Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences
Volume 1 Number 2: 117-118, 2002

Evaluation of Rice Genotypes at Seedling Stage for Salinity Tolerance

Yousaf Ali, A. R. Awan and M. Y. Ashraf
Nuclear Institute for Agriculture and Biology (NIAB) P. O. Box 128,
Faisalabad, Pakistan

Abstract: Rice lines were screened for salinity tolerance at International Rice Research Institute. Out of eighteen lines , eight were found tolerant, five were moderately tolerant and rest were susceptible to high salinity. Two entries showed higher root shoot ratio and were also found tolerant. Screening at seedling stage and higher root shoot ratio provides a clue about salt tolerance potential of a genotype.

Key words: Rice, rapid screening, tolerant, seedling stage

Introduction

Salinity is a worldwide problem of being serious nature in arid and semi-arid regions where most of the developed countries happen to fall. It is one of the most important factor in reducing crop yields in most of the countries of the world, (Khan *et al.*, 1999). The reduction in yield of rice due to salinity accounts for 40-70 percent in Pakistan (Aslam *et al.*, 1995; Ashraf *et al.*, 1998). With the increase in population , effective utilization of these soils has become necessary either by reclamation or by growing salt tolerant crops. Breeding for salinity tolerance in rice requires reliable screening techniques. These techniques must be rapid to keep pace with the large amount of breeding materials generated. Screening under field conditions is difficult due to stress heterogeneity, presence of other soil related stresses and a significant influence of environmental factors such as temperature, relative humidity and solar radiation. These complexities together with the degree of salinity and reproducibility cause difficulties in developing and using reliable methods of screening voluminous material. The rapid screening technique developed at International Rice Research Institute (IRRI), by Glenn *et al.* (1997) is based on the ability of seedlings to grow in salinized solution. This piece of research was conducted to evaluate rice genotypes at seedling stage.

Materials and Methods

An experiment was laid out at International Rice Research Institute (IRRI), Philippines with eighteen entries using two trays per two replications. Seeds were heat-treated for 5 days in a convection oven set at 50°C to break dormancy. Surface sterilized seeds with benlate fungicide were placed in petri dishes with moistened filter papers and incubated at 30°C for 48 hours. Two pre-germinated seeds were sown per hole on the Styrofoam sheet having 100 holes with a nylon net bottom. The sheets were floated on distilled water. After 3 days, the fully germinated seeds were subjected to salinization solution with EC 6 dS/m for two days (Yoshida *et al.*, 1976). Salinity was increased to EC 12 dS/m by adding NaCl salt. The pH was adjusted daily to 5.0 by adding 1N NaOH or HCl. Salinization was continued for 16 days. The nutrient solution was changed after 8 days. Visual scoring of plants (SES) 1-9 scale was done (Table 1). Root shoot ratio was also calculated.

Table 1: Standard Evaluation Score (SES) of visual salt injury at seedling stage

Score	Observation	Tolerance
1	Normal growth, no leaf symptom	Highly tolerant
3	Nearly normal growth but leaf tips of few leaves whitish and rolled.	Tolerant
5	Growth severely retarded, most leaves rolled, only a few are elongating	Moderately tolerant
7	Complete cessation of growth, most leaves dry ; some plants dying	Susceptible
9	Almost all plants dead or dying	Highly susceptible

Results and Discussion

The susceptible check IR-29 expressed stress symptoms (leaf rolling and whitening) and score 9 was graded as highly susceptible where as resistant check Pokkali scored 4 and graded as tolerant. The test entries IR-552182, IR-59418, IR-65195, IR-71657, NR-1 and IR-9 also scored 4 and graded as tolerant. IR-65209, IR-71656, PSBRc-48 and NIAB-6 scored 5 and graded as moderately tolerant. Only IR-65185 scored 6 and was graded as moderately tolerant. IR-64197, PSBRc-50 and DM-25 scored 7 and were graded as susceptible. Varieties IR-64196 and Basmati -385 scored 8 and were graded as susceptible (Table 2). These results are in agreement with the results obtained by Glenn *et al.* (1997) which also confirmed the reliability of this screening technique. Visual salt injury symptoms were compared with the actual grain yield obtained in field under saline and normal soil conditions. It was found that score based on visual symptoms related well to grain yield and proved the reliability of visual symptoms of salt stress as a selection for rapid screening voluminous breeding material. It was observed that in some cases, lines with higher root shoot ratios had visual grading score 4 and 5 i.e., NR-1 and IR-65209, respectively. (Table 2). Thus root shoot ratio may be helpful in screening the rice germplasm against salinity. Such results have also been reported by Ansari *et al.* (1990), Akbar and Yabuno (1974) and Niazi *et al.* (1990).

