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Correlation and Path Coefficient Analyses in Bread Wheat

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ABSTRACT

Correlation and path-coefficient were computed between plant height, flag leaf area, peduncle length, number of tillers per plant, spike length, number of spikelets per spike, spike density, number of grains per spike, 1000-grain weight and grain yield per plant in five wheat varieties and their 20 hybrids. The phenotypic correlation between yield and plant height, tillers per plant, spike length, spikelets per spike and 1000-grain weight while positive and significant genotypic correlation was significant between these characters and grain yield per plant. Among these characters, spike length reflected the highest direct effect of (4.43) towards grain yield; while minimum direct effect was indicated by spikelets per spike (-4.22). Plant height, spike length, spike density, tillers per plant, peduncle length and grains per spike alongwith their indirect causal factors should be considered simultaneously as an effective selection criteria evolving high yielding cultivar because of their direct positive contribution to grain yield.

Key Words: Correlation; Path coefficient; Bread wheat

INTRODUCTION

Grain yield in wheat is a complex character and is the product of several contributing factors affecting yield directly or indirectly. Apart from the direct selection for grain yield, the objective of yield enhancement may in most situations, be effectively achieved on the basis of performance of yield components and selection for closely related morpho-physiologcial characters.

Genotypic and phenotypic correlations are of value to indicate the degree to which various morpho-physiological characters are associated with economic productivity. Path coefficient analysis is a reliable statistical technique, which provides means to quantify the interrelationship of different yield components and indicate whether the influence is directly reflected in the yield or take some other path ways to produce an effect. This technique, therefore, provides a critical examination of specific factors producing a given correlation and can be successfully employed in formulating a selection strategy. Since path-coefficient analysis was applied by Dewey and Lu (1959) on crested wheat grass, this technique has been followed extensively to facilitate selection in various crops. Akhtar (1991) and Chowdhry *et al*. (2000) reported that yield per plant was positively correlated with plant height, number of tillers per plant and 1000-grain weight. However 1000-grain weight and plant height made the most important contribution. Uddin *et al.* (1997) and Mohy-ud-Din (1995) reported number of grains per spike, number of tillers and spike length were positively correlated with grain yield per plant whereas spikelets per spike and number of tiller had the greatest direct effect on yield.

The present studies were initiated to investigate the interrelationship of yield components and the type and extent of their contribution to yield. The informations so derived could be exploited in devising further breeding strategies and selection procedures to develop new varieties of wheat capable of high productivity.

MATERIALS AND METHODS

The research work was carried out in the experimental area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. The Diallel crosses between five wheat varieties namely 8763, 8779, 8784, Inqlab-91 and Iqbal-2000 was made. The seed of F_1 hybrids and their parents was sown in a randomised complete block design with three replications on Nov. 8, 2002. Seeds were planted with the help of a dibble, inter plant and inter row distances were 15 and 30 cm, respectively. Normal agronomic and cultural practices were applied to the experiment through out the growing season. Ten plants from each line were tagged randomly to study different post emergence plant traits and data were recorded for plant height, flag leaf area, peduncle length, number of tillers per plant, spike length, number of spikelets per spike, spike density, number of grains per spike, 1000-grain weight and grain yield.

The data of F_1 hybrids and parental lines were analysed according to the method suggested by Steel and Torrie (1984). The method described by Kown and Torrie (1964) and Dewey and Lu (1959) was followed to calculate phenotypic and genotypic correlation coefficients, and path coefficient, respectively.

