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CORRELATION OF POST EMERGENCE CHARACTERS WITH YIELD IN BREAD WHEAT

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Ten wheat varieties/lines were sown under normal field conditions. Phenotypic and genotypic correlations among the protein and carbohydrate contents and grain yield per plant were estimated. Direct and indirect effects of these traits on grain yield were determined through path coefficient analysis. Days to anthesis, time of pollination, number of grains per spike and 1000-grain weight had positive and significant genotypic as well as phenotypic correlations with grain yield whereas pollen viability had positive but non-significant correlation with yield. Association between protein contents and grain yield was negative and non-significant. Path coefficient determined that flag leaf area, number of grains per spike and number of spikelets per spike are the characters which contribute largely to grain yield.

INTRODUCTION

There has been a phenomenal increase in wheat production during the last two decades. Yield is a complex character dependent on the interaction of growth, environment and the final productivity of the plant. Correlation analysis provides information about the type and extent of association among yield and other important morpho-physiological traits. Path-coefficient analysis (Dewey and Lu, 1960) provides means not only to quantify the interrelationship of different yield components but also indicates whether the influence is directly reflected in yield or takes some other pathway for ultimate effect.

Aziz *et al.* (1960) studied the morphology, germination viability and size of pollen in nine tetraploids, three hexaploids and six interspecific crosses and found that pollen grains were spherical or ovoid, uniform in all species and finely granular with no furrow or configuration. They found great variation in pollen size, the largest in *Triticum vulgare* and the smallest in *Triticum persicum*. Aksel and Johnson (1961) observed in barley that long vegetative period (planting to heading) often resulted in high grain yield. Jain and Singh (1975) found 1000-grain weight to be significantly and positively correlated with yield. Bhutta *et al.* (1980) and Munns and Weir (1981) reported different types of positive and negative correlations of different characters with yield.

MATERIALS AND METHODS

The experimental material comprising ten wheat varieties/strains viz. LU 26S, 4072, Pak 81, 5039, Faisalabad 83, Chakwal 86, Rawal 87, Kohinoor 83, Barani 83 and Chenab 79 was space planted in the experimental area of Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during crop season 1990-91. The experiment was conducted in a randomized complete block design with three replications under normal irrigated conditions. Distance between row to row and plant to plant was kept 30 and 15 cm, respectively. Five rows each of five metres

Table 1. Phenotypic (P) and genotypic (G) correlation coefficients for various post-emergence traits

		Days to anthesis	Pollen viability	Time of pollination	Number of grains per spike	Number of spikelets per spike	Flag leaf area	1000-grain weight	Protein content	Carbohydrate content
Grain yield per plant	P	0.710**	0.121	0.487**	0.833**	0.626**	0.423**	0.787**	-0.322	0.081
	G	0.830	0.151	0.501	1.007	0.687	0.614	0.917	-0.405	0.155
Days to anthesis	P		-0.129	0.370*	0.953**	0.487**	0.293	0.435**	0.343	0.390*
	G		-0.137	0.402	1.060	0.528	0.338	0.473	0.420	0.465
Pollen viability	P			0.433~	0.033	-0.049	-0.536**	0.454**	0.210	0.405*
	G			0.555	0.033	-0.180	-0.753	0.674	0.180	0.684
Time of pollination	P				0.478**	0.020	-0.121	0.562**	0.581**	0.012
	G				0.587	0.004	-0.207	0.658	0.804	0.105
Number of grains per spike	P					0.504**	0.314	0.458	0.408	0.405*
	G					0.615	0.413	0.517	0.507	0.377
Number of spike-lets per spike	P						0.094	0.508**	0.257	0.458**
	G						0.146	0.645	0.378	0.517
Flag leaf area	P							0.041	-0.274	-0.366*
	G							-0.090	-0.450	-0.607
1000-grains weight	P								0.309	0.012
	G								0.438	-0.023
Protein content	P									0.364*
	G									0.409

*, ** = Significant and highly significant at 0.05 and 0.01 probability levels, respectively.

length served as an experimental plot. Central area of 1 x 1 m from each plot was marked to study the parameters on area basis and ten guarded plants from this marked area were tagged to study the different post emergence traits, i.e. days to anthesis, pollen viability, time of pollination, number of grains per spike, number of spikelets per spike, flag leaf area, 1000-grain weight, protein contents, carbohydrates and grain yield per plant on individual plant basis.

The analysis of variance and covariance for all the characters were performed using the method of Steel and Torrie (1980). Genotypic and phenotypic coefficients were worked out according to the method given by Kwon and Torrie (1964).

RESULTS AND DISCUSSION

In most of the cases, the genotypic correlation coefficients were higher than their respective phenotypic ones (Table 1). It indicates a greater contribution of the genetic factors in association development.

Correlation studies showed that time of pollination had positive phenotypic and genotypic correlations with number of grains per spike, 1000-grain weight and protein contents. Days to anthesis and time of pollination were positively and strongly correlated with grain yield. These results are in agreement with earlier findings reported by Bruckner and Frohberg (1987). Association between protein contents, 1000-grain weight and grain yield was also negative. A positive and highly significant phenotypic correlation was observed between grain yield per plant and number of spikelets per spike while at genotypic level, it was non-significant. Sinha and Sharma (1980) also found positive correlations between number of spikelets per spike and grain yield per plant.

Positive genotypic and phenotypic correlations were observed between grain yield,

Table 2. Direct (diagonal) and indirect effect of various post-emergence traits on grain yield in wheat

Character	Days to anthesis	Pollen viability	Time of pollination	Number of grains per spike	Number of spikelets per spike	Flag leaf area	Protein	Carbohydrate	1000-grain weight
Days to anthesis	-1.011	0.139	-0.407	-1.078	-0.534	-0.342	-0.425	-0.470	-0.479
Pollen viability	-0.092	0.673	0.374	0.022	-0.121	-0.507	0.121	0.461	0.453
Time of pollination	0.227	0.306	0.551	0.317	0.588	-0.114	0.443	0.058	0.362
Number of grains per spike	1.017	0.031	0.551	0.953	0.165	0.392	0.484	0.360	0.530
Number of spikelets per spike	0.382	-0.131	-0.003	0.448	0.726	0.106	0.468	0.274	0.376
Flag leaf area	0.381	-0.849	-0.234	0.466	-0.116	1.127	-0.507	-0.684	-0.033
Protein contents	-0.075	-0.032	-0.145	-0.091	0.085	0.081	-0.180	-0.073	-0.079
Carbohydrate contents	0.104	0.154	0.024	0.085	-0.108	-0.136	0.092	0.225	-0.005
1000-grain weight	-0.098	-0.140	-0.216	-0.115	0.002	0.006	-0.091	0.004	-0.208

pollen viability and carbohydrate contents. The pattern thus indicates that selections for pollen viability and carbohydrate contents are likely to improve yield. Similar observations have earlier been reported by Sapra and Hughes (1974).

The association between protein contents and carbohydrate contents was positive and significant at phenotypic level and at genotypic level it was also high and positive. The results thus suggest that an increase in protein contents will possibly result in an increase of carbohydrate contents. Singhal *et al.* (1989) have also reported similar observations.

Path-coefficient analysis indicated that flag leaf area had maximum positive direct effect on grain yield followed by number of grains per spike, number of spikelets per spike, pollen viability, time of pollination and carbohydrate contents. It was, therefore, concluded that these characters are the important components that contribute largely to grain yield directly.

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