



## Variability and Genetic Parameters for Salinity Tolerance, Yield Components and Grain Yield in Rice Genotypes

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### ABSTRACT

Fifty genotypes of rice (*Oryza sativa* L.) were evaluated for genetic variability for salinity tolerant traits, yield components and grain yield during *khariif*, 2010. The analysis of variance revealed significant differences among the genotypes for all the characters studied. The characters viz., shoot length, shoot dry weight, shoot potassium content, productive tillers hill<sup>-1</sup> and grain yield plant<sup>-1</sup> had recorded high variability (PCV and GCV), heritability coupled with high genetic advance as per cent mean under saline conditions indicating an ample scope for improvement of these characters for development of salt tolerant rice varieties..

**Key words** :Genetic parameters, Rice genotypes, Yield.

Rice (*Oryza sativa* L.) is one of the world's most important cereals for human consumption, providing up to 80% of the daily energy intake in some Asian Countries. However the rate of increase of rice production is declining and if the trend is not reversed, severe food short will occur in near future.

To meet the food demand, it is necessary to increase rice production either by increasing the productivity or by increasing the cultivated area. In either way, there are wide spread soil problems and salinity that impair normal growth and limits the realization of yield potential of modern rice varieties (Greenland, 1984).

Variability is quite important to select appropriate parents for hybridization for developing high yielding varieties. Johnson *et al.* (1955) reported that high heritability estimates gives useful indication of relative values of selection based on the phenotypic expression. Heritability values along with genetic gain need to be considered to arrive more reliable information for selection of best donors for hybridization programme.

### MATERIAL AND METHODS

In the present investigation the fifty genotypes procured from diverse places were screened at an estimated initial E.C and pH of 14.21 dsm/m<sup>2</sup> and 7.35 in plot no.1 of Block-E during

*khariif*, 2010. Individual genotypes were sown on well puddled and prepared raised nursery beds of 1 sqm size on 16.08.2010. Thirty-two days old seedlings were uprooted carefully, labeled properly and transplanted at the rate of two seedlings per hill in the main field. The crop was provided with recommended doses of fertilizers, normal cultural operations and need based plant protection measures. The water was never drained out from experimental plot to maintain stable soil E.C and pH for the entire experimentation period.

Five plants per genotype were randomly selected from the two central rows for recording data on twelve (12) characters. The six characters pertaining to salinity tolerance like (i) Shoot length at seedling stage (cm), (ii) Dry weight of shoot at seedling stage (g) (iii) Root length at seedling stage (cm), (iv) Dry weight of root at seedling stage (g) (v) Sodium content in shoot at maximum tillering stage and (VI) Potassium content in shoot at maximum tillering stage. The remaining six characters pertaining to the yield components like (i) Days to 50% flowering, (ii) Plant height, (iii) Number of productive tillers plant<sup>-1</sup>, (iv) Spikelet fertility percent at maturity, (v) 1000 seed weight and (vi) grain yield plant<sup>-1</sup> were recorded. The data on seedling characters were recorded on 30-35 days old seedlings. The mean of replications was used for statistical analysis. The genotypic and

Table 1. Details of experimental material studied in the present investigation.

S.No.	Name	Source	Salient Features
1	NLR 33358	Nellore, A.P.	Selection from IR 50, 110 days duration.
2	NLR 9674(Kotha Molagolukulu - 74)	Nellore, A.P.	Cross derivative of Bulk H 9/Millekunning, 165 days duration
3	NLR 9672(Kotha Molagolukulu - 72)	Nellore, A.P.	Cross derivative of Bulk H 9/Millekunning, 160 days duration.
4	NLR 9672 - 96(Pinakini)	Nellore, A.P.	Cross derivative of Bulk H 9/Millekunning, 160 days duration.
5	NLR 28600(Simhapuri)	Nellore, A.P.	Cross derivative of RP 5-32/Mahsuri, 165 days duration.
6	NLR 27999(Tikkana)	Nellore, A.P.	Cross derivative of RP 31-49-32/BCP 1, 165 days duration.
7	NLR 33057(Swathi)	Nellore, A.P.	Cross derivative of IR 36/MTU 4569, 125 days duration.
8	NLR 34449(Nellore Mahsuri)	Nellore, A.P.	It is a single cross derivative of IR72/BPT5204 with 120-125 days duration.
9	NLR 33648	Nellore, A.P.	Cross derivative of NLR 9672-96/IET 7230, 150 days duration.
10	NLR 33359(Sravani)	Nellore, A.P.	It is a selection from IR 50. Duration is 115 days.
11	NLR 28523(Sri Ranga)	Nellore, A.P.	Cross derivative of RP 5-32/Mahsuri, 160 days duration.
12	NLR 20017	Nellore, A.P.	Cross derivative of BPT 5204/NLR 33892, 155 days duration.
13	NLR 33892(Pardhiva)	Nellore, A.P.	It is single cross derivative of Tikkana/Deepti having 155 days duration.
14	NLR 33365(Penna)	Nellore, A.P.	Cross derivative of NLR 9672/IR 36, 155 days duration.
15	NLR 20002	Nellore, A.P.	It is a cross derivative of NLR 9672-96 / CR1009, 150 days duration.
16	NLR 30491(Bharani)	Nellore, A.P.	Cross derivative of IR 36/IET 2508, 125 days duration.
17	NLR 34242	Nellore, A.P.	Cross derivative of IR 36/IET 2508, 110 days duration.
18	NLR 40024(Swetha)	Nellore, A.P.	Cross derivative of WGL 14280-1/NLR 30491, 120 days duration.
19	NLR 3041(Nellore Sona)	Nellore, A.P.	Cross derivative between BPT 5204 x NLR 145 having 145 days duration.
20	NLR 3042	Nellore, A.P.	Cross derivative of BPT 5204 x NLR 145 with 115 days duration.
21	NLR 20022	Nellore, A.P.	Cross derivative of NLR 9674 / CR1009, 150 days duration.
22	NLR 20084	Nellore, A.P.	Cross derivative between NLR 28600 / NLR 33057, having 160 duration.
23	NLR 20083	Nellore, A.P.	Cross derivative of NLR 33057 x NLR 28600 having 150 days duration.
24	NLR 33641(Vedagiri)	Nellore, A.P.	Cross derivative between NLR 9672-96/IET 7230, having 155 days duration.

