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Character Association for Salinity Tolerance at Seedling Stage and Yield Components Under Saline Conditions in Rice (*Oryza sativa* L.)

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ABSTRACT

The study was conducted to examine the relationships between salinity tolerance at seedling stage and yield components of 80 rice (*Oryza sativa* L.*)* genotypes which were grown under saline conditions. Association studies revealed that plant height, number of ear bearing tillers, number of filled grains, panicle length and test weight unveiled positive and significant collaboration with grain yield indicating that the characters under study assist in selecting the genotypes which can grow normally and induce grain yield under saline conditions.

Key words: *Genotypic correlation, Phenotypic correlation.*

Rice (*Oryza* sativa L.) is principle food for more than three billion people worldwide. Asia alone contributes >90% of the world's rice production (Mitin 2009). The total rice cultivated area in India is about 43.5 mha but the production and productivity of the crop is very low when compared to China. The dismal state of the rice production in our country is due to major abiotic and biotic stresses. Abiotic factors like drought, salinity and floods affect rice production adversely in more than 50% of the area.

Salinity is the second most widespread problem in rice growing countries next only to drought and is considered as a serious limitation in increasing rice production worldwide (Gregorio *et al.,* 1997). Several studies have clearly indicated that rice is sensitive to salt stress not only at early seedling stage but also during pollination and fertilization it gains tolerance both at vegetative stage and maturity stage (Lutts *et al*. 1995).

Earlier examination suggested that the correlation between seedling stage tolerance and reproductive stage tolerance is low and the gene(s) governing the tolerance to salinity at early seedling and reproductive stages are independent. Hence, exposing the genotypes for salt stress separately both at early seedling and reproductive stages is desired to identify the tolerant lines. Since survival of the seedlings is very important at initial stages, seedling stage screening is very important. Appropriate stage for salt stress screening is reproductive stage because grain yield is vital factor in rice. Hence an attempt was made to find association at early seedling and reproductive stages in rice.

MATERIAL AND METHODS

Eighty rice genotypes comprising of ANGRAU varieties and advanced breeding lines from RARS, Maruteru, Agricultural Research Station, Machilipatanam and Agricultural Research Station, Bapatla were used in the current studies.

Phenotyping of ANGRAU varieties and advanced breeding lines for salinity tolerance at seedling stage using hydroponic study was performed as per protocol of Gregorio *et al.* (1997) with certain modifications. Initial salinity stress was imposed with EC=6 dsm^{-1} by adding NaCl to the nutrient solution. The pH was monitored daily and was maintained at 5.0. After eight days of initial salinization, the EC was increased to12 dsm^{-1}. The solution was renewed after eight days. Initial scoring of the selected individual plants was recorded at 10 days after initial salinization as per SES of IRRI (1997).The final score was recorded 16 days after initial salinization. Screening of the genotypes for salinity tolerance at reproductive stage was performed as per protocol of Diana *et al.* (2013) with certain modifications. The experimental design was completely randomized design. Data on plant height (cm), number of tillers $plant^{1}$, panicle length (cm), number of filled grains $panicle^{-1}$, grain yield $plant^{-1}$ (g) and test weight (g) were taken for each plant. Phenotypic and genotypic correlations were worked out by using the formulae suggested by Falconer (1964).

RESULTS AND DISCUSSION

Grain yield is a complex trait and direct selection is not effective as it is a quantitative trait and highly influenced by environment. Hence

Table 1. Estimates of genotpic and phenotypic correlation coefficients among yield parameters and salinity score at seedling stage

character		Plant height	Panicle length	Number of filled grains	Ear bearing tillers	Test weight	Salinity Initial score (10 days)	Salinity Final score (16 days)	Grain yield
Plant height	G	1.000	0.744**	0.082	0.199*	0.199*	-0.079	0.032	0.113
	P	1.000	0.606**	0.082	0.174*	0.181*	-0.072	0.030	0.104
Panicle length	G		1.000	0.214**	0.206*	-0.002	-0.079	0.050	0.214*
	P		1.000	0.168*	0.168*	-0.003	-0.058	0.039	0.181*
Number of filled grains	G			1.000	0.500**	-0.138	0.048	0.005	0.684**
	P			1.000	0.465**	-0.135	0.048	0.005	0.684**
Ear bearing tillers	G				1.000	0.347**	0.049	-0.020	0.591**
	P				1.000	0.309**	0.044	-0.018	0.554**
Test weight	G					1.000	-0.333**	-0.272**	0.521**
	P					1.000	-0.328**	-0.270**	0.521**
Salinity Initial score (10 days)	G						1.000	0.705**	-0.055
	P						1.000	0.703**	-0.052
Salinity Final score (16 days)	G							1.000	-0.024
	P							1.000	-0.024
Grain yield	G								1.000
	P								1.000

*indicates significant at 5 % level;
** indicates significant at 1 % level;
P = phenotypic correlation;
G= genotypic correlation

improvement in yield can be brought by selecting the yield associated characters. For indirect selection of genotypes with high grain yield correlation studies plays a major role, it reveals the suitability of various characters because any particular trait may bring about undesirable changes in other associated characters (Singh, 1998).

Sometimes plant yield was influenced by biotic and abiotic factors hence in the present investigation association studies was done among yield, yield parameters and salinity score after stress. Genotypic and phenotypic correlation coefficients are estimated for the characters under study and presented in Table 1.

Plant height showed positive and non-significant association with number of filled grains (0.082) and also with grain yield (0.113) indicating that these characters inherit independently. These results are in conformance with Vijayadurga (2015). But it unveiled positive and significant association with panicle length (0.744), ear bearing tillers (0.199) and test weight (0.199).

Panicle length marked positive and significant correlation coefficient with number of filled grains (0.214) and ear bearing tillers (0.206) and grain yield (0.214) and similar holdings are reported by Mansuri *et al.* (2012). Hence selection of genotypes with longer panicles and more spikelet fertility would lead to more grain yield under saline conditions.

Number of filled grains exhibited positive and significant association with grain yield (0.684). These results are in agreement with Mansuri *et al.,* (2012) and Vijayadurga (2015). Number of filled grains showed positive and significant association with ear bearing tillers (0.500). The results signifies that selection of genotypes with more number of ear bearing tillers would result in more number of filled grains *i.e.,* with highest percentage of spikelet fertility which in turn leads to higher yield.

Results revealed that ear bearing tillers also showed positive and significant correlation coefficient with grain yield (0.591) and test weight (0.347).These results are in harmony with Khan *et al.* (2014).

Test weight showed positive and significant correlation coefficients with grain yield (0.521) and negative and significant correlation with salinity initial score (10 days) (-0.333) and salinity final score (16 days) (-0.272) indicating that these traits inherit independently.

Both salinity initial score and salinity final score exhibited negative and non-significant association with grain yield (-0.055) and (-0.024), respectively. Similar findings are reported by Mahmood *et al.* (2009). In the present investigation salinity initial score and salinity final score plays a prominent role for an increasing yield performance. But both salinity initial score and salinity final score exhibited negative association with grain yield indicating that with increase in salinity score (susceptible genotypes) as per IRRI protocol would produce low grain yield.

CONCLUSION

The present investigation revealed that plant height, number of ear bearing tillers, number of filled grains, panicle length, test weight unveiled positive and significant collaboration with grain yield indicating that there characters may assist in selecting the genotypes which can grow normally and induce grain yield under saline conditions.

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