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ASSOCIATION ANALYSIS AMONG YIELD COMPONENTS IN THE THREE GENERATIONS OF DURUM WHEAT

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Correlation analysis between grain yield and its component traits were carried out in the three generations namely, parents, F_1 and F_2 developed by 10 × 10 diallel cross (excluding reciprocals) in *durum* wheat. Among component characters grains per spike and tillers per plant would lead to higher yield in durum wheat. The antagonastic relationship between traits of economic importance suggested that intermating in early segregating generations for atleast 3-4 years need to be adopted. A multiple cross involving JNK-4W-14, A-9-30-1, Cocorit-71 and stork's' will be most appropriate to generate the variability in desirable direction for isolating valuable segregants with desirable attributes.

Key words : Durum wheat, correlation analysis, quantitative traits, generations, genotypic and phenotypic coefficient

Grain yield is the end product of interactions of many factors known as yield contributing components and is a complex trait. Selection based on this trait is usually not very useful but the one based on its component characters could be more effective. To make effective selections for higher yield, basic information on major yield contributing characters is essential to ensure efficient selection simultaneously for two or more characters. In case of *aestivum* wheat, number of findings based on fixed genotypes and segregating populations have been reported but there is very little information in *durum* wheat on correlation studies particularly in segregating populations. Therefore, the present study was conducted to collect the information on association of ten quantitative traits, with grain yield in parents, F_1 and F_2 generations of *durum* wheat.

MATERIALS AND METHODS

Ten varieties of *durum* wheat (*Triticum durum* Desf.) viz. Raj 1516, HD 45530, NP 401, Cocorit 71, Flamingo's, Stork 'S', Raj 911, A-9-30-1, Raj 2061 and JNK-4W-184, were crossed in all possible combinations excluding reci procals. The resulting 45 F_1's were planted to get sufficient F_2 populations these along with parents were evaluated in a randomized block design with three replications at ARS, Sriganganagar. Each plot consisted of single 5m long row in parents and F_1's while four rows in F_2's with the spacing of 30cm between rows and 10cm between plants. Recommended cultural practices were followed for raising the crop. Ten competitive plants in each parent and F_1's and 25 plants in each F_2's progeny were selected randomly for recording observations on eleven quantitative characters. The progeny means were used for statistical analysis. Genotypic and phenotypic correlation coefficients were calculated in parents, F_1 and F_2 populations separately according to the procedure proposed by Searle (1961).

RESULTS AND DISCUSSION

From the analysis of variance, the mean squares due to genotypes were found highly significant for all the eleven characters studied indicating sufficient genetic variation among genotypes for all three characters in all the three populations. There were similarities between genotypic and phenotypic coefficient of correlation though the genotypic correlation coefficients were, in general, higher than the corresponding phenotypic correlation coefficients in all the three generations (Table 1). This suggested that selection on phenotypic basis would be equally worthwhile. Grain yield was significantly and positively correlated with number of tillers, spikelets per spike, grains per spike and straw yield in the parents, F_1 and F_2 generations. However, it showed positive and significant association with spike length and plant height in F_2 population also and are in accordance with earlier reports in wheat (Dhomkshes Rao, 1979; Gupta and Ahmed, 1979; Kumar, 1979; Choudhary *et al.*, 1985; Sharma and Kant, 1986; Verma and Yunus, 1993; Srivastava *et al.*, 1993; Chander *et al.*, 1993). In general, there were similarities in association between characters in different generations however some differences of associations of traits in different populations may be due to the differences of genetic constitution of the different populations.

Harvest index showed positive but weak association with grain yield in parents and F_1 generations, however, it showed positive and significant association with it in F_2 generation, it may be ascribed to the breakage of linkages and heterogenous nature of population. This character also showed positive and significant correlation with grains per spike in all the three generations and with number of tillers in F_2 population only. Therefore, improvement in grain yield may be made by this trait. Earlier Studies (Kaltsikes and Lac, 1971; Sidhu *et al.*, 1976; Pace *et al.*, 1978; Thakal *et al.*, 1979; Kumar and Choudhary, 1986; Sharma *et al.*, 1993) substantiate this point.

Table 1. Phenotypic (p) and genotypic (G) correlation among different characters of the parents (P), F_1 and F_2 population in *durum* wheat