Table 1 cont.....

S.No.	Name	Source	Salient Features
25	NLR 145 (Swarnamukhi)	Nellore, A.P.	Cross derivative between CICA-4/IR 625-23-3-1/Tatep, having 135-145 days duration.
26	NLR 33671	Nellore, A.P.	Cross derivative between NLR 33055/NIR 145, having 120 days duration.
27	NLR 34452	Nellore, A.P.	Cross derivative between IR 72 / BPT 5204, having 120 days duration.
28	NLR 34450	Nellore, A.P.	Cross derivative of IR 72/BPT 5204, 120 days duration.
29	NLR 33636	Nellore, A.P.	Cross derivative of NLR 33055/NLR 145 , 130 days duration.
30	MTU 1001(Vijetha)	Maruteru, A.P.	Cross derivative of MTU 5249/MTU 7014
31	MTU 1061(Indhra)	Maruteru, A.P.	Cross derivative of PLA 1100 x MTU 1010, having 155 days duration.
32	RGL 11414 (Vamsadhara)	Ragolu, A.P.	Cross between RGL 4166 x MTU7029 with 150-155 days duration.
33	RGL 2332 (Sreekurma)	Ragolu, A.P.	Cross derivative of BPT 5204/IR54 with 150 - 155 days duration.
34	RGL 2537 (Sreekakulam Sannalu)	Ragolu, A.P.	Cross between CRT 145/CR1014 with 155-160 days duration.
35	RGL 2538 (Vasundhara)	Ragolu, A.P.	Cross between Phalguna/IET 6858 with 135-140 days duration.
36	RGL 1880 (Sri Satya)	Ragolu, A.P.	Cross between RGL 1231/Phalguna//RGL-1231/IR36 with 110-110 days duration.
37	BPT 5204(Samba Mahsuri)	Bapatla, A.P.	Cross between GEB 24 /TN1//Mahsuri with 145 days duration.
38	BPT 2270(Bhavapuri Sannalu)	Bapatla, A.P.	Cross between BPT 5204 x CR 15 MR1523 with 160-165 days duration.
39	BPT 3291(Sona Mahsuri)	Bapatla, A.P.	Cross derivative of Sona/Mahsuri. 145 days duration, fine grain, tolerant to blast with yield potential of 6.25 t/ha.
40	BPT 1768 (Bapatla Sannalu)	Bapatla, A.P.	Cross between BPT 3301/Mahsuri. 165 days duration.
41	BPT 2231(Akshaya)	Bapatla, A.P.	Cross derivative between BPT 4358 x IR 64 with 145-150 days duration.
42	Magadha Sugandha	DRR, Hyderabad	Selection from Basmati composite, long slender grain with 100 days to 50% flowering.
43	Rp Bio 226(Improved BPT 5204)	DRR, Hyderabad.	Cross between BPT 5204 x SS 1113 with 145 days duration.
44	PUSA 1121	DRR, Hyderabad.	Cross derivative of PUSA 614-1-2 x PUSA 614-2-4-3. Duration 135 days.
45	MGP 1(Localcollection)	Machilipatnam, A.P.	150 days duration
46	MGP 2(Localcollection)	Machilipatnam, A.P.	120 days duration
47	MGP 3(Localcollection)	Machilipatnam, A.P.	150 days duration.
48	NDRK 50015	Faizadabad, U.P.	Cross between Narendra Usar-2 x NDRK 5059, 93 days to 50% flowering
49	NDRK 50016	Faizadabad, U.P.	Cross derivative of NDRK-5064 x NDRK-5032 with 101 days to 50% flowering
50	CSR-RIL 06-165	CSSRI,Karnal.	Cross derivative of CSR 27 x MI48 with 105 days to 50% flowering.

Table 2. Analysis of variance for 50 rice genotypes for 12 characters.

