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**Evaluation of rice genotypes under salt stress at
reproductive stage using phenotypic and
molecular markers**

Pratibha Yadav, Babita Yadav, KN Singh and DK Dwivedi

Abstract

Salinity screening for thirty rice genotypes were performed at the reproductive stages, in the net house. Three selected SSR markers were used to determine salinity tolerance in rice genotypes. Phenotyping of the genotypes was done at EC 12dS/m at reproductive stage in net house. The most desirable genotypes for days to 50% flowering were RP-4993-55-14-3-5-1 and MTU-1010; for plant height RP-4993-55-14-3-5-1, R-RHZSM-4 and Sambha mansuri; for panicle bearing tillers/plant IR-91158-85-3-2-3-3; for panicle length IR-91175-27-1-3-1-3, NUD-3, R-RHZSM-4, IR-83294-66-2-2-3-2 and IR-92960-75-1-3; for spikelets/panicle IR-91167-133-1-1-2-3, NDR-359, IR-91167-31-3-1-3-3, IR-91175-27-1-3-1-3, IR-92960-75-1-3, IR-83294-66-2-2-3-2, R-RHZSM-4, NUD-3, R-RHZ-2, Swarna, IR-91171-66-3-2-1-3, IR-91158-85-3-2-3-3 and IR-83668-35-2-2-2; for grains/panicle IR-91167-31-3-1-3-3, IR-91175-27-1-3-1-3, IR-92960-75-1-3, IR-83294-66-2-2-3-2, R-RHZSM-4, NUD-3 and R-RHZ-2; for test weight IR-92953-49-1-3, IR-84722-82-2-3-3-3, Sambha mansuri and IR-91171-70-3-3; for biological yield/plant R-RHZSM-4, R-RHZ-2, Sambha mansuri, Swarna and IR-91171-66-3-2-1-3; for harvest index Taramon were reported highly significant in mean performance for yield and its components traits. Molecular analysis with SSR markers differentiate the rice genotypes into tolerant and susceptible based on banding pattern. The tolerant rice genotypes were NUD 3, IR-68144-2B-2-2-3-166, IR68144-2B-2-2-3-1-120, IR-68100-2B-2-2-3-1-127, IR-1167-31-3-1-3-33 and IR-91171-66-3-2-1-3 and susceptible were NDR-359, Swarna and IR-64. The identified salt tolerant genotypes can be potential germplasm sources for future breeding program002E

Keywords: Rice, Salinity, reproductive stage, phenotyping, genotyping, molecular markers

Introduction

Rice is the seed of the grass species *Oryza sativa* L. (Asian rice) or *Oryza glaberrima* (African rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. It is one of the agronomical and nutritionally important cereal crops. It is a major source of food for more than 2.7 billion people on a daily basis and is planted on about one-tenth of the earth's arable land. It is the single largest source of food energy for more than half of the world's population. Besides its important significance, it is rich in genetic diversity in the form of thousands of land races and progenitor species (Nagaraju *et al.*, 2002).

Salinity is the second most widespread soil problem in rice growing countries after drought and is considered as a serious constraint to increase rice production worldwide (Gregorio *et al.*, 1997). It is quite well known that rice show variation for salt tolerance (Sabouri *et al.*, 2009, Sabouri & Biabani, 2009, Habib *et al.*, 2013) [7, 13, 8].

A number of morpho-physiological growth factors are affected by NaCl stress (Salam *et al.*, 2011) [15]. The identification of major gene locus for salt tolerance near a microsatellite marker can be used by plant breeders to select more efficiently and to better understand salt tolerance, at vegetative and reproductive growth stages (Saqib *et al.*, 2012) [1].

SSR or microsatellite markers are proved to be ideal for making genetic maps (Islam, 2004 & Niones, 2004) [9, 11], assisting selection (Bhuiyan, 2005) [3] and studying genetic diversity in genotype. SSR markers are playing important role to identify gene for salt tolerance that can be helpful for plant breeders to develop new cultivars. The aim of the present study was to screen rice genotypes under saline and non-saline conditions and to evaluate microsatellite markers for the identification of salt tolerant genotypes at the seedling and reproductive stage.

