Thesis Title Translocation and accumulation of sodium chloride in rice plant.

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Abstract

Translocation and accumulation of salt in rice plant were studied in order to identify some physiological characters of rice which might be responsible for the observed difference in tolerance to salinity. Two varieties of rice, Pokkali and RD6, were used in this study and they were grown in nutrient solution under glasshouse conditions in all experiments.

The first experiment was conducted to determine the effects of salinization on growth and tissue contents of sodium, potassium, phosphorus and calcium. The experimental design was a split-plot design, in which variety was main-plot and sodium chloride concentration (0, 30, 60, 90 and 120 mM) was subplot. The result showed that increasing salinity reduced growth of both varieties especially at the concentration above 60 mM. The growth of Pokkali was relatively less affected than that of RD6. Tissue content of sodium was also relatively less in Pokkali than

that in RD6. However, increasing sodium chloride concentration in nutrient solution always resulted in increasing sodium content in plant tissue. On the other hand, tissue content of other ions did not show any particular pattern in the response to the increase of salinity. It was postulated that increasing salinity might proportionally raised the sodium content in leaf tissues and resulted in photosynthetic suppression.

The second experiment was conducted to determine the effect of salinization on the rate of transpiration, and concentration of sodium, nitrogen (NH_4-N), phosphorus, potassium and calcium in xylem sap. It was hypothetized that the rate of salt transported and accumulated in leaf tissues was proportional to the product of transpirational rate and concentration of salt in the xylem sap. The experimental design was a split-plot design in which variety and concentration of sodium chloride were main-plot and subplot respectively. Measurements of transpirational rates, and xylem sap collection, were made during 10.00-12.00 AM. The result indicated that increasing salinization always raised the concentration of sodium in the xylem sap, generally up to 10 to 40 mM. above that in nutrient solution. Sodium concentration in the xylem sap collected from Pokkali was 10 to 20 mM. higher than that collected from RD6. However, increasing salinity did not consistently alter the concentrations of other ions in xylem sap. The transpirational rate of Pokkali was however reduced greatly when compared with that of RD6 variety. As a consequence, the approximated value of sodium transported and accumulated in plant tissue (mg Na/g DW-day) was lower in Pokkali than that of RD6. The results implied that the greater increase in leaf resistance

which was occured with Pokkali might be the primary factor responsible for lower sodium content in the plant tissues of Pokkali as compared with that of RD6. Because of the higher water use efficiency of variety Pokkali, the growth of variety Pokkali, was apparently less affected even when leaf resistance to CO_2 diffusion was increased.

The third experiment was conducted to determine diurnal fluctuation of the rate of transpiration and ions concentrations in the xylem sap. The experimental design was a split-split plot design in which salinity level was main-plot, the varieties was subplot and time of day was sub-subplot. It was noted that the transpirational rate was highest at 12.00-13.00, which opposed to that noted for sodium and chloride concentration in the xylem sap. The osmotic concentration also showed the same pattern as those of sodium and chloride. Approximately, the transportation rate of sodium via xylem should remain almost constant through out the day.

It may be possible to suggest that the difference in tolerance to salinity observed between variety Pokkali and RD6 is related to transpirational rate, water use efficiency, and also the ability of the plant to keep salt accumulated in metabolically less active tissue.