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CORRELATION STUDIES IN SOME OF THE GERMPLASM LINES OF *KHARIF* SORGHUM

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ABSTRACT

Sixty three genotypes consisting of sixty germplasm lines and three improved released varieties of kharif sorghum were evaluated and correlation coefficient were estimated for the grain yield and some of the yield contributing traits including the grain mold rating. Correlation studies revealed that the character grain yield per plant showed positive and significant association with vigour index mass (0.507), vigour index length (0.486), germination percentage of seed (0.482), panicle length (0.402), root length (0.338), shoot length (0.310) and 1000 seed weight (0.181). On the other hand, specific gravity (-0.398), number of leaves (-0.280), electrical conductivity (-0.187) and threshed grain mold rating (-0.150) showed negative and significant correlation with grain yield per plant. The importance should be given to plant height and number of leaves in developing high fodder yielding varieties in sorghum. Similarly seed hardness should be taken in to consideration for improvement in the germination percentage of seed

INTRODUCTION

The information on the nature of association between yield and its components helps in simultaneous selection for many characters associated with yield improvements. Grain yield is complex trait, depend on many attributes. Yield potential accompanied with desirable combination of traits has always been the major objective of sorghum breeding program. The study of relationships among quantitative traits is important for assessing the feasibility of joint selection of two or more traits and hence for evaluating the effect of selection for secondary traits on genetic gain for the primary trait under consideration.

Mahajan *et al*. (2011) reported that grain yield per panicle showed positive and significant correlation with plant height, panicle length and test weight both at genotypic and phenotypic levels. Arunkumar (2013-b) studied 28 sorghum genotypes consisting of twenty three sorghum genotypes along with five local checks and reported that the grain yield recorded positive significant genotypic correlation with ear head length, ear head breadth and seed set percent.

There is need to collect and characterize the sorghum germplasm for various characters including the yield. In case of kharif sorghum grain mold is the major disease affecting both quality as well as the quantity of the kharif sorghum. There is need to identify the characters associated with the grain yield. Similarly there is also need to find out the characteristics related with grain mold resistance in kharif sorghum. The intensity of association of characters is determined by correlation studies. Such correlation studies help us to know which character should be chosen for selection to bring about the maximum increase in the ultimate product.

The present paper deals with the assessment of the nature and the extent of correlation between yield and the yield contributing characters including the grain mold rating.

MATERIALS AND METHODS

Sixty three genotypes consisting of sixty germplasm lines and three improved released varieties of kharif sorghum received from Directorate of Sorghum Research (DSR), Hyderabad were sown at Sorghum Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) during kharif 2012-2013.Material was sown in randomized block design. Observations were recorded on the seventeen different characters namely days to 50% flowering, plant height (cm), number of leaves, panicle length (cm), seed hardness (kg/cm^2), threshed grain mold rating (%), specific gravity of seed (g/ml), germination percentage of seed, electrical conductivity (dsm^{-1}), 1000 seed weight (g), shoot length (cm), root length (cm), root shoot ratio, vigour index length, vigour index mass, fodder yield per plant (g) and grain yield per plant (g).Genotypic correlation coefficients were worked out as per the formulae suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The results presented in Table 1 showed that the character grain yield per plant showed positive and significant association with vigour index mass (0.507**), vigour index length (0.486**), germination percentage of seed (0.482**), panicle length (0.402**), root length (0.338**), shoot length (0.310**) and 1000 seed weight (0.181*). On the other hand specific gravity (-0.398**), number of leaves (-0.280**), electrical conductivity (-0.187**) and threshed grain mold rating (-0.150*)showed negative and significant correlationwith grain yield per plant. Thorat et al. (2005) found positive and significant association between germination percentage and grain yield per plant. Mahajan et al. (2011) and Arunkumar (2013-b) reported that panicle length showed positive and significant association with gain yield per plant. The character 1000 seed weight exhibited positive and significant correlation with grain yield per plant and this result was in conformity with the results of Hemlata et al. (2006) and Premlatha et al. (2006). Arunkumar (2013-a) however reported positive non significant correlation between grain per plant and test weight. Thus selection for vigour index of seed, germination percentage, panicle length and 1000 seed weight will be helpful for simultaneous improvement of grain yield per plant.The characters specific gravity (-0.398**), number of leaves (-0.280**), electrical conductivity (-0.187**) and threshed grain mold rating (-0.150*) showed negative and significant correlation with grain yield per plant.Threshed grain mold rating showed negative and significant association with grain yield per plant and similar results were obtained by Godbharle et al. (2010). Selection for low values for such characters will be helpful for improvement of grain yield per plant.

