.37	29.41	22.17
10	Biological yield per plant		31	83	82	5.08	10.11	9.17	17.87	43.21	38.43
11	Grain yield per plant		46	80	81	3.74	5.79	4.13	28.82	44.07	42.69
12	Harvest index		40	93	93	11.28	17.96	18.44	24.27	40.88	45.05
13	Test weight		41	58	97	6.79	8.39	15.21	15.43	21.98	47.25
14	Grain yield per plot		48	79	91	0.34	0.60	0.58	21.83	40.17	60.44

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