The Andhra Agric. J 57(4):335-338, 2010

Studies on Genetic Variability, Correlation and Path Coefficient Analyses in Rice Under Saline Conditions

K Nagendra Rao, K Bayyapa Reddy and R Krishna Naik
Department of Genetics and Plant Breeding, Agricultural College, Bapatla 522101, Andhra Pradesh

ABSTRACT

A field experiment was conducted using fifty six saline tolerant rice genotypes during *kharif* – 2008 to study the extent of variability and relation ship among yield and yield component characters under saline conditions at Machilipatnam, Andhra Pradesh. Coefficients of variation were high for number of grains per panicle and grain yield per plant. The characters number of grains per panicle and 100 seed weight had high heritability with high to moderate genetic advance as percentage of mean. The character 100 seed weight had positive association with plant height, number of grains per panicle and grain yield per plant. Plant height showed positive direct effect and positive association with grain yield. Number of grains per panicle had positive direct effect, which was approximately to its correlation coefficient with grain yield.

Key words : Correlations, Path Analysis, Rice, Saline, Variability.

Rice is the most important food crop of India occupying about 44 million hectares, the largest rice area in the world after wheat and maize. The yield of rice crop is a complex character and is inter related with different yield attributing characters like number of tillers per plant and number of grains per panicle *etc.* To increase the yield potential of crop in the problematic soils like saline soils it is better to know the relationship between yield component characters and its direct and indirect effects with the yield. The present study was taken up to determine the extent of variability and relationship between yield and yield component characters using 56 saline tolerant rice genotypes under coastal saline soils of Andhra Pradesh.

MATERIAL AND METHODS

Fifty six saline tolerant rice genotypes were evaluated in a randomized block design in three replications at Agricultural Research Station, Machilipatnam during *Kharif* – 2008 season (Table -1). The soil was sandy loam with a pH of 9.5 and ranging 4.7 to 8.0 dsm^{-1}. Twenty five days old seedlings were transplanted under recommended dose of fertilizers *i.e.,* 120N: $40P_2O_5$: $40K_2O$ kg per hectare adapting a spacing of 20cm between rows and 15cm between plants.

Observations were collected on 5 randomly selected plants of each genotype in each replication. The characters studied were plant height, days to 50% flowering, number of productive tillers per plant, panicle length, number of grains per panicle, 100 grain weight and grain yield per plant. The genotypic and phenotypic coefficients of variations (Burton,1952), heritability and genetic advance as percentage of mean (Jhonson *et al.,* 1955) were estimated while the correlation coefficients were estimated as per Falconer (1964) and path coefficient analysis was done as suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSIONS

Analysis of variance revealed significant genotypic difference for all the yield attributing characters studied. In general, phenotypic coefficient of variation (PCV) values were higher than genotypic coefficients of variation (GCV) values. Low heritability was observed for days to 50% flowering and panicle length, where as it was high in case of number of grains per panicle and grain yield per plant. Moderate heritability was recorded for 100 grain weight, plant height, number of tillers per plant and panicle length. The days to 50% flowering herd low heritability and was largely governed by non-additive gene action and mostly attributable to environmental effects, hence selection might not be effective for improvement of this character.

As in conformity with the findings of Govindarasu(1995) and Reddy and De (1996) and Aswani panwar *et al.* (1997) the similar reports were observed for number of grains per panicle and 100 grain weight, which have high heritability coupled with high genetic advance(per cent mean). Hence yield improvement to certain extent is simple and straight forward through direct selection towards higher number of grains per panicle and 100 seed weight.

