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Estimation of Genetic Variability, Character Association and Path Analysis of Yield and Yield Component Traits in Bread Wheat under Normal and Late Sown Environments

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Abstract

The analysis of variance involving 40 genotypes was done for seven characters. Variances due to genotype were highly significant for all the traits in both environments. Genotypic coefficients of variation were lower than the phenotypic coefficients of variation. GCV and PCV were highest for grain yield in both normal and late condition. Significant and positive correlations for grain yield with effective tillers per plant, biological yield and harvest index were observed in E_1 and E_2. Number of grains showed highly significant and positive correlation with grain weight. The path coefficient analysis suggested the importance of biological yield is the main contributor to grain yield.

Key words : Correlation, Genetic variability, Biological yield, Environments, *Triticum aestivum*.

Wheat (*Triticum aestivum* L.) is one of the important staple food crops which is consumed in a variety of ways and is cultivated throughout the world. Wheat crops offer sizeable opportunities of a quantum jump by accelerating its yield potential through genetic manipulation. These grains can be realized by utilizing vast and enormous magnitude of genetic variability available in the crop, for which no efforts should be spread. The genotypic, phenotypic and environmental coefficients of variation are helpful in exposing and understanding the clear picture of existing variability in the population. Whereas, the estimates of heritability and genetic advance provided the index to transmissibility of characters. Thus estimates of direct selection parameters are useful for laying foundation of suitable selection strategy for high yield in a wheat crop. Yield is the result of interaction of several metric traits and is highly influenced by environmental changes of the various component characters, a few of which may be positively associated with yield, often prove to be useful in selection. For efficient breeding program, it is desirable to know the nature of association of yield with its component characters under different environmental conditions (Khan and Shaik 1999). While path coefficients analysis provides an effective means for analyzing forces, which have substantial effect in producing a given correlation by partitioning it into direct effects.

Methods

The study was taken up on 40 genotypes of

Table 1. Mean, range, coefficient of variation for seven character of bread wheat.

Characters	Mean ± SE		Range		GCV		PCV	
	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2
Effective tillers/plant	11.3 ± 0.84	9.6 ± 0.77	7.3 – 15.3	7.0 – 12.3	16.15	12.75	18.53	16.16
Biological yield/plant (g)	55.2 ± 1.86	30.90±1.09	41.4 – 81.9	21.0 – 52.7	16.91	22.78	17.41	23.19
Grain yield/plant (g)	22.3 ± 0.95	10.89 ± 0.87	11.8 – 38.0	5.9 –18.0	21.53	23.17	22.15	25.30
Harvest index (%)	04.06 ± 1.92	35.1 ± 2.68	28.5 – 52.3	26.0 – 44.2	14.04	10.86	15.20	14.35
No. of grains / ear	68.3 ± 0.91	60.5 ± 1.47	50.7 – 86.0	40.0 – 76.3	14.24	16.50	14.33	16.77
Grain weight / ear (g)	2.88 ± 0.37	2.11 ± 0.21	1.98 – 3.58	1.53 – 2.63	8.81	12.94	18.31	17.89
1000-grain weight (g)	43.6 ± 1.80	36.7 ± 0.76	35.1 – 56.6	27.9 – 48.9	10.53	11.17	11.61	11.46

Table 2. Phenotypic correlation coefficient among 40 genotypes of bread wheat in normal (E_1) and late soon condition E_2 (parentheses). *Significant at 5%, **Significant at 1%.

Characters	Effective tillers/ plant	Biological yield/plant (g)	E_1 Grain yield/plant (g)	Harvest index (%)	No. of grains/ ear	Grain weight/ear (g)	1000-grain weight (g)
Effective tillers/plant		0.580** (0.447**)	0.485** (0.396**)	0.009 (0.001)	–0.137 (–0.172)	0.117 (–0.252)	0.293 (–0.141)
Biological yield/plant (g)			0.862** (0.810)	–0.052 (–0.126)	0.141 (–0.152)	0.239 (0.197)	0.184 (0.094)
Grain yield/plant (g)				0.623** (0.511**)	0.072 (0.185)	0.225 (0.297)	0.126 (0.233)
Harvest index (%)					–0.081 (0.101)	0.045 (0.206)	–0.019 (0.231)
No. of grains/ear						0.508** (0.659**)	–0.366* (–0.439*)
Grain weight per ear (g)							0.098 (0.143)
1000-grain weight (g)							

bread wheat under two dates of sowing as normal and late environment (E_1 and E_2) during *rabi* season. All the genotypes were grown in randomized block design with three replications. Data were recorded from seven characters. Coefficient of variation, correlation and path coefficient were estimated according to the formula suggested by Burton (1952), Al-Jibouri et al. (1958) and Dewey and Lu (1959), respectively.

