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PATH COEFFICIENT ANALYSIS IN WHEAT

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An eight parental diallel cross was made to study the extent of variability, interrelationship, direct and indirect effects between grain yield and its components. Genotypic variability coefficient was higher for grain yield as compared to other studied characters. Heritability estimates ranged from moderate (66.20%) to high values (96.95%). Number of grain per spike 1000 grain weight and plant height were positively and significantly correlated with yield except number of spikes per plant. Path coefficient indicated that except plant height the traits have positive direct effect on grain yield.

Key words: *Triticum aestivum,* Advanced lines, Heritability, Correlation, Path coefficient analysis.

Introduction

Wheat is a major cereal crop in Pakistan and staple food of Pakistani peoples. Population of our country is increasing day by day but the wheat production is still constant. So that breeders focus their attention for the evolution of high yielding and rust resistant varieties to make the country self-sufficient in wheat production, which fluctuates widely as a result of environmental interaction. Thus, breeding for high yield. selection of closely related characters in early generations is more useful and practical.

Analysis of variance and statistical paramters like, phenotypic and genotypic coefficient of variability, heritability and genetic advance have been used to assess the nature and magnitude of variation in wheat breeding materials [1-3]. These studies showed low to moderate heritability and genetic advance of grain yield while it was reasonable for plant height and other components. Plant height and 1000-grain weight are reported to be less influenced by environmental effects compared with number of spikes per plant, number of grains per spike and grain yield. Correlation analysis is being used to identify yield components for indirect selection [1, 4-9]. Thus previous studies have revealed that number of spikes per plant and number of grains per spike positively associated with grain yield. However, results are different for plant height and 1000-grain weight.

Path coefficient analysis precisely indicates direct and indirect effects of each yield components [9], such analysis has been used in wheat both in diallel crosses and pure lines [3, 10, 11]. Most of these studies indicate that number of spikes per plant have direct effects on grain yield. Both direct and indirect contribution in plant height and 1000-grain weight on grain yield are widely controversial among the breeders.

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Materials and Methods

An 8 x 8 dialled crosses (excluding reciprocals) were made at Wheat Research Institute, Faisalabad. In 1991-92 seed of F_1's alongwith their parents were planted in 2.5 meter rows following randomized complete block design with three replications. Row to row and plant to plant distance was 30 and 7.5 cm, respectively. The data on grain yield per plant, number of spikes per plant, number of grains per spike, 1000-grain weight and plant height were recorded on 10 randomly selected plants from each parental and hybrid line.

The analysis of variance were done according to Steel and Torrie [12]. Estimates of broad sense heritability, genetic advacne at 5 % selection intensity (2.06) were calculated using the formulae reported by Allard [13]. Path analysis was performed following Dewey and Lu [9].

Results and Disscussion

Differences among the genotypes were highly significant for all the characters under study (Table 1). Estimates of mean range, phenotypic coefficient of variability (PCV), genotypic coefficient of variability (GCV), heritability estimates in broad sense (h) and genetic advance (GA) are presented in Table 2. A wide range of variability was expressed for all characters [1]. PCV was higher for grain yield per plant followed by 1000-grain weight, number of spikes per plant, number of grains per spike and plant height. Whereas similar pattern was noticed for GCV except number of spikes per plant and plant height. A close agreement between PCV and GCV values for plant height and 1000-grain weight and corresponding high heritability indicated that selection would be more effective for these characters than the other [1]. Wheat breeders, should consider heritability estimates alongwith genetic advance values because heritability alone is not a good indicator of the amount of useable genetic variability [1,2]. High heritability

TABLE 1. ANALYSIS OF VARIANCE FOR PLANT HEIGHT, YIELD AND YIELD COMPONENTS IN WHEAT.

Source of variation	d.f.	Grain yield/ plant	Number of spikes/ plant	Number of grains/ spike	1000-grain weight	Plant height (cm)
Rep	2	3.75	0.10	9.08	11.24	21.95
Genotypes	35	17.78**	1.90**	73.73**	100.18**	395.16
Error	70	2.85	0.56	10.72	4.54	4.10

** Highly Significant

TABLE 2. MEAN, RANGE, PHENOTYPIC (PVC%) AND GENOTYPIC COEFFICIENT OF VARIABILITY (GCV%), HERITABILITY (H^2%), GENETIC ADVANCE (GA) AND RELATIVE EXPECTED GENETIC ADVANCE (REGA%) FOR FIVE CHARACTERS IN WHEAT.

