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Research Paper

Deciphering traits association pattern in imparting drought tolerance in durum wheat

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ABSTRACT

A study was conducted during *Rabi* 2006-07, to understand association of yield and yield attributes with traits implicated in drought tolerance in Durum wheat (*Triticum durum* Desf.). 25 genotypes were grown under two environments *viz*, stressed (rainfed) and non stressed (irrigated). Correlation studies indicated that grain yield had significant negative correlation at genotypic and phenotypic level with days to 50 per cent flowering and days to maturity, where as it showed positive significant correlation with root length, root to shoot length ratio and harvest index under rainfed condition at both levels. While under irrigated condition days to 50 per cent flowering, 1000 grain weight and days to maturity showed significant positive correlation with grain yield at both genotypic and phenotypic levels. Plant height showed significant negative association with grain yield, while grains per spike and 1000 grain weight had significant positive effect on grain yield only at genotypic level.

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KEY WORDS : Durum wheat, Drought tolerance, Correlation, Stressed, Non stressed

Wheat (*Triticum* sp.), one of the largest cereal crop of the world, is the second most important source of staple food and income after rice in India. It is unique in several features. It is the only crop to have produced more than 500 million tonnes in a single year and to contribute more calories and more protein to worlds diet than any other food crop.

In peninsular India comprising of Karnataka, and Maharashtra, durum wheat is cultivated in more than 60 per cent of the total area under wheat cultivation. Drought is the most common factor that limits the productivity of durum wheat as it is predominantly grown as rainfed crop. The response of plants to moisture stress conditions, essentially reflects on the adaptive mechanism which in turn is a complex trait. Hence, even at the same level of moisture stress condition different genotypes show characteristically different responses which in turn related to their genetic potential for expression of traits concerning to mechanism of adaptation. However, from the point of plant breeding, the adaptive traits of the plant for drought should also be combined with grain yield. Keeping this in view, the present investigation was undertaken to evaluate proven source of drought tolerance along with newely developed lines at Wheat Improvement Project, MARS, UAS Dharwad under rainfed and irrigated conditions for studying the performance of the genotypes to identify traits that could be associated with the tolerance to drought.

RESEARCH PROCEDURE

25 genotypes were grown under two environments *viz.*, stressed (rainfed) and non stressed (irrigated). The experiment in each environment was laid out in Complete Randomized Block Design with two replications at Wheat Improvement Project, Main Agricultural Research Station, Dharwad during 2006-2007. Observations were recorded on five plants randomly selected for the characters field emergence per cent, coleoptile length, root length, shoot length, root to shoot length ratio, days to 50 per cent flowering, days to maturity, spike length, plant height, number of spikelets per spike, number of effective tillers per plant, number of grains per spike, grain yield (g/plot), 1000 grain weight, harvest index, stress susceptibility index. Genetic parameters and correlations were computed as per standard statistical procedures given by Weber and Moorthy (1952).

RESEARCH ANALYSIS AND REASONING

Analysis variance indicated that there was high significant variation for all the traits studied under both environments *viz,* rainfed and irrigated. Looking to stress susceptibility index genotypes Kiran, Bijaga Yellow and MACS-1967 showed least stress susceptibility index. These genotypes also showed higher yield under stressed condition indicating lower the stress susceptibility index greater will be the yield.

A perusal of correlation coefficients indicated significant negative correlation of grain yield with days to 50 per cent flowering at both genotypic and phenotypic levels reflecting on early flowering as possible drought escape mechanism (Table 1 and 2). Jogshoran (1995) and Singh and Sharma (1999) also reported relative yield advantage of early genotypes during drought. Significant positive correlation of days to 50 per cent and days to maturity with stress susceptibility index also indicated desirability of early maturity under moisture stress condition. Grain yield showed negative correlation with stress susceptibility index indicating higher the SSI lower will be the yield. The seedling traits such as root length, root to shoot length ratio and coleoptile length exhibited positive significant association with grain yield. It indicates higher root and coleoptile length are preferred under stressed condition and these traits are useful in imparting drought tolerance.