RESULTS AND DISCUSSION

The analysis of variance for grain yield and its components revealed highly significant differences between genotypes indicating the presence of differences among the genotypes for all characters. Genotypic and phenotypic

Table I. Genotypic and phenotypic correlation among yield and its components

Traits		Flag leaf area	Peduncle length	Tillers per plant	Spike length	Spikelets per spike	Spike density	No. of grains per spike	1000-grain weight	Grain yield per plant
Plant height	rg	0.239819	-0.23412	0.124376	0.368708	0.687787*	0.337264	-0.1261	0.840313*	0.470903*
	rp	0.227887	-0.21338	0.120337	0.286791*	0.587448**	0.256814	-0.11968	0.814023**	0.45352**
Flag leaf area	rg		0.155781	0.090717	0.342316	0.390601	0.052585	0.182322	-0.11092	0.311787
	rp		0.149687	0.087752	0.307038**	0.338989*	-0.00154	0.186985	-0.08988	0.298861*
Peduncle length	rg			0.271443	0.1781	0.13389	-0.37805	0.248236	-0.20873	0.317369
	rp			0.258606	0.120243	0.13402	-0.28845*	0.243745	-0.17835	0.301165*
Tillers per plant	rg				0.547217*	0.222872	-0.35088	0.398024*	0.026199	0.767079*
	rp				0.435307**	0.18094	-0.28327*	0.399348**	0.02511	0.743485**
Spike length	rg					0.595109*	-0.45466	0.71308*	0.394124	0.773029*
	rp					0.529819**	-0.5598**	0.583072**	0.314675*	0.61579**
Spikelets per spike	rg						0.443302	0.351349	0.608449*	0.542893*
	rp						0.402114**	0.318522*	0.508937**	0.445518**
Spike density	rg							-0.41747	0.24229	-0.27722
	rp							-0.32818*	0.164434	-0.24291
No. of grains per spike	rg								-0.13383	0.547585*
	rp								-0.12483	0.52817**
1000-grain weight	rg									0.361361*
	rp									0.346529*

* = Significant $P \leq 0.05$

** = Highly significant $P \leq 0.01$

correlation coefficients provide a quantitative evaluation of effects of environments on particular character. The association of grain yield with other characters was estimated by genotypic and phenotypic correlation coefficients (Table I). Grain yield had a highly significant positive phenotypic correlation with plant height, number of tillers per plant, spike length, spikelets per spike and 1000-grain weight whereas it had a significant positive genotypic correlations with all above characters. These results are in agreement with Akhtar (1991), Mohy-ud-Din (1995), Narwal *et al*. (1999), Uddin *et al*. (1997), Ashfaq *et al* (2003) and Nayeem-KA and Baig (2003).Tillers per plant also had positive and significant genotypic correlation with spike length and grains per spike while spike length with spikelets per spike and grains per spike, spikelets per spike with 1000-grain weight also showed positive significant genotypic correlation and highly positive significant phenotypic correlations. Flag leaf area and peduncle length exhibited positive and significant genotypic correlation with grain yield while 1000-grain weight showed positive and significant correlation with grain yield per plant at both genotypic and phenotypic levels. The highest positive correlation of 0.77 was appeared between spike length and grain yield whereas the lowest positive correlation of 0.03 was expressed between tillers per plant and 1000-grian weight. The path coefficient analysis appeared to provide a clue to the contribution of various components of yield to over all grain yield in the genotypes under study. It provides an effective way of finding out direct and indirect sources of correlation. The direct contribution of spike length to grain yield was highest (4.43) followed by spike density (3.77), plant height (1.08), peduncle length (0.41), number of grains per spike (0.35) and number of tillers per plant (0.26); whereas, spikelets per spike had maximum negative direct effect (-4.22) on grain yield. Number of grains per spike had the highest indirect effect (3.16) via spike length. Spikelets per spike also had an appreciable indirect effect (2.63) via spike length. Plant height showed considerable indirect effect via spike length (1.63) and spike density (1.27). Flag leaf area and peduncle length also had considerable indirect effect via spike length but tillers per plant and spike length had the highest indirect effects of 2.44 and 0.40 via spike length and plant height respectively. Spike density and 1000-grain weight had an appreciable amount of indirect effect via plant height (0.63) and spike length (1.74) respectively.

It may be concluded from the present studies that plant height, peduncle length, tillers per plant, spike length, spike density and number of grains per spike appeared to contribute to the grain yield. Therefore indirect selection for higher grain yield may be effective for improving these characters, as had been shown by Chowdhry *et al*. (2000), Narwal *et al*. (1999), Uddin *et al*. (1997) and Jedynski (2001) in various studies on wheat crop.