Table 2: Rapid screening for salinity tolerance in rice at seedling stage

Code	Designation	Source	Score	Root shoot ratio
SS	IR-29	Br.Sd.	9	0.87
1	IR-55182-2B-10-3-3	SST-09	4	0.67
2	IR-59418-7B-13-1	SST-14	4	0.86
3	Ir-65185-3B-8-3-2	SST-03	6	0.95
4	IR-65209-3B-6-3-1	SST-17	5	0.95
5	IR-65195-3B-13-2-3	SST-05	4	0.65
6	IR-64196-3B-14-3	SST-15	8	0.84
7	IR-64197-3B-12-3	SST-16	7	0.87
8	IR-71656-5R-B-12PB	SST-08	5	0.75
PR	Pokkali	F1-Phyto	4	0.42
SS	IR-29	Br.Sd.	9	0.84
9	IR-71657-5R-B-12PB	SST-10	4	0.73
10	PSBRc 48	Br.Sd.	5	0.73
11	PSBRc 50	Br.Sd.	7	0.68
12	Basmati-385	NIAB	8	0.51
13	DM-25	NIAB	7	0.58
14	NR-1	NIAB	4	1.15
15	NIAB-6	NIAB	5	0.66
16	IR-9	NIAB	4	0.67
PR	Pokkali	F1-Phyto	4	0.41

It may be concluded from these results that screening at seedling stage along with root shoot ratio may provide a clue about the salt tolerance of a

genotype. This technique provides rapid screening of large number of materials and reproducible results.

Acknowledgments

Research facilities provided by IRRI to the senior author under the financial support of IAEA (T. C. Project) are highly acknowledged.

References

Akbar, M. and T. Yabuno, 1974. Breeding for saline resistant varieties of rice II. Comparative performance of some rice varieties to salinity during early development stages. Jpn. J. Breed, 25: 176-181.

Ansari, R. A. N. Khanzada and S. S. M. Naqvi, 1990. Studies on salt tolerance in rice. In Current developments in salinity and drought tolerance in plants. (eds: Naqvi, S. S. M., R. Ansari, T. J. Flower and A. R. Azmi), pp: 207-239 Published by AEARC Tandojam (Sind) Pakistan.

Ashraf, M. Y., Yousaf Ali and T. M. Qureshi, 1998. Effect of salinity on photosynthetic efficiency and yield of rice genotypes. Pak. J. Biol. Sci., 1: 72-74.

Aslam, M. I. Ahmad, I. A. Mahmood, J. Akhtar and S. Nawaz, 1995. Physiological basis of differential tolerance in rice to salinity. Pak. J. Soil Sci., 10: 38-41.

Glenn, B. Gregorio, D. Senadhira and R. D. Mendoza, 1997. Screening rice for salinity tolerance. International Rice Research Institute , Manila, Philippines. Discussion Paper No. 22;1-30.

Khan, M. J., H. Rashid, A. Rashid and R. Ali, 1999. Intervarietal variability in wheat grown under saline conditions. Pak. J. Biol. Sci., 2: 693-696.

Niazi, M. H. K., T. M. Chatta and M. Younas, 1990. Relative salt tolerance of rice during germination and early seedling development. In " Current developments in salinity and drought tolerance in plants." (eds: Naqvi, S. S. M., R. Ansari, T. J. Flower and A. R. Azmi), pp: 248-251 Published by AEARC Tandojam (Sind) Pakistan.

Yoshida, S., D. A. Forna, J. H. Cock and K. A. Gomez, 1976. Laboratory manual for physiological studies of rice. International Rice Research Institute, Manila, Philippines.