Under irrigated condition days to 50 per cent flowering and days to maturity showed significant positive correlation with grain yield at both genotypic and phenotypic levels. Grain yield showed significant and positive correlation with number of grains per spike only at genotypic level (Table 3 and 4). Similar reports have come from Khan *et al.* (1999) and Nayem *et al.* (2002). Wherein, they observed positive and significant association of grain yield with days to 50 per cent flowering, in which, they used F_1 crosses and parents of wheat for experiment. Jadhav (1994), Chaturvedi and Gupta (1995) and Singh *et al.* (1996) noticed positive and significant correlation of days to maturity with grain yield. Under irrigated condition the plant height has shown significant negative association and 1000 grain weight has shown significant positive association with grain yield. These results are in confirmation with Rana and Sharma (1997) who reported strong negetive association for plant height and Narwal *et al.*(1999) reported positive correlation of grain yield with 1000-grain weight, which support present results.

Correlation studies indicated that under stressed condition early maturing genotypes are preferred as indicated by negative correlation of days to 50 per cent

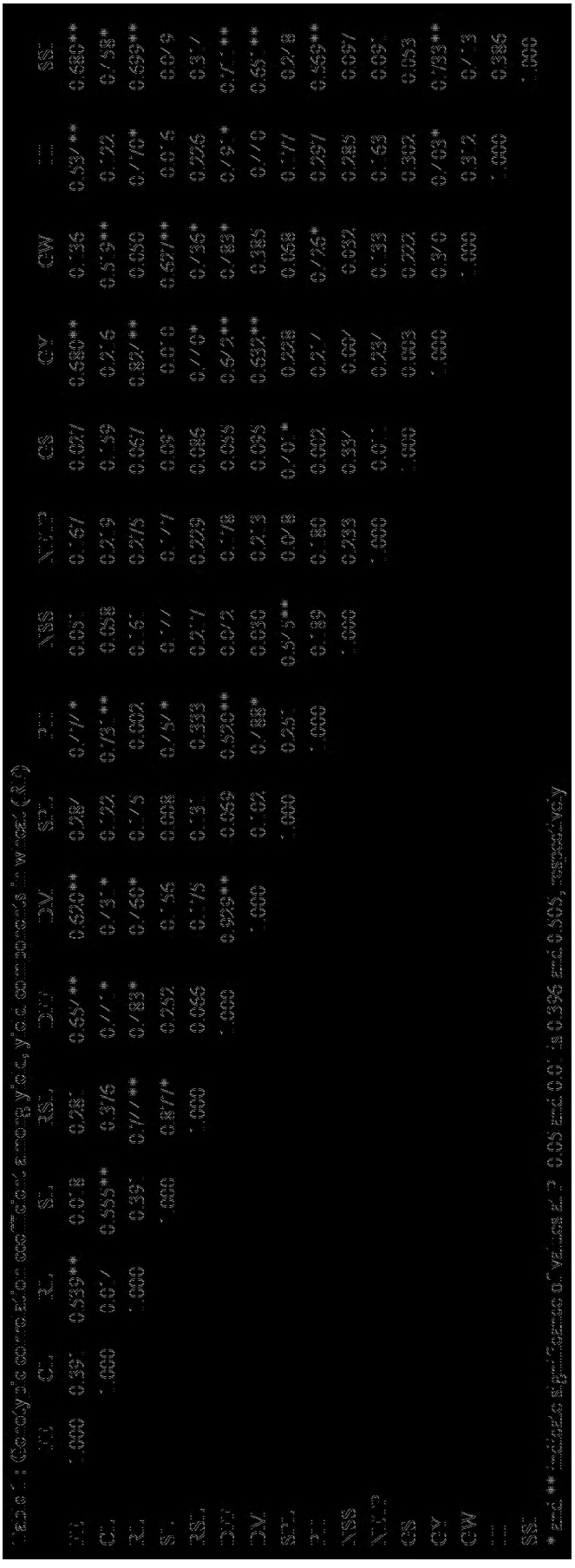

Table 2 : Phenotypic correlation coefficient among yield, yield components in wheat (RF)