Table II. Direct (diagonal) and indirect effects of qualitative traits on grain yield in wheat

Traits	Plant height	Flag leaf Area	Peduncle length	Tillers per plant	Spike length	Spikelets per spike	Spike density	No. of grains per spike	1000-grain weight	Grain yield per plant
Plant height	1.0847	-0.0543	-0.9543	0.0321	1.6325	-2.9006	1.2730	-0.0439	-0.4564	0.4709
Flag leaf area	0.2601	-0.2262	0.0639	0.0234	1.5156	-1.6473	0.1985	0.0635	0.0602	0.3118
Peduncle length	-0.2540	-0.0352	0.4103	0.0701	0.7885	0.5647	-1.4269	0.0865	0.1134	0.3174
Tillers per plant	0.1349	-0.0205	0.1114	0.2583	2.4228	-0.9399	-1.3243	0.1387	-0.0142	0.7671
Spike length	0.3999	-0.0774	0.0731	0.1413	4.4276	-2.5099	-1.1760	0.2484	-0.2141	0.7730
Spikelets per spike	0.7460	-0.0883	-0.0549	0.0576	2.6349	-4.2175	1.6732	0.1224	-0.3305	0.5429
Spike density	0.3658	-0.0119	-0.1551	-0.0906	-2.0130	-1.8696	3.7744	-0.1455	-0.1316	-0.2772
No. of grains per spike	-0.1368	-0.0413	0.1018	0.1028	3.1573	-1.4818	-1.5756	0.3485	0.0727	0.5475
1000-grain weight	0.9115	0.0251	-0.0586	0.0068	1.7450	-2.5661	0.9145	-0.0466	-0.5431	0.3614

REFERENCES

Akhtar, M., 1991. Correlation and path coefficient studies on stress related characters in wheat. *M.Sc. Thesis*, Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad–Pakistan

Aashfaq M., A.S. Khan and Z. Ali, 2003.Association of morphological traits with grain yield in wheat. *Int. J. Agri. Biol*., 5: 262–4

Chowdhry, M.A., M. Ali, G.M. Subhani and I. Khaliq, 2000. Path coefficients analysis for water use efficiency, evapo–transpiration efficiency and some yield related traits in wheat at different micro environments. *Environ. Ecol.,* 9: 906–10

Dewey, R.D. and K.H. Lu, 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.,* 52: 515–8

Jedynski, S., 2001. Heritability and path coefficient analysis of yield components in spring wheat. *Grupy Problemowej Wodowli Pszenicy. Proceeding of Symposium, Zakopane, Poland.* No. 218–19: 203–9

Kown, S.H. and J.H. Torrie, 1964. Heritability and interrelationship among traits of two soybean population. *Crop Sci.,* 4: 196–8

Mohy–ud–Din, Z., 1995. Association analysis of various agronomic traits in bread wheat. *M.Sc. Hons Thesis*, Department Plant Breeding and Genetics, University of Agriculture, Faisalabad–Pakistan

Narwal, N.K., P.K. Verma and M.S. Narwal, 1999. Genetic variability, correlation and path coefficient analysis in bread wheat in two climatic zones of Haryana. *Agric.Sci. Diget. Karnal.,* 19: 73–6

Nayeem, K.A. and K.S. Baig, 2003. Correlation studies in durum wheat. *J. Res. Angrau.,* 31: 116–21

Steel, R.G.D. and J.H. Torrie, 1984. *Principles and Procedures of Statistic: A Biometrical Approach.* pp: 337–9. McGraw Hill Book Co., New York, USA

Uddin, M.J., B. Mitra, M.A.Z. Chowdhry and B. Mitra, 1997. Genetic parameters, correlation path–coefficient and selection indices in wheat. *Bangladesh. J. Sci. Indus. Res.,* 32: 528–38

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