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GENETIC VARIABILITY AND CORRELATION STUDIES IN WHEAT (*Triticum aestivum* L)*

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Thirty wheat cultivars were evaluated during rabi seasion of 1998-99 under agro-climatic conditions of western Uttar Pradesh (India). Among the characters studied plant height, number of tillers plant^{-1}, ear length, 1000 grain weight and yield plant^{-1} exhibited higher values of variability. Flag leaf area showed moderate heritability value (65.6%) for better sink development. Grain yield was positively correlated with 1000-grain weight and harvest index. Numbers of grain ear^{-1} were found to be negatively correlated with 1000-grain weight, harvest index, and flag leaf area. While it was positively correlated with seed and straw yield, suggesting significant effect of number of grains ear^{-1} on grain yield of wheat.

Key words: Wheat, genetic variability, correlation

Wheat being a promising cereal crop possess second ranks after rice in India. The wheat production was substantially increased with the introduction of dwarf Mexican varieties from 1967 onwards but the production reported to be decreased after 1996-97. Hence, it needs immediate attention for grain yield improvement. Genetic improvement of economic character like yield through selection depends largely on the amount of genetic variability present in the population, heritability and genetic advance under selection. However, direct selection for a complex character like yield is not very effective. Therefore, knowledge of correlation among the characters and their direct and indirect effects on the complex character is required to construct suitable selection indices. The present investigation was therefore, carried out to estimate the amount of genetic variability, heritability and genetic advance for yield and its components, correlation among these characters and their analysis with seed yield in wheat cultivars.

MATERIALS AND METHODS

The experiment was laid out at the experimental farm of the Janta Vedic Post Graduate College, Baraut, Uttar Pradesh, during *rabi* season of 1998-99 to evaluate thirty cultivars of wheat. These cultivars were tested in randomized block design with three replications. Each treatment consisted of six lines with a row length of 4 meters. The distance between rows was 22.5 cm and within row 2.5 cm, the crop was fertilized by 100 kg N, 40 kg P2O5 and 40 kg K/ha. At harvest growth and yield data were recorded and was subjected to further analysis for correlation and other variances as per standard procedure.

RESULTS AND DISCUSSION

Estimates of variability, heritability and genetic advance for yield and its component characters are presented in Table 1. Among the characters studied, plant height, length of ear, number of grains per ear, 1000 grain weight and seed yield exhibited wide range of variability.

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Phenotypic and genotypic coefficient of variations for number of tillers per plant, number of ears per plant, plant height, 1000 grain weight and flag leaf area were higher as compared to other characters, namely germination count, ear length, number of spikelets per ear and harvest index. For straw yield, numbers of grains per ear and grain yield per m^2, the coefficient phenotypic and genotypic variance were high suggesting effectiveness of phenotypic and genotypic selection. Paroda and Joshi (1970) reported that number of ears per plant, grains per ear and grain weight were the major yield component.

Higher heritability of 82.5 per cent was recorded for harvest index, followed by plant height (78.7%), number of spikelets per ear (73.9%) and 1000 grain weight (72.6%), the characters like flag leaf area, grain yield, ear length, number of grains per ear and grain yield had heritability of medium range 55.9 to 65.6 per cent. This indicates the pre-dominance of additive gene action and thus selection for these characters would be effective. However, characters viz., tillers per plant, ears per plant and germination count showed low heritability of the expression. These traits are mainly governed by several environmental and agronomic factors like soil fertility, moisture and temperature. Major change in trend was found in case of harvest index, where the heritability was higher i.e., 82.5 per cent, while genetic advance was only 4.26 per cent. High heritability coupled with low genetic advance for harvest index suggested that high heritability is due to favourable environment influence rather then genotypic effects (Singh *et al.*, 1997). In case of straw and grain yield, the heritability was of medium order but genetic advance for these traits was 74.01 and 48.05 respectively. Highly significant positive correlation of germination count was found with harvest index and grain yield but strongly and negatively correlated with tiller number, ears per plant and ear length. However, 1000 grain weight, flag leaf area and straw yield were negatively correlated with low magnitude, while positive correlation was observed with grain yield and harvest index. Tillers per plants were positively correlated with number of ears per plant, ear length and straw yield. It was negatively correlated with plant height, number of grains per ear, 1000 grain weight, harvest index, flag leaf area and grain yield. Plant height was positively correlated with

Table 1. Estimates of variability, heritability and genetic advance for seed yield and its components in wheat

Character	Range	Mean SE	CV%	GCV	PCV	h2b	GA
Germination per meter	31.00-40.00	37.66±2.03	6.61	4.56	8.03	32.3	2.01
Tillers per plant	1.74-3.03	2.32±0.20	10.57	9.58	14.26	45.1	0.31
Ears per plant	1.55-2.56	2.00±0.20	12.22	10.68	16.23	45.3	0.29
Plant height (cm)	54.80-80.77	71.72±2.81	4.80	9.24	10.41	78.7	12.11
Length of ear (cm)	9.60-12.93	11.51±0.42	4.52	5.71	7.28	61.5	1.06
No. of spikelets per ear	15.27-20.70	17.92±0.61	4.21	7.08	8.24	73.9	2.25
No. of grains per ear	41.47-62.47	53.19±3.12	7.20	8.84	11.41	60.1	7.51
1000 grain weight (g)	26.17-46.47	33.34±2.07	7.59	12.36	14.51	72.6	7.23
Harvest index (%)	33.40-43.80	40.73±0.86	2.57	5.59	6.15	82.5	4.26
Flag leaf area (cm)	20.40-33.27	26.50±2.03	9.39	12.98	16.02	65.6	5.74
Grain yield (gm^{-2})	333.33-468.00	412.09±19.04	5.66	7.20	9.16	61.8	48.05
Straw yield (gm^{-2})	487.33-693.33	600.48±34.82	7.10	8.00	10.70	55.9	74.01