Among the components, the character days to 50% flowering showed significant and positive association with root shoot ratio (0.437**), plant height (0.431**),fodder yield per plant (0.401**), root length (0.276**), number of leaves (0.201**) and vigour index length (0.171*). On the other hand, it showed negative and highly significant association with electrical conductivity (-0.291**), threshed grain mold rating (-0.282**), specific gravity (-0.236**) and panicle length (-0.193**). Seetharam and Ganeshmurthy (2013) reported positive correlation between days to 50% flowering and plant height. Positive significant association between days to 50% flowering and fodder yield per plant was also obtained by Godbharle *et al.* (2010) and Arunkumar (2013-b). Thus selection for days to 50% flowering will be helpful for simultaneous improvement of plant height and subsequently increased fodder yield per plant also. Negative correlation between days to 50% flowering and electrical conductivity and threshed grain mold rating indicated that early maturing lines (less days to 50% flowering) will show more threshed grain mold rating which in turn will increase the electrical conductivity due to damage of the seed by grain mold. It is well known that in early flowering lines generally flowering to grain maturity stage is caught in the late rains and the condition become suitable for development of grain mold. Rathod (2005) reported similar correlation of days to 50% flowering with electrical conductivity and threshed grain mold rating. This indicated that the early maturing lines in kharif sorghum tend to be more attacked by the grain mold.

Plant height exhibited positive and highly significant correlation with fodder yield per plant, number of leaves, 1000 seed weight and specific gravity of seed Jain *et al.* (2009) observed similar correlation between plant height with fodder yield and number of leaves. Thus selection of plant height will be helpful in simultaneous improvement of fodder yield per plant and it can be very well exploited for development of high fodder

Table 1: Genotypic correlation coefficients between grain yield and yield contributing characters

CHARACTER	PH	NOL	PL	SH	TGMR	SG	GP	EC	1000SW	SL	RL	RSR	VIL	VIM	FY	GY
DT50%F	0.431**	0.201**	-0.193**	0.062	-0.282**	-0.236**	0.106	-0.291**	0.141	0.001	0.276**	0.437**	0.171*	0.102	0.401**	-0.009
PH		0.363**	0.084	0.041	-0.006	0.193**	-0.079	-0.015	0.218**	0.005	-0.050	-0.074	-0.044	-0.147*	0.755**	0.011
NOL			-0.118	-0.255**	0.182*	0.352**	-0.413**	0.129	0.036	-0.038	-0.036	-0.031	-0.180*	-0.468**	0.222**	-0.280**
PL				0.168*	-0.037	0.109	0.192**	-0.103	-0.148*	-0.160*	0.059	0.292**	0.098	0.146*	0.056	0.402**
SH					-0.870**	0.191**	0.628**	-0.712**	-0.079	-0.036	0.007	0.035	0.230**	0.617**	0.129	0.079
TGMR						-0.104	-0.740**	0.870**	-0.040	-0.099	-0.186*	-0.135	-0.353**	-0.731**	-0.110	-0.150*
SG							-0.281**	-0.013	0.106	-0.076	-0.162*	-0.177*	-0.210**	-0.309*	-0.009	-0.398**
GP								-0.721**	0.018	0.341**	0.555**	0.387**	0.781**	0.977**	0.029	0.482**
EC									-0.003	-0.064	-0.178*	-0.145*	-0.335**	-0.668**	-0.085	-0.187*
1000SW										0.303**	0.274**	0.019	0.236**	0.091	0.256**	0.181*
SL											0.825**	-0.121	0.996**	0.329**	-0.035	0.310**
RL												0.464**	0.960**	0.588**	-0.042	0.338**
RSR													0.068	0.475**	0.023	0.066
VIL														0.789**	0.007	0.486**
VIM															0.032	0.507**
FY																0.054

*Significant at 5% ** Significant at 1%; DT50%G- Genotypic correlation coefficient, P- Phenotypic correlation coefficient, *Significant at 5% ** Significant at 1%; F - Days to 50% flowering, PH - Plant height, NOL - Number of leaves, PL – Panicle length, SH - Seed hardness, TGMR – Threshed grain mold rating, SG - Specific gravity of seed, EC – Electrical conductivity, GP – Germination percentage of seed, 1000SW – 1000 Seed weight, SL – Shoot length, RL – Root length, RSR – Root shoot ratio, VIL – Vigour index length, VIM – Vigour index mass, FY – Fodder yield per plant, GY – Grain yield per plant yielding varieties in sorghum.

