Evaluation of Submergence Tolerance in Twenty-two Rice (*Oryza sativa* L.) Genotypes based on Anaerobic Germination

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Flash flooding during germination limits direct-seeded rice in rainfed lowlands. Twenty-two rice genotypes were evaluated for submergence tolerance during germination stage. Materials included improved varieties from Rice Research and Development Institute, Bathalagoda; traditional varieties collected from local farmers; and six genotypes selected from previous studies, representing both red- and white-pericarp genotypes. The experiment was conducted from July to August 2025 at the Crop Farm, Ariviyal Nagar, Kilinochchi District, Agro Ecological Zone DL_3 on low-humic gley soils using Completely Randomized Design with three replicates. Seeds were sown in plastic containers filled with puddled soil at the depth of 5 cm and subjected to controlled submergence for 3(T_2), 7(T_3), 10(T_4), and 14(T_5) days, with non-submerged seeds as control(T_1). Germination percentage, shoot length (cm), root length (cm), and seedling vigor index were recorded 7 days after submergence. Data were analyzed using analysis of variance (ANOVA) with mean comparisons by Duncan's Multiple Range Test (DMRT) at 5% significance level in SAS 9.4. Rice genotypes were classified as tolerant, moderately tolerant, or susceptible based on germination percentage using the IRRI (2013) descriptor, and cluster analysis. Under seven days of submergence (T_3), *Pachaiperumal, Bw 372* (red pericarp) showed >75% germination and were identified as tolerant; *Mottaikaruppan karainagar, Mottaikaruppan Ariyalai, At 362, Pachaiperumal, Analvariyan, At 307, Mottaikaruppan Karainagar, Bg 379/2* exhibited as moderately tolerant under seven days of submergence (T_3) compared to < 25% germination in susceptible genotypes. *Mottaikaruppan Ariyalai, Mottaikaruppan Karaiainagar, Bg 400-6, Pachaiperumal, Bw 372* showed >50% germination and identified as moderately tolerant even under fourteen days of submergence (T_5). *Bw 372, Pachaiperumal* and *Bg 400-6* were identified as superior submergence tolerant genotypes at germination. Tolerant genotypes exhibited shoot elongation and seedling vigor, enabling better establishment in anaerobic conditions. These are valuable genetic resources for flood-prone direct-seeded rice systems and require multi-location validation.

Keywords: Anaerobic germination, Cluster Analysis, Flood tolerance, *Oryza sativa* L., Sri Lanka