Source	Df	Shoot length at seedling stage	Shoot weight at seedling stage	Shoot sodium contentat M.T.S	Shoot potassium contentat M.T.S	Root lengthat seedling stage	Root Dry weightat seedling stage	Days to 50 per cent flowering	Plant height tillers hill <sup>-1</sup>	Spikelet fertility percentage	1000 seed weight	Grain yield plant <sup>-1</sup>
Replications	2	20.53	0.01	0.01	0.01	8.6	0.01	44.46	116.63	6.31	0.27	3.19
Genotypes	49	312.65**	0.04**	0.84**	0.11**	17.65**	0.03**	864.64**	710.52**	195.02**	24.72**	26.88**
Error	98	14.82	0.01	0.01	0.01	0.95	0.01	15.05	41.4	24.13	0.57	0.83

\*Significant at 5 per cent level

\*\*Significant at 1 per cent level

phenotypic coefficients of variabilities were calculated according to the formula given by Falconer (1981) and heritability (Broad sense) as per Burton (1952) and genetic advance as percent of mean by (Allard, 1960).

**RESULTS AND DISCUSSION**

The analysis of variance (ANOVA) revealed significant differences among the genotypes for all characters studied (Table-2) indicating existence of sufficient variability for effective selection. In present study highest heritability (99.74%) coupled with high genetic advance (127.18) is recorded for shoot sodium content (Table-3) indicating the role of additive genes for control of this trait and a scope for effective improvement of this trait through selection under saline conditions. These results are in consonance with the findings of Sharma and Sharma (2007); Krishna *et al.* (2008); Prasad *et al.* (2009); Sivaparvathi *et al.* (2011) and Sudharani (2012).

The magnitude of difference between PCV and GCV was relatively low for the most of the characters studied except root length (PCV: 21.02 and GCV: 19.44) and root dry weight (PCV: 25.94 and GCV: 17.97) which revealed the least influence of environment on these traits.

Wide variability was observed in the case of shoot length, shoot dry weight, shoot sodium content, shoot potassium content, Number of productive tillers plant<sup>-1</sup> and grain yield plant<sup>-1</sup>. This indicates its amenability towards directional selection. These results are in agreement with Maiti *et al.* (2006) and Sudharani (2012).

The traits Days to 50% flowering, plant height, spikelet fertility and 1000 seed weight recorded moderate variability. Similar results were also reported by Jaiswal *et al.* (2007); Vijayalakshmi *et al.* (2008); Satish Chandra *et al.* (2009); Mohanlal and Chauhan (2011) and Shivaprasad *et al.* (2011).

High heritability accompanied by moderate genetic advance was observed for spikelet fertility revealing the involvement of both additive and non-additive gene actions in the inheritance of the trait and improvement of this trait is possible by simultaneous exploitation of both additive and non-additive components by adopting breeding procedure like biparental mating, diallel selective mating system or cyclic hybridization. Saidaiah *et al.* (2010) also reported high heritability for this character.

Table 3. Mean, range, GCV, PCV, Heritability, GA and GAM for 12 characters.

S.No.	Character	Mean	Range		Phenotypic coefficient of variation (%)	Genotypic coefficient of variation (%)	Heritability (%)	Genetic advance as (%)	Genetic advance as per cent mean
			Minimum	Maximum					
1	Shoot length (cm) at seedling stage	34.42	13.37	59.43	31.04	28.95	87.01	19.15	55.63
2	Shoot Dry weight (g) at seedling stage	0.32	0.12	0.57	34.76	34.15	96.53	0.22	69.12
3	Shoot sodium content at Maximum tillering stage	0.86	0.21	2.43	61.90	61.82	99.74	1.09	127.18
4	Shoot potassium content at Maximum tillering stage	0.63	0.23	1.00	29.31	29.05	98.23	0.37	59.29
5	Root length(cm) of seedling	12.14	7.30	17.70	21.02	19.44	85.50	4.49	37.02
6	Root Dry weight(g) of seedling	0.15	0.05	0.21	25.94	17.97	48.00	0.04	25.65
7	Days to 50 per cent flowering	116.68	84.67	146.33	14.81	14.42	94.96	33.78	28.95
8	Plant height (cm)	88.80	59.63	119.47	17.73	17.13	93.39	30.28	34.11
9	No. of productive tillers hill <sup>-1</sup>	6.33	3.10	10.60	34.41	32.46	89.01	3.99	63.09
10	Spikelet fertility (%)	72.07	52.15	85.61	12.50	10.47	70.24	13.03	18.08
11	1000 seed weight (g)	17.99	13.20	22.93	16.32	15.77	93.41	5.65	31.40
12	Grain yield plant <sup>-1</sup> (g)	8.87	5.23	17.70	34.80	33.24	91.20	5.80	65.36

Therefore, it would be rewarding to lay due emphasis on the selection of plants with high shoot length, shoot dry weight, shoot potassium content, productive tillers hill<sup>-1</sup> and grain yield plant<sup>-1</sup> for rapid improvement of grain yield under saline conditions.

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