ear length, number of spikelets, number of grains per ear, 1000 grain weight, flag leaf area, grain yield and straw yield, but negatively correlated with harvest index, there by suggesting that improvement of any of these characters may simultaneously improve the other except harvest index. 1000 grain weight was positively correlated with harvest index, flag leaf area, grain yield significantly and was positive with straw yield. Harvest index was significantly and positively correlated with grain yield and positively correlated with low magnitude flag leaf area, but negatively correlated with straw yield. Flag leaf area was positively correlated with higher magnitude in both grain and straw yield and similarly grain yield also positively correlated with straw yield.

The phenotypic correlation with germination count was negatively correlated with number of tillers, ears per plant, length of ear, 1000 grain weight and straw yield. (Table 2). However, for rest of the characters i.e., number of spikelets per ear, number of grains per ear, harvest index, flag leaf area and grain yield was positive with low magnitude. Tillers per plant was positively and significantly correlated with number of ears per plant. The positive correlation was also with length of ear, number of spikelets per ear and straw yield was favourable. Number of ears per plant was negatively correlated with plant height, number of spikelets per ear, number of grains per ear, 1000 grain weight, harvest index, flag leaf area and grain yield. Plant height was positively correlated with most of characters.

Table 2. Genotypic (G) and Phenotypic (P) correlation coefficient of seed yield and its components in wheat

Character	Tillers/ plant	Ears/ palnt	Plant height (cm)	Length of ear (cm)	No.of spikelets/ear	No.of grains/ ear	1000 grain weight (g)	Harvest index (%)	Flag leaf area (cm^2)	Grain yield/ (gm^{-2})	Straw yield (gm^{-2})
Germina-	G-0.563**	-.0658**	0.014	-0.319	0.086	0.030	-0.0212	0.149	-0.078	0.181	-0.012
tion/metre	P-0.269	-.0354	0.000	-0.084	0.068	0.034	-0.073	0.080	0.060	0.074	-0.045
Tillers/plant	G	0.698**	-0.188	0.157	0.044	-0.324	-0.317	-0.415*	-0.218	-0.406*	0.133
	P	0.677**	-0.120	0.119	0.032	-0.086	-0.195	-0.256	-0.158	-0.200	0.091
Ears/plant	G		-0.350.	-0.038	-0.248	-0.669**	-0.155	-0.334	-0.006	-0.345	0.073
	P		-0.219	0.075	-0.145	-0.291	-0.137	-0.261	-0.084	-0.137	0.176
Plant height	G			0.615**	0.313	0.349	0.326	-0.308	0.312	0.342	0.624**
(cm)	P			0.456*	0.290	0.225	0.246	-0.292	0.198	0.274	0.514**
Length of	G				0.261	0.238	0.145	-0.372*	0.245	0.150	0.575**
ear (cm)	P				0.358	0.301	0.062	-0.320	0.218	0.192	0.426*
No.of	G					0.839**	-0.426*	-0.695**	-0.218	-0.317	0.506**
spikelets/ear	P					0.664**	-0.315	-0.541**	-0.137	-0.139	0.352
No.of	G						-0.404*	-0.370*	-0.271	-0.315	0.134
grains/ear	P						-0.338	-0.277	-0.165	-0.107	0.150
1000 grain	G							0.442*	0.524**	0.699**	0.101
weight (g)	P							0.383*	0.346	0.446*	0.020
Harvest	G								0.140	0.494**	-0.680**
index (%)	P								0.074	0.377*	-0613**
Flag leaf	G									0.526**	0.315
area (cm^2)	P									0.344	0.198
Grain yield	G										0.337
(gm^{-2})	P										0.449*

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

Similarly ear length was positively correlated with rest of the characters except harvest index. Its association with number of spikelets, number of grains per ear, flag leaf area, both grain and straw yield were most important. 1000 grain weight was positively correlated with harvest index, flag leaf area, grain yield, their correlations were significant. However, low positive correlation of 1000 grain weight with straw yield was also important as this character can help in grain yield without hampering straw yield. These results are in agreement with those of (Singh *et al.*, 1979).

Germination count was negatively correlated with tillers per plant, number of ears per plant, plant height, grain and straw yield. But positively correlated with ear length, number of spikelets per ear, number of grains per ear, 1000 grain weight, harvest index and flag leaf area though most of these correlations were of very low magnitude (non significant) except with flag leaf area. Number of tillers per plant were significantly and positively correlated with number of ears per but positive correlation was found with length of ear, number of spikelets, number of grains per ear, flag leaf area, grain and straw yield. Their negative correlations were found with plant height, 1000 grain weight and harvest index.

Plant height was positively correlated with ear length, number of spikelets per ear, grain and straw yield, but had negative association with number of grains per ear, 1000 grain weight, harvest index and flag leaf area. Harvest index was strongly and negatively correlated with straw yield and flag leaf area, but positively correlated with grain yield further suggested the limitation of increasing straw yield without reduction in harvest index. Flag leaf area was positively correlated with grain and straw yield. Grain yield had strong positive correlation with straw yield at environmental level.

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