

Effect of Salinity on Root Characteristics of Saline Susceptible Rice Seedlings

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The root system of a plant is more exposed to and affected by soil salinity, and it requires adaptations to withstand soil salinity. The salinity effect on root characteristics determines the resistance to salinity. Studying the root characteristics of rice under soil salinity is crucial for understanding the adaptive mechanisms and identifying its responses to salinity. Saline-susceptible varieties are those that exhibit distinct responses to salinity stress. Therefore, root characteristics of a widely grown saline susceptible rice variety, Bg 300, at its seedling stage were evaluated under different levels of electrical conductivity (i.e., 0.3, 0.4, 0.75, 1.5, 3, and 4 dSm⁻¹). Rice seedlings were grown in pots inside a greenhouse at the Faculty of Agriculture, University of Peradeniya. The experiment was laid out in a completely randomized design with five replicates. One-month-old seedlings were harvested, and root length, root volume, root thickness, and root surface area were measured and analyzed. Results revealed that salinity level beyond a threshold of 3 dSm⁻¹ significantly reduced the root length of the rice plant; at 4 dSm⁻¹ salinity, root length was reduced by 36% to 3 dSm⁻¹, while significantly increasing the average root diameter of the rice plant by 43.3% ($p < 0.05$). As a result, root volume remained unaffected by salinity stress. Salinity stress may have inhibited cell division and elongation, resulting in shorter roots, while thicker roots formed due to increased lignin and suberin deposition—an adaptive response that enhances salt tolerance by limiting ion uptake, promoting ion compartmentalization, and strengthening oxidative defence. Overall, soil salinity more than 3 dSm⁻¹ resulted in activation of salt tolerance adaptations, which led to short and thick roots in rice seedlings.

Keywords: Lignin, Osmotic stress, Root diameter, Root length, Salinity