Materials and Methods

Plant materials: A total of 30 traditional and improved rice genotypes were used in the study viz., IR91167-31-3-1-33, IR91167-99-1-1-1-3, IR91167-133-1-1-2-3, IR91171-66-3-2-1-3, IR91175-27-1-3-1-3, IR91158-85-3-2-3-3, IR92953-49-1-3, IR92960-75-1-3, IR92966-95-1-3, IR92971-70-3-3, IR68144-2B-2-2-3-1-166, IR82475-110-2-2-1-2, IR83294-66-2-2-3-2, IR83668-35-2-2-2, IR84722-82-2-3-3-3, RP-BIO-5478-185M, RP4993-55-14-3-5-1, R-RHZ-2, R-RHZSM-4, R-RHZIH-7, IR68144-2B-2-2-3-1-120, IR68144-2B-2-2-3-1-127, Taramon, Swarna, IR-64, NUD-3, NDR-359, Ayaar, Sambha mansuri and MTU-1010. Three markers viz. RM3412, RM8049 and RM6648 were selected to evaluate 30 rice genotypes for salt tolerance.

Screening of rice genotypes at the reproductive stage: The genotypes were evaluated for their tolerance to salinity under net house. The experimental design was completely randomized design with three replications. Two setups were maintained: normal and salinized. Pregerminated seeds of rice genotypes were sown in earthen pots. After 2 weeks,

seedlings were thinned and the water level was raised to about 1 cm. The pots were salinized at EC 12dS /m 3 weeks after sowing and EC was monitored in every week. Data were recorded for plant height (cm), Days to flowering, Panicle bearing tillers/plants, Spikelets/panicle, Panicle length, Grain/panicle, Spikelet fertility (%), Test weight (g), Biological yield (g), Harvest index (%), Grain yield (g), and Na^+/k^+ and the data were compiled by taking mean values over randomly selected plant from three replications and subjected to the following statistical analysis: Analysis of variance for the design of experiment, Coefficient of variability, Correlation coefficient and Path coefficient analysis.

Genotyping of salinity tolerant rice genotypes: Modified CTAB method was used for DNA extraction for 25-day old seedling (IRRI, 1997) [7]. Twelve primers were used for this study. Among these primers, three primers were showed polymorphic and clear bands (Table 1). Each PCR reaction carried out with 20.0 μ l reactions containing 2.0 μ l 10x buffer, 2.0 μ l dNTPs, 0.5 μ l primer forward, 0.5 μ l primer reverse, 0.5 μ l taq polymerase, 13.5 μ l ddH₂O and 1.0 μ l of each template DNA samples. PCR profile was maintained as initial denaturation at 94oC for 5 min, followed by 34 cycles of denaturation at 94oC for 1 min, annealing at 55oC for 1 min and polymerization at 72oC for 2 min; and final extension by 7 min at 72oC. Then electrophoresis in 2.5% agarose gel was done after polymorphism in the PCR products and stained in ethidium bromide. Banding patterns were visualized with ultraviolet gel documentation system. Susceptible and tolerant genotypes was identified on the basis of banding patterns obtained from gel documentation system.

Table 1: Sequence of SSR primer-pairs provided clear amplification in rice genotypes

S. No.	Primer code	Sequence (5'→3')	Forward/ Reverse	Tm (°C)	Range of amplified allele (bp)
1.	RM3412	TGATGGATCTCTGAGGTGTAAGAGC	F	55	200-220
		TGCACTAATCTTTCTGCCACAGC	R		
2.	RM8049	GATCTGTAAATGCTTCATGG	F	55	150-190
		ACTCAATTTCAACAATGGTG	R		
3.	RM6648	GATCGATCATGGCCAGAGAG	F	56	150-190
		ACAGCAGGTTGATGAGGACC	R		