	FE	CL	RL	SL	RSL	DFF	DM	SPL	PH	NSS	NETP	GS	GY	GW	HI	SSI
FE	1.000	0.322	0.427*	0.018	0.251	0.575**	0.491*	0.240	0.398*	0.016	0.126	0.019	0.524**	0.096	0.447*	0.525**
CL		1.000	0.034	0.542**	0.350	0.423*	0.418**	0.123	0.718**	0.039	0.214	0.158	0.188	0.515**	0.115	0.437*
RL			1.000	0.359	0.748**	0.439*	0.412*	0.133	0.008	0.169	0.260	0.058	0.711**	0.040	0.429*	0.618**
SL				1.000	0.858**	0.254	0.159	0.007	0.449*	0.148	0.150	0.089	0.004	0.618**	0.020	0.047
RSL					1.000	0.057	0.154	0.127	0.317	0.227	0.230	0.081	0.392	0.425*	0.217	0.287
DFF						1.000	0.894**	0.069	0.510**	0.045	0.180	0.053	0.622**	0.475*	0.469*	0.681**
DM							1.000	0.101	0.468*	0.027	0.191	0.091	0.600**	0.370	0.399*	0.605**
SPL								1.000	0.249	0.524**	0.045	0.399*	0.222	0.069	0.172	0.243
PH									1.000	0.196	0.175	0.005	0.198	0.422*	0.284	0.541**
NSS										1.000	0.226	0.321	0.031	0.025	0.277	0.087
NETP											1.000	0.235	0.235	0.131	0.147	0.102
GS												1.000	0.001	0.221	0.296	0.056
GY													1.000	0.324	0.375	0.701**
GW														1.000	0.302	0.402*
HI															1.000	0.346
SSI																1.000

* and ** indicate significance of values at P 0.05 and 0.01 is 0.396 and 0.505, respectively

Table 3 : Genotypic correlation coefficient among yield, yield components in wheat (IR)

	FE	DFF	DM	SPL	PH	NSS	NETP	GS	GY	GW	HI
FE	1.000	0.625**	0.525**	0.291	0.529**	0.040	0.132	0.407*	0.603**	0.275	0.298
DFF		1.000	0.802**	0.058	0.318	0.087	0.063	0.281	0.639**	0.405*	0.311
DM			1.000	0.233	0.502*	0.083	0.216	0.304	0.744**	0.395	0.266
SPL				1.000	0.334	0.428*	0.044	0.002	0.338	0.022	0.058
PH					1.000	0.213	0.240	0.161	0.498*	0.460*	0.075
NSS						1.000	0.291	0.515**	0.259	0.043	0.148
NETP							1.000	0.408*	0.365	0.077	0.305
GS								1.000	0.450*	0.022	0.028
GY									1.000	0.490*	0.439*
GW										1.000	0.132
HI											1.000

* and ** indicate significance of values at P 0.05 and 0.01 is0.396 and 0.505, respectively

Table 4 : Phenotypic correlation coefficient among yield, yield components in wheat (IR)

	FE	DFF	DM	SPL	PH	NSS	NETP	GS	GY	GW	HI
FE	1.000	-0.544**	-0.498*	0.262	0.471*	-0.048	0.072	-0.364	-0.409*	0.239	0.251
DFF		1.000	0.762**	0.062	-0.314	0.078	-0.053	0.278	0.461*	-0.398*	-0.299
DM			1.000	-0.216	-0.481*	-0.094	0.194	0.288	0.525**	-0.375	-0.225
SPL				1.000	0.332	0.412*	-0.050	-0.006	-0.234	-0.022	0.065
PH					1.000	0.204	0.210	-0.161	-0.358	0.455*	0.074
NSS						1.000	0.263	0.497*	0.199	-0.036	0.127
NETP							1.000	0.355	0.350	-0.079	0.200
GS								1.000	0.308	-0.018	-0.035
GY									1.000	0.047	0.270
GW										1.000	-0.134
HI											1.000

* and ** indicate significance of values at P=0.05 and 0.01 is 0.0396 and 0.505, respectively

flowering and days to maturity as water is limited. In contrast under irrigated condition genotype with late maturity preferred as indicated by positive correlation with yield, as water availability is not a problem at different growth stages of the crop plant.

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