Validation of Known Randomly Amplified Polymorphic DNA Markers for Molecular Breeding of Salt Tolerant Rice Varieties in Sri Lanka

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Soil salinity is a major problem in Sri Lankan rice industry. Breeding of salt tolerant rice varieties is considered as the most feasible solution to address this problem. Production of salt tolerant rice varieties through conventional breeding is time consuming and difficult as salt tolerance is controlled by polygenic factors and the varietal selection using phenotypic data is not accurate. Molecular breeding is a significant improvement to conventional breeding where varietal selection is done by using DNA markers.

DNA markers are specific landmarks of genomes that can be linked to physiological traits such as salt tolerance. DNA markers that are linked to traits of interest accelerate the process of selection in breeding and reduce the amount of resources needed for breeding and provide precise results. DNA markers for various molecular breeding programmes of rice have been established by international research groups. However, their applicability in Sri Lankan rice breeding programmes must be validated prior to utilisation because DNA markers discovered internationally have to be polymorphic in the local germplasm to be used in marker assisted selection. This study was performed to validate the applicability of three previously reported Randomly Amplified Polymorphic (RAPD) DNA markers (UBC9, UBC244 and UBC251) for salt tolerance in Sri Lankan rice breeding programmes.

Six salt tolerant and four salt sensitive rice varieties were used in the study. The effect of salinity on seed germination was evaluated by soaking seeds in a saline solution and in distilled water followed by seed germination. The percentage of germinated seeds was taken as the response to salt stress. Genomic DNA was extracted from young leaves of rice seedlings and Polymerase Chain Reaction (PCR) was carried out for three RAPD markers followed by separation of PCR products by using agarose gel electrophoresis. The PCR procedure was carried out three times to see the repeatability of results with conditions reported by original work on three RAPD markers.

The rice varieties BG300, BG358, BG360, At408 and Line 4-91 showed less tolerance to saline condition in seed germination tests, whereas rice varieties At354, Pokkali, Nonabokra, Line 11-139 and Line 5-110 showed higher tolerance. All three RAPD markers produced bands. However, the DNA markers tested were not polymorphic enough to differentiate salt sensitive and salt tolerant varietal groups for rice varieties used in this study. This could be due to the genetic fixation of three RAPD loci in Sri Lankan rice germplasm that led to homozygosity/ monomorphism. Therefore, these three RAPD markers cannot be used in molecular breeding programmes of Sri Lankan rice varieties for salt tolerance. This shows the importance of validating DNA markers in local germplasm resources before using in molecular breeding programmes.