Number of leaves showed positive and highly significant correlation with specific gravity of seed and fodder yield per plant, similarly positive and significant correlation with character like, threshed grain mold rating. Similar positive and significant correlation was reported by Jain *et al*. (2012) between number of leaves and fodder yield per plant. Thus selection for number of leaves will be helpful in simultaneous improvement of fodder yield per plant and it can be very well exploited for development of high fodder yielding varieties in sorghum.

Seed hardness exhibited positive and highly significant association with germination percentage of seed, vigour index mass, vigour index length, specific gravity of seed. The characters threshed grain mold rating and electrical conductivity showed negative and highly significant correlation with seed hardness. Similar negative and significant correlation between seed hardness and grain mold attack as well as electrical conductivity was reported by Bhakare (2010). Thus selection for seed hardness will be helpful in simultaneous improvement of germination percentage of seed and vigour index of seed. Similarly it will reduce threshed grain mold rating and subsequently the electrical conductivity due to less damage to seed due to grain mold attack.

Threshed grain mold rating expressed positive and highly significant association with electrical conductivity. It is well known that due to the attack of the grain mold the seed coat gets damaged and it ultimately increases the electrical conductivity. Similar positive and highly significant correlation between grain mold attack and electrical conductivity was reported by Bhakare (2010).The characters germination percentage of seed, vigour index mass and vigour index length showed the negative and highly significant association with threshed grain mold rating. Negative and significant association was observed for root length with threshed grain mold rating. For threshed grain mold rating negative correlation is desirable. The characters germination percentage of seed and both vigour index of seed exhibited negative and highly significant association with threshed grain mold rating, which suggested that reduction in grain mold infestation improves the vigour index of seed and the germination percentage of seed.

Germination percentage of seed showed positive and highly significant association with vigour index mass, vigour index length, root length, root shoot ratio and shoot length. Thus improvement in germination percentage of seed will be helpful in simultaneous improvement of vigour index of seed, root length and shoot length which give better plant stand in the field and ultimately increase the yield of crop. Germination percentage of seed exhibited negative and highly significant association with electrical conductivity indicating that higher the electrical conductivity lower will be germination percentage. It is well known that due to high grain mold attack the seed coat gets damaged which increases the electrical conductivity ultimately it results in lower germination percentage. Similar negative and highly significant correlation between germination percentage and electrical conductivity was reported by Bhakare (2010)

Electrical conductivity expressed negative and highly significant association with vigour index mass and vigour index length, while character root length and root shoot ratio showed negative and significant association with electrical conductivity. Due to grain mold attack seed coat gets damaged and it increases the electrical conductivity and reduces the germination percentage of seed. It ultimately reduces the vigour index of seed because vigour index is calculated using germination percentage of seed.

Shoot length expressed positive and highly significant association with vigour index length, root length and vigour index mass. It means increase in root length of seedling it might be useful in increasing the shoot length of seedling also which ultimately increases the vigour index length and vigour index mass because of these indexes are calculated on the basis of seedling length and seedling dry weight respectively.

Root length exhibited positive and highly significant association with vigour index length, vigour index mass and root shoot ratio. More root length is ultimately useful in increasing the vigour index length, vigour index mass and root shoot ratio and this relationship is confirmed by the positive and highly significant association between them.

Root shoot ratio expressed positive and highly significant association with vigour index mass. Seedling having high root shoot ratio have more dry weight and this dry weight of seedling is used for estimation of vigour index mass. So this relationship is confirmed by the positive and the highly significant association between them.

Vigour index length showed positive and highly significant correlation with vigour index mass. It is known that more the seedling length more will be the vigour index length. Also due to more seedling length the mass of the seedling will be more which in turn will increase the vigour index mass**.** This relationship is confirmed by the positive and highly significant correlation between them.

Thus it was concluded form the present study that panicle length exhibited positive and highly significant association with grain yield per plant. So for the development of high yielding varieties in sorghum, panicle length should be considered during selection. Plant height and number of leaves had shown positive and highly significant correlation with fodder yield per plant. So, due importance should be given to plant height and number of leaves in developing high fodder yielding varieties in sorghum. Similarly seed hardness should be taken in to consideration for improvement in the germination percentage of seed due to their positive and significant association. This is because seed hardness and TGMR (Threshed Gain Mold Rating) has shown the negative and highly significant association indicating that grain mold attack will be low on the seeds having more seed hardness. It is known that the grain mold is responsible for reduction in the germination percentage of the seed. So it is necessary that the proper control measures for grain mold should be undertaken during seed production to maintain the seed health and improve the germination percentage of the seed. Breeding efforts need to be intensified for developing grain mold resistant genotypes.

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