Results and Discussion

The estimates of genotypic and phenotypic coefficients of variation for all the characters under normal and late shown conditions are presented in Table 1. Phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV). PCV were highest for grain yield (22.2) and (25.3) in normal and late environment, respectively. GCV was highest for grain yield followed by biological yield under both environments. The occurrence of high variability for grain yield and biological yield were also reported by Jag Shoron (1995), and for grains per ear were reported by Sethi et al. (1992) and Khan and Shaik (1999).

Correlation studies were carried out to find the association at phenotypic levels between different quantitative characters contributing to grain yield in both the environments. The results are presented in Table 2. Grain yield showed highly significant and positive correlation with harvest index in both the environments. Number of grain per ear showed highly significant and association with grain weight per ear in both the environments (0.508 and 0.659), respectively. It showed significant and negative correlation with 1,000-grain weight under normal (–0.366) and late (–0.439) conditions. Grain weight per ear showed positive correlation with 1,000-grain weight. Positive association of grain yield with grain weight per ear and harvest index was also reported by Budak and Yilderin (1995), and Choudhary and Mandal (1991). Jadhav (1994) also reported that there was positive and highly significant association between grain yield and biological yield.

Path-coefficient analysis was carried out to know direct and indirect effect taking grain yield as a resultant variable and rest of the characters as causal variables. For this the correlations at genotypic level were taken into consideration. The results are presented in Table 3.

Direct Effects

The path-coefficient analysis in which diagonal values are direct effects revealed that biological yield had highest positive effect in both the environment having values of 0.774 and 0.956, respectively, followed by harvest index (0.625 and 0.430) under normal and late environments respectively.

Indirect Effects

Regarding indirect effect, the effective tiller per

Table 3. Direct (diagonal) and indirect effects of component trait on grain yield per plant of wheat in $E_1$and E_2 (parentheses) environment. Residual = 0.00813; (0.00767). *, ** Significant at 5% and 1%, respectively.

Characters	Effecttive tillers/plant	Biological yield/plant (g)	Harvest index (%)	No. of grains/ear	Grain weight/ear (g)	1000-grain weight (g)	*r* with yield/plant
Effective tillers/plant	-0.001	0.451	0.035	0.001	0.005	-0.000	0.491**
	(0.042)	(0.519)	(-0.067)	(-0.018)	(0.015)	(-0.008)	(0.483**)
Biological yield/plant (g)	-0.000	0.774	-0.007	-0.001	0.013	-0.000	0.773**
	(0.023)	(0.956)	(-0.057)	(0.012)	(-0.008)	(0.005)	(0.931**)
Harvest Index (%)	-0.000	-0.009	0.625	0.000	-0.000	0.000	0.616**
	(-0.006)	(-0.127)	(0.430)	(0.011)	(-0.009)	(0.018)	(0.317*)
No. of grains/ear	+0.000	0.112	-0.052	-0.007	0.26	0.000	0.079
	(0.099)	(0.148)	(0.059)	(0.081)	(-0.028)	(-0.024)	(0.137)
Grain weight/ear (g)	-0.000	0.424	-0.000	-0.008	0.023	0.000	0.439**
	(-0.019)	(0.258)	(0.119)	(0.069)	(-0.032)	(0.006)	(0.401*)
1000-grain weight (g)	-0.000	0.125	-0.020	0.004	-0.002	-0.000	0.107
	(-0.007)	(0.097)	(0.152)	(-0.037)	(0.004)	(0.053)	(0.254)

plant (0.451) had contributed toward grain yield mainly via biological yield under both the environments. Biological yield contributed to the grain yield mainly through its direct effect. Similar results for one or more characters were noticed by Singh and Sharma (1994), Jag Shoron (1995) and Moghaddam et al. (1998).

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