NUTRIENT USE EFFICIENCY OF RICE AS SUSTAINABLE RESOURCE UTILIZATION TO PROTECT RICE-BASED ECOSYSTEM HEALTH IN SRI LANKA

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Abstract: Plant nutrients play a significant role in the growth and development of the rice plant (*Oryza sativa* L.). Today rice cultivation including those grown the tank cascade systems, is heavily dependent on chemical fertilizers. Breeding rice varieties for improved nutrient use efficiency (NUE) is one of the most feasible ways to increase grain yields without losses to the natural ecosystems. Therefore, the study focused on the root architecture enhancing the NUE of different rice varieties under nutrient-sufficient and deficient conditions. A field experiment was conducted under nutrient-sufficient and deficient conditions with 17 rice varieties with the objective of selecting rice varieties with a high number of S-type roots, which are crucial to increase the NUE of plants. The root system was studied at the panicle initiation stage from uprooted plants. Rhizotrone structure was prepared to observe and analyse the variations in root architecture. Results of root scanning indicated that the number of S-type roots was significantly higher ($P<0.05$) in nutrient-sufficient conditions compared to the nutrient-deficient conditions. In the rhizotrone study, the root system architecture of selected rice varieties was analysed and grouped into 0°-30°, 30°-60°, and 60°-90° angles. The highest number of S-type roots in 0°-30° was observed in Bg 375. The H4 variety showed the highest number of S-type roots in 30°-60° and 60°-90° angles. The ratio between L-type roots to S-type roots of H4 at a 60°-90° angle was 1:20. The ratio between main roots to S-type roots of H4 at a 60°-90° angle was 1:175. Therefore, H4 and Bg 375 varieties have the potential to be used as parents for the breeding of rice varieties with high NUE. This research outcome will help to ensure future food security while considering safe rice-based ecosystem in the major rice growing areas in Dry and Intermediate zone in Sri Lanka.

Keywords: Food security; Nutrient use efficiency; Plant nutrients; Rhizotrone; Root system architecture