Table 1. List of different rice genotypes tested under saline conditions

1.	NDR- 9830119	29.	CSR RIL -06-10394
2.	CN – 1347	30.	CR 2219-44-2
3.	CN – 1266-9-6	31.	NDRK -50013
4.	NDRK- 50012	32.	CR 2472-1-6-2-1
5.	RP- 4679-3-2-8-1-1	33.	CR 2216-35-1-2
6.	CR-2094-155-4	34.	CR 2459-9-1-1
7.	CR-2093-7-1	35.	CR 2214-35-2-2
8.	JAYA	36.	NDRCP-608
9.	CR- 2094-46-3	37.	CR 2218-41-2-1
10.	CR-2092-88-1	38.	CR 2577-1
11.	RP-4631-146-9-1-1-1-3	39.	NDRK -50014
12.	NDRK-9730015-(IR-66879-63NDR-2—1-1-1)	40.	CR 2216-59-1
13.	CR-2095-181-1	41.	CR-2460-69-21-1
14.	CR-2092-141-2	42.	CR-246069-21-2
15.	RP-4353-MSC28-13-3-1-1-3	43.	CR-2472-2-38-2-1
16.	CR 2069-16-1	44.	CR-2459-23-2-1
17.	CR 2092-96-2	45.	CSR-27
18.	RP 4631-46-6-5-1-1-1	46.	CR 2213-5-3
19.	TR-2003-3	47.	CR 2472-33-155-1
20.	NDRK -50009	48.	CR 2472-3-27-2
21.	CN 1271-5/9	49.	CSR-13
22.	CST -7-1	50.	TR 2000-08
23.	CR 2096-71-2	51.	CSRCPWF 05-15
24.	CST- 7-1	52.	AURCO2-05-1
25.	RP 4631-46-20-4-1-1-1	53.	JAYA
26.	DR 2071-245-3	54.	NDRCP-108
27.	CR 2473-7-169-1	55.	CR-2472-4-28-2
28.	CSR RIL -069-94	56.	MTU-1061 (INDRA)

Genotypic correlation coefficients were in general higher than the corresponding phenotypic correlation coefficients. The character 100 grain weight and number of grains per panicle showed significant positive correlation with grain yield per plant at both genotypic and phenotypic levels. Plant height showed significant positive correlation with panicle length and 100 grain weight at both genotypic and phenotypic levels. This result suggests that there should be optimum plant height, lengthy panicle and heavy grains to get more grain yield. Days to 50% flowering had significant positive correlation with panicle length. Number of productive tillers per plant exhibited negative significant correlation with 100 grain weight at both level and with grain yield per plant at gentypic level. Similar result were reported by Murthy *et al.,* (1992). 100 grain weight had significant positive correlation with plant height, number of grains per panicle and grain yield per plant. Similar results were reported by Prasanth *et al.,* (1999) and Tara satyavathi *et al.* (2001). It was further observed that all the characters were associated among themselves and also with grain yield. In order to develop high yielding varieties selection pressure has to be imposed on number of grains per panicle and 100 grain weight which had positive significant association with grain yield.

Plant height had positive direct effect on grain yield and its direct effect through other characters was also cumulated to positive correlation with grain yield. Similar results were reported by Padmavathi *et al.,* (1996) and Santhi and Singh (2000). Number of productive tillers per plant showed negative direct effect on grain yield per plant. Panicle length, number of grains per panicle and 100 grain weight had positive direct effect on grain yield per plant. Similar results were recorded by Santhi and Singh (2000) and Tara Satyavathi *et al.,* (2001). This study given us scope of identifying potential genotypes with more number of grains per panicle, lengthy panicle and high dense grain types.

Table 2. Genetic parameters for yield and yield attributing characters in rice genotypes under saline conditions.

S.No.	Parameter	Days to 50% flowering	Plant height (cm)	Effective tillers plant^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	100 grains weight (g)	Grain yield plant^{-1}
1	2	3	4	5	6	7	8	9
1	Phenotypic coefficient of variation	4.31	12.62	15.31	7.71	29.64	17.63	26.49
2	Genotypic coefficient of variation	3.83	10.23	11.34	4.56	26.92	15.32	24.98
3	Heritability (broad sense)	0.84	0.69	0.48	0.32	0.71	0.73	0.75
4	Genetic advance (%)	10.76	19.72	1.24	1.93	102.58	0.41	7.82
5	Genetic advance (percentage of mean)	9.89	20.91	20.98	7.99	51.49	28.87	48.41

Table 3: Estimation of Phenotypic and genotypic correlation coefficients between yield and yield attributing characters in 56 genotypes of rice under saline conditions

	Plant height (cm)	Days to 50% flowering	No. of effective tillers plant^{-1}	Panicle length (cm)	100 grains weight (g)	No. of grains panicle^{-1}	Grain yield plant^{-1}
1	2	3	4	5	6	7	8
Plant height (cm)	—	0.0032	-0.2138	0.3389*	0.3512*	0.2018	0.2113
		0.0043	**-0.2419***	**0.5321****	**0.3181***	**0.2483**	**0.2372***
Days to 50% flowering	—	—	0.1368	0.2481	-0.2480	-0.1428	-0.1623
			0.1492	**0.2689***	**-0.2582**	**-0.1839**	**-0.1684**
No. of effective tillers plant^{-1}	—	—	—	0.0261	-0.4027**	-0.2381	-0.2019
				0.1383	**-0.5284****	**-0.2723**	**-0.2384***
Panicle length (cm)	—	—	—	—	0.0781	0.1083	0.1423
					0.1243	**0.2011**	**0.2382**
100 grains weight (g)	—	—	—	—	—	0.4384**	0.4989**
						0.4493**	**0.5862****
No. of grains panicle^{-1}	—	—	—	—	—	—	0.8742**
							1.0042**

Bold figures indicate genotypic correlation coefficients
* and ** Significant at 5% and 1% level, respectively

Table 4. Direct and indirect effect of yield attributing characters on grain yield per plant in rice under saline conditions.

