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ASSOCIATION STUDIES IN *TRITICALE*

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Correlation and path coefficient analyses were carried out in 63 strains of *triticale* for grain yield and its components. Grain yield / plant showed significantly positive association with tillers/plant, grains/main spike and spikelets/main spike, while length of main spike and 100-grain weight though had positive association but of low magnitude. Plant height had negative correlation with yield. Path coefficient analysis revealed that tillers/plant, grains/main spike and 100-grain weight had positive direct effects on grain yield/plant. Spikelets/main spike and spike length also showed positive direct effect on grain yield/plant but of low magnitude. Therefore, due stress must be laid on number of tillers/plant, number of grains/main spike, 100-grain weight, number of spikelets/main spike and length of main spike during the selection for higher yield in *triticale*.

The primary *triticales* synthesized by doubling the chromosomes of the f_1 hybrids between *Triticum aestivum* and *Secale cereale* are very low in yield as compared to wheat and barley which is primarily due to shrivelled endosperm and poor seed set. The secondary *triticales* produced by selection also did not prove better and hence further improvement may be achieved through hybridization and selection for which a clear picture of the interrelationship between yield and its components is

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essential. Path analysis proposed by wright (1921) facilitates the partitioning of the correlation coefficients into direct and indirect effects of various characters on grain yield or any other trait. It also permits to study the specific forces acting to produce a given correlation in correlated variables. Hence, the present investigation was undertaken to determine the correlation and direct and indirect association among yield attributes through path coefficient analysis.

MATERIALS AND METHODS

The material consisted of 63 genotypes grown in a randomized block design with three replications at Raja Balwant Singh College Research Farm, Bichpuri, Agra in *rabi* 1979-80 and 1980-81. Each genotype was represented by a single row of 3m length. The spacing was kept 25cm and 15cm between and within the lines. Five plants in each replication were selected at random for recording observations on plant height, tillers / plant, spikelets / main spike, spike length, grains/main spike, grain yield / plant and 100-grain weight. Genotypic correlations were computed following the method of Al-Jibouri *et al.* (1958) and path coefficient analysis by that of Dewey and Lu (1959).

RESULTS AND DISCUSSION

The genotypic correlations between all possible combinations of seven characters are presented in Table 1. Grain yield/plant showed positive and significant association with tillers / plant, grains/main spike and spikelets/ main spike, whereas with length of main spike its magnitude was low as compared to other traits in both the years. Plant height was found negatively correlated with yield. Sethi *et al.* (1977) however, found positive and significant association only with number of spikes/plant and Gill *et al.* (1976) with number of grains / spike and number of spikelets per spike. Tillers/ plant showed negative correlation with all the characters except plant height and grain yield / plant. The values of genotypic correlation coefficients for spikelets/main spike were high and positive with grains/main spike and grain yield/plant, whereas with those of spike length were moderate and positive but negative with 100-grain weight. Spike length also showed positive and moderate values of genotypic correlation coefficients with grains/main spike and grain yield/plant but negative with 100-grain weight. 100-grain weight exhibited positive though insignificant association with plant height and grain yield / plant but was negatively associated with rest of the characters.

The results of path coefficient analysis summarized in Table 2 indicated that plant height was directly responsible to decreased grain yield/plant as it had negative direct effect on grain yield in 1979-80 and in 1980-81 the magnitude was very low. Further, its main positive indirect effect by increasing the spikelets/main spike was neutralized by the negative indirect effects decreasing the tillers/plant, spike length, grains/main spike resulting in lower number of ears / plant, grains / main spike and lower 100-grain weight and