Results and Discussion

Screening of rice genotypes for salt tolerance at the reproductive stage: Under salt stress 30 rice genotypes showed wider variation for yield and yield contributing characters. In salinized setup the genotypes had less vigorous growth whereas in non-salinized condition they had been showed vigorous growth (Fig. 2). On the basis of mean performance of genotypes, under control and saline conditions the most desirable genotypes for days to 50% flowering were RP-4993-55-14-3-5-1 and MTU-1010; for plant height RP-4993-55-14-3-5-1, R-RHZSM-4 and Sambha mansuri, Choi *et al.*, (2003) [6] observed that the plant height decreased; for panicle bearing tillers/plant IR-91158-85-3-2-3-3; for panicle length IR-91175-27-1-3-1-3, NUD-3, R-RHZSM-4, IR-83294-66-2-2-3-2 and IR-92960-75-1-3; for spikelets/panicle IR-91167-133-1-1-2-3, NDR-359, IR-91167-31-3-1-33, IR-91175-27-1-3-1-3, IR-92960-75-1-3, IR-83294-66-2-2-3-2, R-RHZSM-4, NUD-3, R-RHZ-2, Swarna, IR-91171-66-3-2-1-3, IR-91158-85-3-2-3-3 and IR-83668-35-2-2-2; for grains/panicle IR-91167-31-3-1-33, IR-91175-27-1-3-1-3, IR-92960-75-1-3, IR-83294-66-2-2-3-2, R-RHZSM-4, NUD-3 and R-RHZ-2 (Powar & Mehta, 1997) [12]; for test weight IR-

92953-49-1-3, IR-84722-82-2-3-3-3, Sambha mansuri and IR-91171-70-3-3; for biological yield/plant R-RHZSM-4, R-RHZ-2, Sambha mansuri, Swarna and IR-91171-66-3-2-1-3; for harvest index Taramon were reported highly significant in mean performance for yield and its components traits. Tolerant genotypes had lower reduction than the susceptible genotypes. This result was consistent with the result observed by Islam (2004) [9] who worked with 80 recombinant inbred lines of Pokkali X IR29. He reported that total biomass of tolerant lines was reduced by 49.5% in salinized condition whereas those of susceptible lines were reduced by 64%. This result is supported by Bhowmik *et al.*, (2009) [4] who worked with 11 rice genotypes and found that the genotype THDB had the lowest reduction of total dry mater whereas the genotype Kaliboro had the highest reduction. This result supported by Asch *et al.*, (1999) [2] who worked with 8 rice cultivars and found that cultivars differed in their salt uptake and tolerant cultivars had lower salt effect on yield and yield components than susceptible. Filled grain weight and total dry matter weight contributed the most variation to grain yield under salinity stress and these traits were selected for tagging the salinity tolerance genes.

