Screening of Some Traditional Rice Cultivars in Sri Lanka for Salinity Tolerance at the Seedling Stage in a Hydrophonic System

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Abstract

Salinity is a major constraint for rice production of the world. Salinity affects all growth stages of rice plant which limit growth and yield of rice. In present study sixteen traditional rice cultivars were investigated for salinity stress at the seedling stage. The experiment was carried out according to the randomized complete block design with four replicates and ten plants were included in to each replicate. Dormancy broken, surface sterilized rice seeds were germinated in distilled water for three days and they were transferred to Yoshida solution salinized up to 6 dS/m. After three days, salinity level was increased to 12 dS/m and seedlings were kept in the same conditions for 14 days. Shoot length, root length, and survival rate were evaluated on the 14th day and root dry weight and shoot dry weight were evaluated at the end of the experiment after keeping materials at 70 °C for 7days. Control experiment was carried out along with the treatment. Data were analyzed using ANOVA. Among tested traditional rice cultivars 18% of rice cultivars recorded more than 15% survival rates. *Sudu Karayal* which recorded the highest survival percentage (25%) at salinity stress can be considered as a potential cultivar for further studies in salinity tolerance at different growth stages.

Key words: Salinity tolerance, Traditional rice cultivars, Yoshida solution

Introduction

Agricultural losses caused by salinity are difficult to assess but estimated to be substantial and expected to increase with time. Secondary salinization of agricultural lands is particularly widespread in arid and semiarid environments where crop production requires irrigation schemes. Rice is somewhat tolerant to salinity at germination stage very sensitive at early seedling stage and gains tolerance during vegetative growth. It becomes sensitive during pollen development stage but increasingly tolerant at maturity stage (Pearson *et al.*, 1996). Salt tolerance is generally a sustained growth the plant in the soil environment impregnated with NaCl or other salt combinations (Gregorio *et al., 1997*). Extent of genetic variability present in a gene pool is an important factor for genetic improvement in rice. Traditional rice gene pool of Sri Lanka consists of many abiotic and biotic stress tolerant traits with diverse agronomical characters. The selected abiotic stress tolerant rice cultivars have a potential of direct introduction in to farmer fields (Djilianov *et al.*, 2005) or utilization of them in the breeding programs implement to develop abiotic stress tolerance rice cultivars (Djilianov *et al.*, 2005). Therefore, the present study was conducted to find the salinity tolerant cultivars within the Sri Lankan traditional rice cultivars.

Materials and Method

The experiment was carried out at Faculty of Agriculture, University of Ruhuna using sixteen traditional rice cultivars selected from PGRC Gannoruwa.

Experiment was designed according to the randomized complete block design with four replicates and 10 plants per each replicate. Dormancy broken, surface sterilized rice seeds were germinated in distilled water for three days and they were transferred to Yoshida solution salinized up to 6 dS/m. After three days salinity level was increased to 12 dS/m and seedlings were kept in the same conditions for 14 days. Root length and survival percentage root

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dry weight and shoot dry weight were evaluated at the end of the experiment after keeping materials at 70 °C for 7 days. Data were analyzed using ANOVA with Statistical Analysis System and Duncan multiple range test was performed.

Results and Discussion

The highest survival percentage at salinity stress was recorded by *Sudu Karayal* but the highest plant height was observed in *Polayal, Matara Wee, Sivappu Paleusithri,* respectively (Table 1). Both *Buruma Thavalu* and *Polayal* recorded the comparatively higher survival percentages as well as green plant heights. Among all the tested traditional rice cultivars *Sivappu Paleusithri* was observed significantly highest growth parameters such as plant height, root length and shoot dry matter. However, its survival percentage was less (Table 1). Hence, a single parameter such as green plant height can't be used as a tool for the screening of traditional rice cultivars for salinity. Rodrigo *et al.* (2011) reported that, salinity significantly affects on plant height, plant dry matter weight and plant survival percentage which align with the findings of the present study. There were strong correlations in between survival percentage and plant height, as well as survival percentage and root length in rice cultivars grown at the salinized solution (Data are not shown).

Among tested traditional rice cultivars *Sudu Karayal* is the best salinity tolerant cultivar at the seedling stage. Survival percentage at salinity tolerance is correlated with green plant height and root length but a single

Table 1. DMRT grouping of survival percentage, plant height, root length, root dry weight and shoot dry weight

Variety	PGRC accession number	Survival percentage α=0.0069	Green plant height (cm) α=0.0001	Root length (cm) α=0.0001	Root dry weight (g/plant) α=0.0001	Shoot dry weight (g/plant) α=0.0001
Induru karayal	3646	5^{bc}	16.2^{f}	6.2^{c}	0.0025^{bcd}	0.0083^{def}
Sudu Karayal	3665	25^{a}	16.4^{ef}	6.3^{c}	0.0035^{a}	0.0098^{cde}
Sirappu Paleusithri	3389	5^{bc}	22.6^{a}	7.9^{a}	0.0033^{a}	0.0151^{a}
Kalukanda	3713	0^{c}	16.4^{ef}	7.6^{ab}	0.0025^{bcd}	0.0069^{f}
Karayal	3463	2.5^{c}	16.9^{def}	8.4^{a}	0.0032^{ab}	0.0094^{cde}
Buruma Thavalu	3652	17.5^{ab}	18.1^{bcde}	6.1^{c}	0.0035^{a}	0.0112^{bc}
Polayal	3639	17.5^{ab}	21.7^{a}	8.5^{a}	0.0035^{a}	0.0106^{bc}
Matara Wee	3435	5^{c}	22.1^{a}	6.2^{c}	0.0023^{cd}	0.0105^{bc}
Madael Galle	3508	2.5^{c}	18.7^{bcd}	5.6^{c}	0.0025^{bcd}	0.0085^{def}
Sudu Goda Wee	3477	5^{c}	18.7^{bcd}	6.5^{bc}	0.0025^{bcd}	0.0101^{cd}
Muthumanikkam	3645	5^{c}	11.2^{g}	3.7^{d}	0.0014^{ef}	0.0044^{g}
Yakada Wee	3445	2.5^{c}	19.5^{b}	5.6^{c}	0.0024^{cd}	0.0099^{cde}
Lumbini	3638	5^{c}	19.2^{bc}	5.8^{c}	0.0025^{bcd}	0.0119^{b}
Kalu Karayal	3653	5^{c}	19.5^{b}	5.8^{c}	0.0020^{de}	0.0108^{bc}
Jamis Wee	3616	2.5^{c}	17.6^{cdef}	5.7^{c}	0.0022^{cd}	0.0082^{ef}
Dawaraddiri	3407	0^{c}	17.3^{def}	6.1^{c}	0.0011^{f}	0.0112^{bc}

parameter such as green plant height, root length or dry matter weight can't be considered as a tool to evaluate the salinity tolerance

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