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CHLOROPHYLL CONTENT AND PEROXIDASE ACTIVITY AS BIOMARKERS IN SCREENING RICE VARIETIES AGAINST IRON (Fe^{2+}) TOXICITY

H.M.M.Y. Mudalige and K. Masakorala*

Department of Botany, Faculty of Science, University of Ruhuna, Matara, Sri Lanka
**mas@bot.ruh.ac.lk*

Iron toxicity is one of the widely distributed nutritional disorders that affect rice production negatively. Therefore, the identification of efficient biomarkers for screening rice varieties with tolerance to excess Fe^{2+} is important. However, leaf bronzing has been widely used as a phenotypic biomarker in screening rice varieties against Fe^{2+} toxicity. Hence, this study aimed to investigate the applicability of chlorophyll content and peroxidase activity (POD) as biomarkers for screening rice varieties against iron (Fe^{2+}) toxicity. Two rice varieties recommended for the low-country Wet Zone (LCWZ) of Sri Lanka were identified as iron tolerant (Ld408) and susceptible (Ld365) by the initial study before being used in the experiments. Seven-day old seedlings of both varieties were exposed to different levels of Fe^{2+} [150 mg L^{-1}(Control), 450 mg L^{-1}, 650 mg L^{-1}, 850 mg L^{-1}, 1,050 mg L^{-1} and 1,250 mg L^{-1}] at pH 5.5 for seven days. A randomized block design (RBD) was employed with three replicates per treatment and control, and the experiment was carried out in a modified flood and drain hydroponic system. At the end, the total chlorophyll content and POD activity were measured. All data were analyzed through two-way ANOVA followed by Tukey's posthoc test using the statistical software MINITAB 17. Ld408 showed Fe^{2+} level-dependent significant ($p < 0.050$) increase in the total chlorophyll content and POD activity with the increase in Fe^{2+} concentration. In contrast, Ld365 indicated a significant reduction ($p < 0.050$) in the total chlorophyll content and POD in the treatments with the Fe^{2+} concentration higher than 450 mg L^{-1} and 650 mg L^{-1}, respectively. Further POD activity of Ld408 showed a lower rate in all treatments compared to Ld365. The observed decreases in the chlorophyll content and increasing POD activity of Ld365 infer that the exposed plants to Fe^{2+} treatments are under the stressful condition compared with plants of Ld408 under the same treatments. The overall results indicate the variety-specific sensitivity of both chlorophyll content and POD towards Fe^{2+} concentration, highlighting higher tolerance of Ld408 than Ld365 for the excess Fe^{2+}. According to our preliminary data, it may be possible to apply total chlorophyll content and peroxidase (POD) activity as biomarkers for screening tolerant rice varieties to Fe^{2+} toxicity at the early growth stage.

Keywords: Chlorophyll, Iron toxicity, Ld365, Ld408, Peroxidase activity