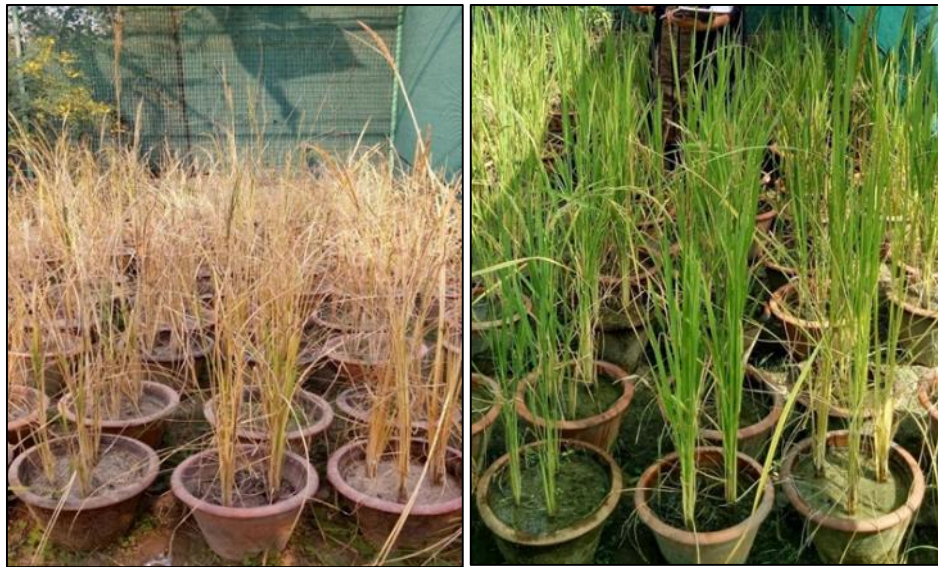


Fig 1: Rice genotypes in saline and normal condition at reproductive stage

Table 2: Mean performance of different rice genotypes under control condition

Characters	Days to 50% flowering	Plant height (cm)	Panicle bearing tillers/ plant	Panicle length (cm)	Spikelets/ panicle	Grains/ panicle	Spikelet fertility (%)	Test weight (g)	Biological yield/ plant (g)	Harvest index (%)	Grain yield/ plant (g)	Na+	K+	Na+/K+
IR-64	102.67**	71.84**	8.81	18.46	60.64	56.33	92.92	24.37**	30.34	39.72	12.04	3.80	25.03	0.15
IR-68144-2B-2-2-3-166	101.00**	69.97**	9.08	16.84	78.00	72.07	92.44	15.56	30.59	37.82	11.55	3.80	25.03	0.15
IR-91167-133-1-1-2-3	101.00**	98.63	8.44	22.64	174.67**	170.27**	97.50	16.73	30.78	37.91	11.66	3.90	25.27	0.15
NDR-359	102.33**	72.69**	9.39	25.35	137.56**	131.20**	95.34	21.76	27.60	40.05	11.04	3.20	36.17	0.09
RP-4993-55-14-3-5-1	104.00**	66.20**	8.59	25.57	88.64	82.88	93.49	20.22	33.45	40.34	13.48	4.83	25.07	0.19
IR-91175-27-1-3-1-3	109.33	90.65	11.73	28.40**	141.58**	134.77**	95.19	15.55	29.61	38.92	11.51	3.80	35.67	0.10
IR-91167-31-3-1-33	108.33	96.70	13.34	26.11*	131.13**	124.80**	95.21	12.76	31.80	39.48	12.48	3.13	27.37	0.11
IR-68144-2B-2-2-3-1-120	106.33*	84.91	13.82	23.86	92.05	84.48	91.76	17.63	25.54	46.72	11.93	3.17	27.73*	0.12
IR-92953-49-1-3	106.33*	99.45	10.01	25.50	102.84	93.94	91.37	23.82**	27.94	44.59	12.44	3.07	29.17**	0.11
MTU-1010	102.33**	78.55*	8.69	20.67	85.19	78.96	92.66	16.94	26.57	43.52	11.54	2.90	28.23**	0.10
RP-BIO-5478-185M	118.33	114.89	12.85	24.84	116.62	112.58	96.50	20.61	27.12	41.40	11.19	3.57	28.27**	0.13
Taramon	108.00	77.00*	8.44	25.06	63.92	57.00	89.31	20.54	20.36	56.69**	11.50	3.30	23.30	0.15
IR-68144-2B-2-2-3-1-127	108.33	74.33**	9.37	24.75	108.30	98.16	90.56	21.72	24.41	51.74**	12.61	3.63	20.77	0.18**
IR-84722-82-2-3-3-3	106.00	78.20*	10.15	27.33**	103.18	98.87	95.77	24.56**	33.98	38.11	12.57	3.50	21.13	0.16
IR-92960-75-1-3	104.33**	83.42	8.22	32.78**	201.23**	190.22**	94.52	18.19	27.91	41.91	11.69	3.88	21.75	0.18**