Characters			Days to maturity	Plant height (cm)	Number of tillers	Spike length (cm)	Spikelets per spike	grains per spike	1000 grain weight (g)	Grain yield per plant (g)	Straw yield (g)	Harvest index (%)
Days to heading	P	p	0.62**	0.42*	0.09	0.75**	0.57**	0.11	–0.18	0.22	0.37*	–0.30
		G	0.66	0.42	0.17	0.81	0.60	0.12	–0.19	0.29	0.43	–0.31
	F_1	p	0.68**	0.35**	–0.08	0.50**	0.48**	0.01	0.04	0.01	0.34**	–0.21*
		G	0.78	0.38	–0.10	0.59	0.54	0.01	0.05	0.03	0.45	0.27
	F_2	p	0.73**	0.35**	0.07	0.63**	0.62**	0.14	–0.18*	0.17*	0.47**	–0.42**
		G	0.85	0.38	–0.02	0.72	0.68	0.15	–0.18	0.16	0.60	–0.54
Days to maturity	P	p	0.16	0.05	0.46*	0.28	–0.47**	0.36	–0.80	0.52**	–0.32	
		G	0.19	0.04	0.54	0.32	–0.52	0.42	–0.90	0.64	–0.76	
	F_1	p	0.01	–0.01	0.38**	0.28**	–0.16	0.22	0.02	0.28**	–0.15	
		G		0.02	–0.18	0.45	0.36	–0.23	0.15	–.12	0.25	–0.21
	F_2	p	0.11	0.04	0.41**	0.41**	–0.06	–0.04	0.07	0.40**	–0.40**	
		G		0.15	–0.08	0.58	0.54	–0.08	–0.04	–0.04	0.46	0.34
Plant height (cm)	P	p			–0.28	0.50**	0.41*	0.30	0.19	0.29	0.57**	–0.46*
		G			–0.43	0.54	0.45	0.32	0.18	0.34	0.64	–0.51
	F_1	p			0.07	0.58 **	0.59**	0.21*	0.24**	0.32**	0.59**	–0.21*
		G			0.06	0.64	0.64	0.24	0.27	0.40	0.73	–0.30
	F_2	p			0.04	0.40**	0.40**	0.26**	0.01	0.35**	0.59**	–0.38**
		G		–0.01	0.46	0.47	0.27	0.03	0.44	0.74	–0.50	
Numbers of tillers	P	p				0.12	0.31	0.31	–0.48**	0.63**	0.11	0.22
		G				0.05	0.41	0.39	–0.58	0.51	–0.17	0.31
	F_1	p				0.21**	0.17*	0.33**	–0.17*	0.81**	0.52**	0.10
		G				0.15	0.10	0.53	–0.33	0.79	0.34	0.17
	F_2	p				0.06	0.12	0.29**	–0.44**	0.69**	0.26**	0.48**
		G				–0.02	0.13	0.43	–0.65	0.60	–0.06	–0.40
Spike length (cm)	P	p					0.73**	0.15	–0.17	0.21	0.48**	–0.33
		G					0.78	0.18	–0.13	0.24	0.50	–0.41
	F_1	p					0.60**	0.08	0.24**	0.35**	0.55**	–0.16
		G					0.63	0.06	0.20	0.36	0.64	–0.25

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	F_2	P	0.66**	0.08	–0.13	0.08	0.40**	–0.40**
		G	0.72	0.05	–0.12	0.05	0.47	–0.45
Spikelets per spike	P	P	0.49**	–0.35	0.53**	0.35	–0.19	
		G		0.55	–0.35	0.67	0.45	–0.26
	F_1	P		0.30**	0.04	0.39**	0.54**	–0.12
		G		0.31	0.10	0.40	0.61	–0.22
	F_2	P		0.34**	–0.39**	0.21*	0.38**	–0.27**
		G		0.44	–0.47	0.25	0.46	–0.31
	P	P			–0.67**	0.72**	–0.06	0.42*
Grains per spike		G			–0.72	0.81	–0.09	0.51
	F_1	P			–0.43	0.51**	0.21*	0.30**
		G			–0.60	0.65	0.26	0.24
	F_2	P			–0.55**	0.57**	0.19	0.25**
		G			–0.69	0.71	0.13	0.36
1000 grain weight (g)	P	P				–0.36	0.49**	–0.73**
		G				–0.43	0.57	–0.80
	F_1	P				–0.01	0.31**	–0.18
		G				–0.08	0.40	–0.29
	F_2	P				–0.27	0.09	–0.33**
		G				–0.36	0.20	–0.46
Grain yield per plant (g)	P	P					0.40*	0.16
		G					0.34	0.02
	F_1	P					0.68**	0.01
		G					0.66	0.06
	F_2	P					0.48**	0.26**
		G					0.41	0.19
10. Straw yield	P	P						–0.74**
		G						0.89
	F_1	P						–0.23**
		G						–0.29
	F_2	P						–0.64**
		G						–0.70

* P = 0.05, ** P = 0.01

Grain weight exhibited negative correlation with yield in all three generations, however, it was significant in case of parents and F_2 population. This character also had negative and highly significant correlation with number of tillers and grains per spike (Sharma and Kant, 1986). Therefore, simultaneous improvement for these traits would not be feasible unless unfavourable linkage are broken by intermating in the segregating populations.

Number of tiller per plant had no significant correlation with spike length, spikelets per spike and grains per spike in parental lines but there were significant positive association of tillers with these traits in F_1. In F_2 population, tiller number showed positive and highly significant correlation with grains per spike. Therefore, simultaneous selection for such traits in genetically variable population may lead to the improvement of grain yield.

In conclusion, correlation studies revealed that selection for grains per spike and tillers per plant would lead to higher yield. The antagonistic relationship between traits of economic importance suggested that intermating in early segregating generations for atleast 3-4 years be adopted. Intermating would enhance the frequency of desirable combination of genes in the segregating population. For this purpose, a multiple cross involving JNK-4W-184, A-9-30-1, cocorit 71 and stork's will be most appropriate in present material. The material generated after intermating may offer great scope for isolating valuable segregants with desirable attributes in *durum* wheats.

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