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CORRELATION AND PATH-COEFFICIENT OF STRESS RELATED TRAITS IN SPRING WHEAT

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Fifteen wheat varieties/lines were sown under greenhouse and in normal field conditions. Phenotypic and genotypic correlations among the seedling traits, some mature plant attributes, protein contents and grain yield plant^{-1} were estimated. Direct and indirect effects of these traits on grain yield were determined through path-coefficient analysis. Survival rate, total leaf area and leaf area index had positive but non-significant genotypic as well as phenotypic correlation with grain yield whereas epidermal cell size, flag leaf area and protein contents had negative but non-significant correlation with yield. Path-coefficient determined that leaf area index and epidermal cell size are the characters which contribute largely to grain yield.

INTRODUCTION

Wheat *(Triticum aestivum* L.) is an important rabi food crop. Its area and production is adversely affected by drought hazards, especially in barani areas of the Punjab province. So there is great need to develop varieties which can tolerate such situations. The present study was conducted under both drought and normal conditions to evaluate cultivars to withstand severe agroclimatic conditions.

Alam (1965) showed that drought tolerant varieties of wheat had the smallest leaf area. Singh *et al.* (1979) using the path-analysis in 18 varieties revealed that flag leaf area had a positive indirect effect on yield through 1000-grain weight. Talwar and Chandrappa (1983) worked out the correlation coefficient between flag leaf area and tillers plant^{-1}, grains spike^{-1}, grain weight and grain yield. Genotypic correlation suggested an inherent association between these characters. Sarivastava *et al.* (1988) using correlation and path-analysis indicated that yields of 19 cultivars and 48 hybrids were positively and significantly correlated with flag leaf area.

MATERIALS AND METHODS

The experiment was conducted in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. Experimental material comprised 15 wheat varieties/lines viz., DSN-9, DSN-16, DSN-24, DSN-75, DSN-82, HTN-1, HTN-6, HTN-7, HTN-9, HTN-27, HTN-31, HTN-35, LU26S and 5039. Seeds were sown in 23 x 8 cm perforated polythene bags. River sand was thoroughly sieved and washed free of salt and nutrient, using distilled water for the final washing. The sand was dried in a drying cabinet at 50°C for 36 hours, analysed for moisture contents and filled in labelled polythene bags @ 1 pound sand bag^{-1}. One seed was planted in each bag and was irrigated with Hoagland's solution. Twenty bags were used for each genotype. Ten bags with equally vigorous seedlings at three-leaf stage were selected from each genotype. Soil moisture was replenished to the desired

Table 1. Genotypic (G) and phenotypic (P) correlation coefficients of various drought related characters in wheat

		Root-shoot ratio	Coleoptile length	Epidermal cell size	Flag leaf area	Total leaf area	Leaf area index	Protein content	Grain yield plant^{-1}
Survival rate	P	-0.11	-0.35	-0.06	0.05	0.27	0.29	-0.10	0.16
	G	-0.42	-0.40	-0.10	0.09	0.28	0.03	-0.11	0.27
Root-shoot ratio	P		0.39	0.43*	-0.22	-0.28	-0.29	0.05	-0.71**
	G		0.27	0.44*	-0.23	-0.29	-0.30	0.06	-0.92**
Coleoptile length	P			0.20	-0.32	0.07	0.08	-0.05	-0.42*
	G			0.20	-0.33	0.08	0.08	-0.05	-0.56*
Epidermal cell size	P				0.09	0.36	0.35	0.14	-0.09
	G				0.09	0.36	0.37	0.17	-0.12
Flag leaf area	P					0.68**	0.71**	-0.33	-0.01
	G					0.71**	0.75**	-0.39	-0.03
Total leaf area	P						0.99**	-0.21	0.08
	G						1.00**	-0.25	0.12
Leaf area index	P							-0.22	0.08
	G							-0.26	0.12
Protein content	P								-0.10
	G								-0.27

level by weighing the individual bag, restoring the deficit if any by adding water. The bags were placed in drought chamber at 40°C with 65% relative humidity up to 50% mortality. After the treatments were over, the bags were taken out of chamber and irrigated with nutrient solution regularly for 7 days to record survival rate on genotype basis. Same genotypes were tested under normal field conditions in experimental area of the Department of Plant Breeding and Genetics using triplicated randomised complete block design with 22 and 15 cm distance between rows and plants, respectively.

Data were recorded on the seedling and mature plant attributes and subjected to variance and cross product analysis. Phenotypic and genotypic correlation coefficients between all the traits were computed according to Kwon and Torrie (1964). Standard errors of genotypic correlation coefficients were calculated by using the method of Reeve (1955). Direct and indirect path-coefficients were calculated according to Dewey and Lu (1960).

Table 2. Direct (diagonal) and indirect effects of various stress-related traits on grain yield in wheat

Character	Survival rate	Root-shoot ratio	Coleoptile length	Epidermal cell size	Flag leaf area	Total leaf area	Leaf area index	Protein content
Survival rate	-0.14	0.44	0.42	-0.06	-0.14	-0.41	0.05	0.08
Root-shoot ratio	0.06	-1.06	-0.27	0.26	0.34	0.40	-0.60	-0.05
Coleoptile length	0.05	-0.29	-1.05	0.12	0.50	-0.10	0.17	0.04
Epidermal cell size	0.01	-0.47	-0.21	0.60	-0.14	-0.52	0.74	-0.13
Flag leaf area	-0.01	0.24	0.35	0.05	-1.15	-1.02	1.52	0.30
Total leaf area	-0.04	0.30	-0.08	0.21	-1.07	-1.44	2.03	0.19
Leaf area index	-0.03	0.31	-0.09	0.23	-1.13	-1.44	2.03	0.29
Protein content	0.01	-0.06	0.06	0.10	0.58	0.36	-0.54	-0.78

RESULTS AND DISCUSSION

In most of the cases, the genotypic correlation coefficients were higher than their respective phenotypic ones. It indicates a greater contribution of the genetic factors in association development. The observations (Table 1) suggested that in most cases, sign of phenotypic correlation coefficient was same as was of genetic correlation coefficient.

Survival rate was positively correlated with all the other traits except total leaf area, flag leaf area and epidermal cell size (Table 2). Path-coefficient analysis for root-shoot ratio indicated high and negative direct effect on grain yield. Association between root-shoot ratio and grain yield was also negative. Correlation between coleoptile length and grain yield was negative and also had high negative direct effect on grain yield. Epidermal cell size had negative relationship with all the other traits except for survival rate and leaf area index and direct effect was also negative. The results are in accordance with the earlier findings of Nasser (1989).

Flag leaf area had positive association

with all the other traits except for survival rate and total leaf area which were negatively associated with grain yield. The direct effect of flag leaf area on grain yield was also negative. These findings are in contradiction with those of Akhtar (1989). Total leaf area was associated both positively and negatively with other traits and had high negative direct effect on grain yield. Similar findings were also reported by Sarivastava *et al.* (1988) who found that yield was positively and significantly correlated with flag leaf area. Leaf area index was positively associated with grain yield and also had positive high direct effect on yield. This trait deserves attention for sustained improvement. Nasser (1989) also observed similar results in wheat crop.

Protein contents had negative association with grain yield plant^{-1} and mostly positively correlated with other traits and had a direct high negative effect on grain yield. Nasser (1989) also observed similar results in wheat crop.

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