Characters	Grain yield/ plant (g)	Number of spikes/ plant	Number of grains/ spike	1000-grain weight (g)	Plant height (cm)
Mean	12.51	7.73	43.53	39.35	96.48
Range	3.97-19.07	5.00-9.90	20.95-57.34	20.63-55.03	68.40-120.70
CV%	22.37	13.64	12.94	15.34	12.02
GCV%	17.75	9.10	10.53	14.35	11.83
h2%	62.96	44.55	66.20	87.53	96.95
GA	3.63	0.92	7.68	10.88	23.16
REGA%	29.02	12.48	17.64	27.65	24.00

indicates that the selection would be practiced on individual plant basis in early segregating generations while low to moderate heritability for number of spikes per plant and grain yield per plant reflected that for these traits plants may be selected in later segregating generations.

Phenotypic (r_p) and genotypic (r_g) correlation coefficients in all possible combinations are presented in Table 3. Generally r_g values were greater than the respective r_p ones [5-7, 10]. There are two exceptions; r_g lesser than r_p in case of association between grain yield and number of spikes per plant and between number of spikes per plant and plant height. It could be due to modifying effect of environmental factors on character association. All the characters were positively and significantly correlated with grain yield per plant except number of spikes per plant. Number of grains per spike and 1000-grain weight were significantly associated with plant height, whereas, number of spikes per plant was negatively and significantly associated with 1000-grain weight. The r_g values indicated that number of grains per spike, 1000-grain weight and plant height are the most important components for indirect selection for grain yield.

Path coefficient analysis [9] has been used effectively in wheat to break down total (r_g) into direct and indirect components [1,3,4,8-10]. Direct and indirect effects of different characters on grain yield per plant are presented in Table 4. All characters showed positive direct effect except plant height. Higher direct effect on grain yield per plant was exerted by

TABLE 3. PHENOTYPIC (R_p) AND GENOTYPIC (R_g) CORRELATIONS COEFFICIENTS BETWEEN PLANT HEIGHT, YIELD AND YIELD COMPONENTS IN WHEAT.

Characters		Nuber of spikes/ plant	Number of grains/ spike	1000-grain weight	Plant height
Grain yield/plant	r_p	0.311	0.692**	0.571**	0.559**
	r_g	0.072	0.787**	0.679**	0.727**
Number of spikes/ plant	r_p		-0.037	-0.376*	0.079
	r_g		-0.126	-0.685**	0.0004
Number of grains/ spike	r_p			0.225	0.371*
	r_g			0.296	0.509**
1000-grain weight	r_p				0.466**
	r_g				0.493**

* = 0.05; ** = 0.01

TABLE 4. DIRECT AND INDIRECT EFFECTS OF DIFFERENT CHARACTERS OF GRAIN YIELD IN WHEAT.

Characters	Number of spikes/ plant	Number of grains/ spike	1000-grain weight	Plant height	r_g
Number of spikes/plant	(0.7136)	-0.0783	-0.7072	-0.0001	-0.072
Number of grains/spike	-0.0899	(0.6215)	0.3056	-0.0502	0.787**
1000-grain weight	-0.4888	0.1839	(1.0325)	-0.486	0.679**
Plant height	0.0003	0.3164	0.5090	(-0.0987)	0.727**

* P = 0.05; ** P = 0.01

Note: Parenthesis values denote direct effect on grain yield.

1000-grain weight followed by number of spikes per plant. Number of grains per spike and plant height showed higher r_g values than direct effect which was due to positive indirect effect through other components. Genotypic correlation (0.787) was greater than direct effect (0.6215) in case of number of grains per spike because of indirect positive effect through 1000-grain weight (0.3056). Direct effect of 1000-grain weight (1.0325) on yield was higher than r_g (0.679). This was due to negative indirect effect through number of spikes per plant and plant height.

From this study it appears that there is great scope for developing high yielding lines from the experimental material. Selection for higher number of spikes per plant in advance generation and more number of grains per spike and 1000-grain weight in early generation would be effective to improve grain yield.

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