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VARIATION OF PHASE I SALT TOLERANCE OF SELECTED RICE (*ORYZA SATIVA* L.) VARIETIES WITH THE PHENOLOGICAL STAGE

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Soil salinity represents an increasing threat to diminish rice production. Salt tolerance in different rice varieties can vary with the phenological stage. Therefore, this study was conducted to determine: (a) the variation with phenological stage (*i.e.* Phase I stress during vegetative or reproductive stages only and during both stages) of Phase I salt tolerance in four selected rice varieties (*i.e.* At303, Bg34-8, Bw302 and Pachchaperumal), and (b) possible mechanisms of salt tolerance at different stages.

Plants were grown in nutrient solutions with two salinity levels (1 mM and 100 mM NaCl) in three separate sets to impose salt stress at vegetative and reproductive stages only and at both stages. Salt stress was imposed in four 25 mM NaCl steps at two-day intervals at the respective phenological stages. Plants were harvested 24 hours after salt stress was increased to 100 mM NaCl to measure fresh and dry weights, leaf area and Na^+, K^+ and Cl^- concentrations. Percentage reduction in area of the two youngest leaves developing after imposition of salt stress relative to the area of corresponding leaves in the control treatment (*i.e.* 1 mM NaCl) was taken as the index of salt tolerance of a given variety.

When salt stress was imposed at the vegetative stage, ‘At303’ and ‘Bg34-8’ showed relatively greater tolerance (24% and 21% reductions in area per leaf, respectively) than Bw302 and Pachchaperumal (56% and 59% reductions respectively). All four varieties showed increased osmotic stress tolerance when Phase I salt stress was imposed at the reproductive stage. Notably, Pachchaperumal, which showed high susceptibility at the vegetative stage showed tolerance at the reproductive stage, with no significant ($p=0.05$) reductions in area per leaf. ‘At303’ and ‘Bg34-8’ maintained their tolerance while ‘Bw302’ showed susceptibility in both stages. ‘At303’ retained its Phase I salt tolerance even when salt stress was imposed at both stages with an unstressed period in-between. There were highly significant ($p<0.0001$) reductions in leaf net photosynthetic rate, transpiration rate and stomatal conductance and significant increases in transpiration efficiency in all varieties at both stages. In all varieties, root and shoot Na^+ concentrations increased significantly when stress was imposed at vegetative or reproductive stages. When both stages were stressed, eventhough root Na^+ concentration increased there was no corresponding increase in shoot Na^+, indicating possible Na^+ exclusion in the root induced by the stress episode during the vegetative stage. The observed variation of shoot Na^+ concentrations among the different varieties did not show a relationship with their relative salt tolerance as measured in terms of reduced leaf area growth during the stress period. These results indicate two possibilities regarding the mechanisms of Phase I salt tolerance of these rice varieties. Firstly, they rule out Na^+ exclusion from the shoot as a mechanism of tolerance and suggest intracellular compartmentation and cytoplasmic salt tolerance as possible mechanisms. Secondly, it is possible that Phase I salt tolerance is controlled by osmotic factors such as differential abilities of turgor maintenance rather than shoot and root Na^+ concentrations which may not have increased to toxic concentrations during the initial period of salt stress development that is represented by Phase I.