IR-83294-66-2-2-3-2	109.33	133.12	9.52	27.98**	142.52**	131.50**	92.27	20.80	35.81	37.85	13.56	3.08	22.07	0.14
R-RHZSM-4	110.00	73.41**	8.11	27.16**	143.83**	134.39**	93.45	21.47	43.50**	31.72	13.81	2.82	21.72	0.13
NUD-3	103.00**	87.28	11.19	27.25**	185.44**	172.85**	93.22	21.07	33.59	31.78	10.68	2.92	23.59	0.12
R-RHZ-2	112.00	76.06*	19.51**	21.42	174.86**	161.33**	92.28	22.96**	43.24**	38.63	16.67**	3.24	22.14	0.15
Sambha mansuri	111.00	66.57**	11.50	21.63	104.89	84.33	80.41	24.78**	37.90**	32.17	12.23	3.14	21.93	0.14
IR-91171-70-3-3	108.00	86.80	16.90**	22.45	105.17	100.47	95.51	24.30**	28.10	44.46	12.43	3.16	22.41	0.14
Swarna	110.33	86.99	10.56	24.98	131.31**	121.71*	92.71	21.00	44.47**	34.94	15.53**	3.37	23.41	0.14
IR-91171-66-3-2-1-3	121.00	121.58	10.54	25.24	182.60**	174.83**	95.75	24.71**	39.76**	35.84	14.24	3.27	22.64	0.14
IR-91167-99-1-1-1-3	115.67	71.47**	16.63	24.39	108.79	100.84	92.69	22.99**	26.88	45.50	12.24	3.33	25.25	0.13
Ayaar	115.67	70.11**	8.91	21.96	103.79	91.10	87.65	21.62	27.47	42.05	11.50	2.89	23.01	0.13
R-RHZ-14-7	115.33	76.65*	11.65	22.61	101.97	87.87	86.23	18.91	41.79**	33.30	13.91	3.14	25.05	0.13
IR-82475-110-2-2-1-2	114.33	116.92	14.37	21.89	100.04	92.85	92.84	19.51	35.88	43.57	15.63**	3.36	24.91	0.14
IR-92966-95-1-3	120.33	83.38	18.91**	23.54	118.12	110.11	93.29	21.32	24.85	53.97**	13.38	3.27	24.69	0.13
IR-91158-85-3-2-33	102.67**	82.42	19.19**	21.27	132.96**	125.39**	94.29	17.61	27.69	49.20**	13.58	3.26	23.19	0.14
IR-83668-35-2-2-2	108.00	93.85	18.52**	24.86	145.46**	132.46**	91.07	18.90	35.90	34.81	12.49	3.15	23.25	0.13
Mean	108.84	86.14	11.90	24.23	122.24	113.62	92.61	20.43	31.83	40.96	12.70	3.36	24.97	0.14
C.V.	1.21	4.54	15.08	4.70	2.80	4.11	3.42	5.08	7.88	9.82	9.85	12.30	6.17	13.45
C.D. 5%	2.15	6.40	2.93	1.86	5.59	7.62	5.18	1.70	4.10	6.58	2.05	0.68	2.52	0.03
C.D. 1%	2.86	8.51	3.90	2.48	7.44	10.14	6.89	2.26	5.45	8.75	2.72	0.90	3.35	0.04
Range Lowest	101.00	66.20	8.11	16.84	60.64	56.33	80.41	12.76	20.36	31.72	10.68	2.82	20.77	0.09
Range Highest	121.00	133.12	19.51	32.78	201.23	190.22	97.50	24.78	44.47	56.69	16.67	4.83	36.17	0.19