hence reduced grain yield/plant. The number of tillers/plant showed highest positive direct effect on grain yield in both the crop seasons but its imporant contribution was indirect through spikelets / main spike ultimately giving positive correlation with grain yield / plant. These results are in conformity with the findings of Malhotra and Jain (1972), Tandon and Singh (1973), Sharma *et al.* (1973) and Sethi *et al.* (1977) who have considered the number of tillers/plant as the main yield contributing character. Number of spikelets/main spike had positive direct effect on grain yield/plant by increasing the number of grains/main spike. The direct contribution of spike length though was positive but of low magnitude in both the crop seasons. Indirect effect of main spike length via spikelets/main spike and grains / main spike were positive but other traits showed negative indirect effects. Thus, the significant contribution to grain yield by spike length was through the spikelets/main spike and grain/main spike. Number of grains/main spike was second in rank as obvious component of importance as it had high positive direct effect on grain yield/plant in both the crop seasons. Gill *et al.* (1976) have also concluded that number of spikelets/spike and number of grains/spike were the main yield contributing characters, which lends support to the present findings. 100-grain weight was found next to number of grains / main spike to contribute directly to grain yield. Plant height which showed negative effect in the first year gave positive effect in the second crop season, may be attributed to the changed environmental conditions of the two seasons, while those which remained stable in two environments were supposed to have greater genetic homeostasis. It is, therefore, suggested that for developing high yielding varieties in *triticale* stress must be laid on number of tillers/plant, number of grains/main spike, 100-grain weight, number of spikelets/main spike and length of main spike during the selection programme.

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Table 1. Genotypic correlation coefficients in *triticale*

Characters	Tillers/ plant	Spikelets/ main spike	Spike length	Grains/ main spike	Yield/ plant	100-grains weight
Plant height	0.2075 (0.2499)*	0.3262** (0.5879)**	0.4843** (0.4427)**	0.0768 (0.0844)	—0.2918* (—0.2548)	0.1429 (0.3540)*
Tillers/plant		—0.1227 (—0.1670)	—0.1305 (—0.1280)	—0.0277 (—0.1482)	0.6886** (0.6435)**	—0.1483 (—0.2300)
Spikelets/main spike			0.1994 (0.3486)*	0.6180** (0.5327)**	0.4304** (0.4575)**	—0.1991 (—0.1545)
Spike length				0.2506* (0.1485)	0.2433* (0.2553)*	—0.2102 (—0.1605)
Grains/main spike					0.6868** (0.6098)**	—0.1089 (—0.0810)
Yield/plant						0.3763** (0.3624)**

Values of 1980-81 in paranthesis

* and ** Significant at 5 and 1 per cent level respectively.

Table 2. Genotypic path coefficients with yield in *triticale*

Characters	Plant height	Tillers / plant	Spikelets / main spike	Spike length	Grains/ main Spike	100-grain weight	Genotypic correlation with yield
Plant height	— 0.0100 (0.0362)	—0.1176 (—0.1815)	0.0540 (0.0329)	—0.0805 (—0.0234)	—0.0685 (—0.0249)	—0.0692 (—0.0941)	— 0.2918 (— 0.2548
Tillers/plant	—0.0020 (—0.0165)	0.7851 (0.7261)	0.0129 (0.0455)	—0.0109 (—0.0067)	—0.0247 (—0.0438)	—0.0718 (—0.0611)	0.6886 (0.6435
Spikelets/main spike	—0.0032 (—0.0389)	—0.0104 (— 0.0665)	0.1052 (0.1240)	—0.166 (—0.0184)	0.4517 (0.4983)	—0.0963) (—0.0410)	0.4304 (0.4575)
Spike length	—0.0048 (—0.0293)	—0.0111 (—0.0129)	0.0209 (0.0432)	0.0836 (0.0530)	0.2237 (0.2439)	—0.0690 (—0.0426)	0.2433 (0.2553)
Grains/main spike	—0.0007 (—0.0055)	0.0023 (0.0075)	0.0650 (0.0412)	—0.0209 (—0.0078)	0.6928 (0.5957)	0.0527 (— 0.0213)	0.6858 (0.6098)
100-grain weight	—0.0014 (—0.0234)	—0.0126 (—0.0670)	0.0209 (0.0191)	—0.0175 (—0.0085)	—0.0972 (—0.0237)	0.4841 (0.4659)	0.3763 (0.3624)

Residual effect : 0.2074 (0.1212)

1980-81 in paranthesis, underlined values denote the direct effects.