	Plant height (cm)	Days to 50% flowering	No. of effective tillers plant^{-1}	Panicle length (cm)	100 grains weight (g)	No. of grains panicle^{-1}
Plant height (cm)	0.0438	0.0013	-0.0132	0.0142	0.0113	0.0131
	0.2381	**0.0019**	**-0.0784**	**0.1471**	**0.1182**	**0.0532**
Days to 50%	0.0010	0.0541	0.0007	0.0082	-0.0171	-0.0121
flowering	**0.0024**	**0.2113**	**0.0249**	**0.0643**	**-0.0463**	**-0.0332**
No. of effective tillers	0.0064	-0.0029	-0.0219	-0.0010	0.0123	0.0048
plant^{-1}	**-0.0368**	**0.0208**	**0.1293**	**0.0142**	**-0.0724**	**-0.0324**
Panicle length (cm)	0.0021	0.0012	0.0002	0.0048	0.0003	0.0005
	-0.1318	**-0.0658**	**-0.0113**	**-0.2149**	**-0.0212**	**-0.0328**
100 grains weight (g)	0.0324	-0.0178	-0.0463	0.0073	0.0873	0.0485
	0.0892	**-0.0542**	**-0.0032**	**0.0232**	**0.1284**	**0.1093**
No. of grains	0.2013	-0.1762	-0.2149	0.1081	0.4398	0.8437
panicle^{-1}	**0.2584**	**-0.2096**	**-0.3092**	**0.2088**	**0.4982**	**1.0048**
Correlation coefficient with grain yield plant^{-1}	0.2097	-0.1389	-0.2811	0.1294	0.4838**	0.8349**

Underlined values are direct effects and all other values are indirect effects.
Figures in bold are genotypic estimates.

The present study revealed that there was enough amount of variability in the characters numbers of grains per panicle and 100 grain weight. For developing high yielding potential rice genotypes for saline soils selection pressure need to be imposed on plant height, panicle length, number of grains per panicle and 100 seed weight.

LITERATURE CITED

Aswani Panwar, Dhaka R P S, Sharma R K, Acharya K P A and Panwar A 1997. Genetic variability and inter-relation ship in rice (*Oryza sativa* L.). Advances in Plant Sciences 10(1): 29-32.

Burton G W 1952. Quantitative inheritance in grasses. Proceedings of International 6th Grassland Congress.277-281.

Dewey D R and Lu K H 1959. Correlation and path coefficient analysis in components of crested wheat grass seed production. Agronomy Journal 51:515-518.

Falconer D S 1964. An Introduction to Quantitative Genetics. 2nd edition, Oliver and Boyd Ltd, Edinburgh.pp.312-324.

Govindarasu R 1995. Analysis of variability and correlation among high density grain characters in rice. Madras Agricultural Journal 82:681-682.

Jhonson H W, Robinson H F and Comstock R E 1955. Estimates of genetic and environment variability in soybean. Agronomy Journal 47:314-318.

Murthy N, Shivasankar G and Parameswarappa 1992. Correlation and path coefficient analysis for grain yield in rice. Journal of Maharastra Agricultural Universities17:502-510.

Padmavathi N, Mahadevappa M and Reddy O U K 1996. Association of various yield components in rice (*Oryza sativa* L.). Crop Research 12:353-357.

Prasant G B, Shailaja H and Shashidar H E 1999. Character association and path coefficient analysis in indica x japonica doubled populations of rice. Oryza 34(3):209-212.

Reddy J N and De RN 1996. Genetic variability in low land rice. Madras Agricultural Journal 83(4):269-270.

Santhi P and Singh J 2000. Correlation and path analysis in induced mutants of Mashuri rice (*Oryza sativa* L.). The Andhra Agricultural Journal 47 (1&2):43-45.

Tarasatyavathi C, Bharadwaj C H and Subramanyam D 2001. Variability, correlation and path coefficient analysis in rice varieties under different spacings. Indian Journal of Agricultural Research 35 (2): 79-84.

(Received on 24.07.2009 and revised on 25.05.2010)