Table 3: Mean performance of different rice genotypes under saline condition

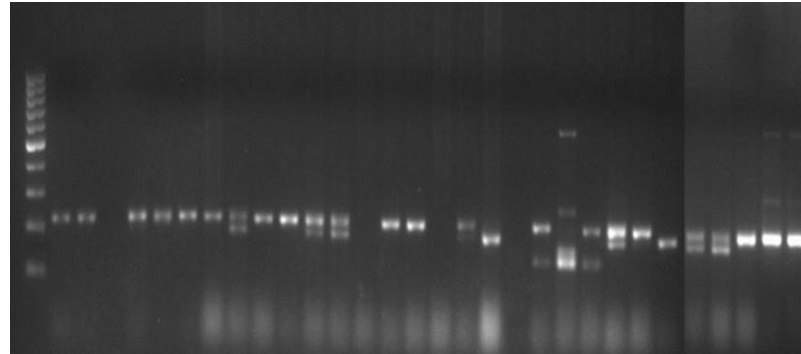
Characters	Days to 50% flowering	Plant height (cm)	Panicle bearing tillers/ plant	Panicle length (cm)	Spikelets/ panicle	Grains/ panicle	Spikelet fertility (%)	Test weight (g)	Biological yield/ plant(g)	Harvest index (%)	Grain yield/ plant (g)	Na+	K+	Na+/K+
IR-64	103.67	64.42	7.96	15.48	55.28	48.84	88.40	23.16**	28.29	38.33	10.84	4.30	26.50	0.16
IR-68144-2B-2-2-3-166	101.00	68.68*	8.10	15.14	66.05	59.85	90.62	14.11	29.08	43.68*	12.70**	3.94	25.47	0.15
IR-91167-133-1-1-2-3	89.67	71.58	8.75	19.13	166.64**	159.91	95.97*	16.50	27.89	40.39	11.27	4.35	26.11	0.17
NDR-359	100.00	68.91*	7.22	23.76*	120.07**	112.53	93.72	20.60	27.60	40.05	11.04	3.82	35.85**	0.11
RP-4993-55-14-3-5-1	93.67**	61.03**	9.57	22.31	79.51	72.29	90.95	20.45	29.70	41.34	12.29*	5.29**	25.99	0.20**
IR-91175-27-1-3-1-3	99.67	75.57	10.03	24.59**	135.66**	129.20**	95.24	13.32	26.18	40.74	10.66	4.26	37.16**	0.12
IR-91167-31-3-1-33	97.33*	71.35	12.38	21.96	125.94**	119.97**	95.27	10.96	28.47	41.91	11.93	3.55	29.20	0.12
IR-68144-2B-2-2-3-1-120	92.67**	74.55	11.16	19.92	78.41	70.61	90.09	16.25	24.33	41.64	10.12	3.27	28.28	0.11
IR-92953-49-1-3	93.67**	93.90	8.02	25.71**	93.61	87.19	93.13	22.31**	27.72	40.57	11.25	3.67	29.48	0.13
MTU-1010	91.67**	74.65	7.77	20.39	74.86	76.09	91.10	16.25	24.97	39.34	9.83	3.67	29.68	0.12
RP-BIO-5478-185M	109.67	103.38	9.55	20.88	103.85	96.90	93.31	19.63	24.77	36.50	9.02	3.48	29.18	0.12
Taramon	101.67	71.35	8.32	20.10	56.20	49.05	87.33	20.59	17.72	45.43**	8.05	3.27	29.46	0.11
IR-68144-2B-2-2-3-1-127	100.67	68.70*	10.54	20.55	101.44	94.97	93.61	20.68	22.35	39.96	8.93	4.16	23.87	0.18*
IR-84722-82-2-3-3-3	98.47*	73.36	10.74	23.64*	94.63	87.58	92.53	22.66**	30.46**	37.04	11.25	4.17	22.73	0.18*
IR-92960-75-1-3	94.67	81.49	9.70	28.98**	188.30**	180.22**	95.71*	16.77	24.86	42.12	10.46	4.20	24.25	0.17
IR-83294-66-2-2-3-2	101.33	102.89	8.50	24.92**	137.14**	128.51**	93.70	18.12	33.84**	35.09	11.88	4.00	26.31	0.15
