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Root Architecture of Rice as Affected by Phosphorus Starvation and Salt Stress

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Abstract

Salt stress is one of the most harmful environmental factors affecting production of crops such as rice (*Oryza sativa*). In Cuba about 15 % of the agricultural land is affected. Plants exposed to high salinity often also suffer from insufficient nutrient supply. It is known that salinity and phosphorus (P) availability in soil can modify the root morphology, but only little information is available regarding their combined effects on root-system architecture (RSA). In our study we quantified the variation on RSA of two rice genotypes (INCA LP-5 and Perla de Cuba) in dependence of salt level (0 and 50 mM) and P availability (1 and 10 ppm) in mini-rhizotrons under controlled conditions. After 21 days of growth the root systems were carefully placed on a scanner and analysed with the free software GiA Roots. The results showed significant differences of the root system between both rice cultivars mainly regarding the total length, network surface area, network volume and root system extension, which all were higher in INCA LP-5 than Perla de Cuba. Phosphorus starvation and salt stress resulted in a decrease of these characteristics. A combined stress of P shortage and salinity, however, did not further alter the traits except the total root size, which was more decreased when both stress factors occurred together. Both, P starvation and salt stress also reduced considerably the shoot biomass by more than 50 %. The P concentration was rarely affected. The root architecture at early growth stage could possibly affect the adaptation to salt stress and P deficiency at later growth periods, and might be used as an indicator to select adapted genotypes.

Keywords: Nutrients, rhizotron, *Oryza sativa*, root size, salt stress

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