

VARIATION OF ROOT CHARACTERS IN SELECTED SHORT-DURATION RICE VARIETIES REPRESENTING DIFFERENT PERIODS OF RICE VARIETAL IMPROVEMENT IN SRI LANKA

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Root is a vital organ which absorbs nutrients and water, thus directly influencing yield determination. The objective of this study was to determine the variation of key root characters, absorption capacity of major nutrients (N, P and K) and their absorption efficiency of short-duration (2 ½ and 3-month) varieties during the rice varietal improvement from 1951 to 2010. Ten rice varieties representing different varietal groups and periods of varietal improvement were grown using soil columns (1 m height and 9 cm diameter), filled with Low-Humic Gley Soils. These included two traditional varieties (TVs, Suwandel and Kaluheenati) and eight improved varieties, [H4 (representing 1950s), H7 (1960s), Bg94-1 and Bg34-6 (1970s), Bg300 and Bg750 (1980s), Bg304 (1990s) and Bg250 (2000s)]. Root systems were recovered intact at the mid-booting stage, scanned and measurements of root length, surface area and diameter were obtained by an image analyzing software.

Per hill mean values of total root length (TRL), total root surface area (RSA), total root number (TRN) and mean root diameter (RDM) showed significant ($p < 0.1$) variation among varieties and variety groups. TRL and TSA had decreased with development of OIVs in the 1950s and 1960s. However, with the development of new improved varieties (NIV) both these parameters increased so that NIVs showed the highest TRL and TSA. NIVs had a greater mean TRN than TVs and old improved varieties (OIV). In contrast to the above-mentioned root characters, mean RDM did not show an increasing pattern with the breeding of NIVs. Total N uptake per plant showed a slight upward trend with the development of NIVs in the 1970s and 1980s. However, since 1980s, N uptake has remained stable. The NIVs absorbed 10% greater N than OIVs and TVs. In contrast to N, there were no clear trends in the uptake of P and K during the varietal improvement of short duration rice varieties. Nutrient uptake efficiency (NtUpE), i.e. uptake of a nutrient per unit root surface area, showed an increasing trend, especially for N and K, during the early stages of rice varietal improvement when OIVs were developed. However, the NtUpEs of the short duration NIVs developed since 1980s were lower than those developed in the 1970s and 1980s.

Distribution of root length among different diameter classes showed that roots of the finest diameter class (< 0.1 mm) formed 49-53 % of total root length, while the next larger diameter class (0.1 – 0.2 mm) formed 14-16 %. When averaged across different variety groups, the NIVs had greater fine (0 – 0.5 mm) and medium (0.5 – 1.5 mm) roots than the other two groups with OIVs having the lowest.

Based on the present study, it is concluded that development of NIVs of shorter life cycle durations have resulted in a shift towards greater total root length, root surface area and root number.