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Physiological Response to Salinity in Rice Plant : V. Varietal difference in ion exclusion of root exposed to NaCl stress under different hydraulic pressures

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Abstract:

The objective of the study was to determine the varietal difference in ion exclusion of rice root exposed to NaCl stress under hydraulic pressure. A total of 10 varieties, namely eight indica i.e. Hsieh-Tso 12, IR4595-4-1-13, Jyothi, Kala-Rata 1-24 (KR1), Mangasa, Milyang 23, Pokkali, SEW 273-5-13 and two japonica i.e. Akebono and Asahi, were used. At the 8th leaf stage, 6~8 cm excised nodal roots (5 to 6 d old) of each variety were submerged in a test tube with Kimura B nutrient solution containing 20 or 50 mmol l⁻¹ NaCl (pH 5.5) and applied 294 or 686 kPa hydraulic pressure in a pressure chamber. The relative value, which is the ratio of ion concentration in the exudate to that in the medium, was used to indicate the ion exclusion rate. At both pressure levels, all roots of each variety exhibited ion exclusion capacity. Milyang 23 and SEW 273-5-13, both salt tolerant, and Mangasa, salt susceptible, remarkably increased their exclusion rate at higher pressure. In low or high pressure, Hsieh-Tso 12 and KR1, both salt tolerant, showed a high exclusion rate, while it was low in Pokkali and Asahi. Results showed that at the same flow rate of exudate, the ion fluxes of Na⁺, Cl⁻, and K⁺ were lower at the higher pressure. Also, at the high pressure, varieties with higher amounts of lignin in roots showed lower Na⁺ and Cl⁻ concentrations in the exudate. These results clearly suggest the presence of negative pressure in the roots, which can be provided by transpiration or osmotic adjustment, will increase the salt exclusion rate.

Keywords:

Cell-wall constituents, Hydraulic pressure, Ion exclusion, Reverse osmosis, Rice root, Salt tolerance, Varietal difference

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