R-RHZSM-4	101.33	60.56**	9.59	24.24**	137.62**	129.95**	94.43	19.77	39.78**	33.20	13.18**	3.73	25.65	0.15
NUD-3	97.33*	79.78	10.32	25.32**	171.86**	162.79**	94.72	19.45	30.22**	40.72	12.30*	3.91	25.96	0.15
R-RHZ-2	101.67	75.68	16.48	19.87	165.67**	158.47**	95.65*	21.02*	41.76**	43.62	18.21	3.70	26.29	0.15
Sambha mansuri	103.00	63.63**	9.69	18.81	101.83	95.97	94.27	22.29**	31.53**	39.24	12.36*	4.08	23.53	0.18*
IR-91171-70-3-3	99.00	84.29	13.15*	19.58	95.38	88.85	93.16	22.27**	26.22	44.71*	11.71	3.42	24.86	0.14
Swarna	103.00	81.66	9.29	19.94	118.49**	111.78	94.35	22.33**	38.23**	35.90	13.73	3.70	24.69	0.15
IR-91171-66-3-2-1-3	103.33	92.61	8.98	21.81	174.60**	166.67**	95.46*	22.83**	30.28**	41.28	12.50*	3.90	23.98	0.16
IR-91167-99-1-1-1-3	115.33	68.42*	13.32**	20.80	101.26	95.31	94.12	21.18*	24.88	43.02	10.70	3.78	23.74	0.16
Ayaar	109.67	67.12	8.89	19.86	101.92	95.29	93.51	19.48	23.08	37.01	8.54	4.14	23.69	0.18
R-RHZ-14-7	108.67	68.63*	9.18	19.63	95.85	88.96	92.81	18.14	34.39**	35.99	12.37*	4.04	21.73	0.19
IR-82475-110-2-2-1-2	112.33	109.78	12.24	19.51	93.32	85.53	91.62	18.37	30.17**	39.83	12.00	4.08	22.92	0.18
IR-92966-95-1-3	108.00	75.88	16.30	22.04	106.17	99.68	93.89	20.71	20.15	43.75*	8.81	4.03	24.10	0.17
IR-91158-85-3-2-33	113.33	70.32	13.70**	19.33	122.29**	115.65**	94.56	15.92	25.24	40.86	10.32	3.89	26.02	0.15
IR-83668-35-2-2-2	106.33	91.87	17.98	21.79	139.15**	130.58**	93.85	17.55	30.15**	36.40	10.97	4.07	25.39	0.16
Mean	101.73	77.20	10.58	21.33	113.43	106.64	93.24	19.12	28.48	39.99	11.31	3.93	26.40	0.15
C.V.	2.23	6.56	11.61	6.00	1.78	3.54	1.42	5.46	3.43	5.59	5.27	7.96	9.83	12.93
C.D. 5%	3.70	8.28	2.01	2.09	3.30	6.17	2.17	1.71	1.60	3.65	0.97	0.51	4.24	0.03
C.D. 1%	4.92	11.01	2.67	2.78	4.39	8.21	2.88	2.27	2.12	4.86	1.29	0.68	5.65	0.04
Range Lowest	89.67	60.56	7.22	15.14	55.28	48.84	87.33	10.96	17.72	33.20	8.05	3.27	21.73	0.11
Range Highest	115.33	109.78	17.98	28.98	188.30	180.22	95.97	23.16	41.76	45.43	18.21	5.29	37.16	0.20

