Submergence Tolerance and Survival Mode of Twenty-Six Traditional Rice Accessions at the Seedling Stage

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Abstract

Rice is the staple food for more than half of the world's population. The demand for rice production is increasing with the rising population in the world. At the same time, climate change has limited the cultivable land area for rice. Among many abiotic and biotic factors, flooding is one of the major factors for reducing cultivable lands in the area where rice is being cultivated under monsoon rains. Sri Lanka is also highly affected by intermittent flooding reducing rice yield drastically and increasing the cost of production by sawing seeds several times per a crop-season. The traditional rice gene pool in Sri Lanka consists of many valuable traits though they were replaced by high-yielding improved varieties with time. In the present study, twenty-six traditional rice accessions were evaluated for submergence tolerance at complete submergence stress under 9-day and 14-day separately. Two weeks old seedlings were subjected to submergence stress and seedlings have been allowed to recover for fourteen days. Survival percentage and plant height during the submergence period compared to that of control plants was recorded. *Swarna sub 1* was included as the positive control in the experiment. According to the scoring system of IRRI for submergence tolerance, *Heenati* (3707), *Mawee* (4145), *Rathuheenati* (5486), and *Swarna sub 1* showed 100% survival rates after 9-day of submergence stress. The accessions *Murungakayan* (3489) and *Pokkali* (3562) reported 88.89% and 85.71% survival rates respectively at 9-day submergence stress. The accession *Rata wee* (3466) recorded an 87.5% survival rate at 14-day complete submergence stress and *Kaluheenati* (4621) reported 71.43% tolerance at both stress levels. There was no strong correlation between plant height and survival rates at 9-day (r=-0.096, α=0.640) and 14-day (r=-0.320, α=0.111) submergence stress conditions. Sub1A gene has been found to play a key role in submergence tolerance in rice. The seedling elongation under the submergence stress is suppressed by Sub 1A gene expression and it is the reason for a negative correlation between submergence tolerance and height gain. In the present study, such a strong correlation has not been reported indicating that the Sub1A gene expression was not prominent among the studied rice accessions since both tolerant and susceptible rice accessions had been included in the study. The selected moderately-tolerant and tolerant rice accessions can be integrated with future breeding programs for developing submergence tolerance.

Keywords: Submergence tolerance, survival mode, rice, seedling stage

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