(**- Highly significant value *- Significant value)

Genotyping evaluation of rice genotypes using SSR markers: Molecular analysis with SSR markers differentiate the rice genotypes into tolerant and susceptible based on banding pattern. The tolerant rice genotypes were NUD 3, IR-68144-2B-2-2-3-166, IR68144-2B-2-2-3-1-120, IR-68100-2B-2-2-3-1-127, IR-1167-31-3-1-33 and IR-91171-66-3-2-1-3 and susceptible were NDR-359, Swarna and IR-64. These three primers (RM3412, RM8049 and RM6648) showed

polymorphisms in studying genotypes because they showed different banding pattern and discriminated tolerant genotypes from susceptible (Fig 1,2,3). Those markers showed as highly polymorphic in IR29 x Pokkali for tagging salt tolerant genes as reported by Islam, 2004 ^[9] & Niones, 2004 ^[11]. Chakravarthi & Naravaneni (2006) ^[5] also reported that SSR primers had distinct polymorphism in rice while they studied 30 SSR primers on 15 rice genotypes.

L1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

**Fig 2:** Amplification of 30 rice genotypes with SSR primer RM 3412

L1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

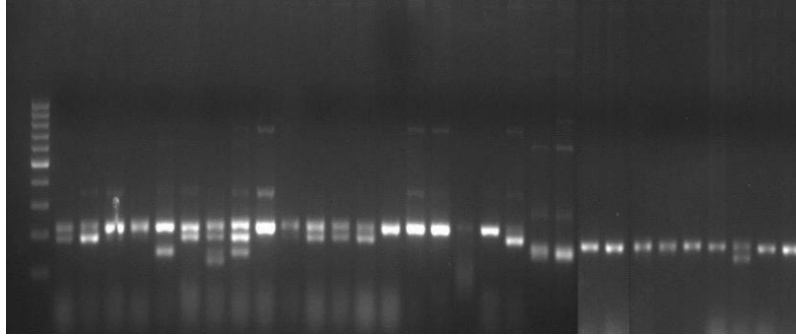


Fig 3: Amplification of 30 rice genotypes with SSR primer RM 8049

L12 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

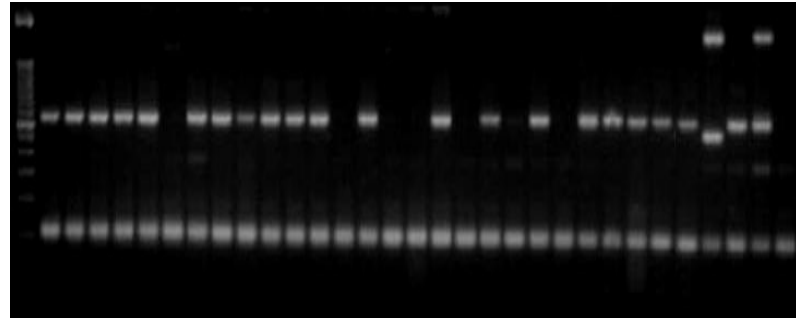


Fig 4: Amplification of 30 rice genotypes with SSR primer RM 6648

List of rice genotypes: Ladder (100 Kb), Lane 1- IR-64, Lane 2- IR-68144-2B-2-2-3-166, Lane 3- IR-91167-133-1-1-2-3, Lane 4- NDR-359, Lane 5- RP-4993-55-14-3-5-1, Lane 6- IR-91175-27-1-3-1-3, Lane 7- IR-91167-31-3-1-33, Lane 8- IR-68144-2B-2-2-3-1-120, Lane 9- IR-92953-49-1-3, Lane 10- MTU-1010, Lane 11- RP-BIO-5478-185M, Lane 12- Taramon, Lane 13-IR-68144-2B-2-2-3-1-127, Lane 14- IR-84722-82-2-3-3-3, Lane 15- IR-92960-75-1-3, Lane 16- IR-83294-66-2-2-3-2, Lane 17- R-RHZSM-4, Lane 18- NUD-3, Lane 19- R-RHZ-2, Lane 20- Sambha mansuri, Lane 21- IR-91171-70-3-3, Lane 22- Swarna, Lane 23- IR-91171-66-3-2-1-3, Lane 24- IR-91167-99-1-1-1-3, Lane 25- Ayaar, Lane 26- R-RHZ-14-7, Lane 27- IR-82475-110-2-2-1-2, Lane 28- IR-92966-95-1-3, Lane 29- IR-91158-85-3-2-33, Lane 30- IR-83668-35-2-2-2

Conclusion

At reproductive stage under control and saline conditions (pot) the most desirable genotypes for days to 50% flowering were RP-4993-55-14-3-5-1 and MTU-1010; for plant height RP-4993-55-14-3-5-1, R-RHZSM-4 and Sambha mansuri; for panicle bearing tillers/plant IR-91158-85-3-2-33; for panicle length IR-91175-27-1-3-1-3, NUD-3, R-RHZSM-4, IR-83294-66-2-2-3-2 and IR-92960-75-1-3; for spikelets/panicle IR-91167-133-1-1-2-3, NDR-359, IR-91167-31-3-1-33, IR-91175-27-1-3-1-3, IR-92960-75-1-3, IR-83294-66-2-2-3-2, R-RHZSM-4, NUD-3, R-RHZ-2, Swarna, IR-91171-66-3-2-1-3, IR-91158-85-3-2-33 and IR-83668-35-2-2-2; for grains/panicle IR-91167-31-3-1-33, IR-91175-27-1-3-1-3, IR-92960-75-1-3, IR-83294-66-2-2-3-2, R-RHZSM-4, NUD-3 and R-RHZ-2; for test weight IR-92953-49-1-3, IR-84722-82-2-3-3-3, Sambha mansuri and IR-91171-70-3-3; for biological yield/plant R-RHZSM-4, R-RHZ-2, Sambha mansuri, Swarna and IR-91171-66-3-2-1-3; for harvest index Taramon were reported highly significant in mean performance for yield and its components traits. SSR markers differentiate the rice genotypes into tolerant and susceptible based on banding

pattern. The tolerant rice genotypes were NUD 3, IR-68144-2B-2-2-3-166, IR68144-2B-2-2-3-1-120, IR-68100-2B-2-2-3-1-127, IR-1167-31-3-1-33 and IR-91171-66-3-2-1-3 and susceptible were NDR-359, Swarna and IR-64. The identified salt tolerant genotypes can be potential germplasm sources for future breeding program.

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