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Adaptive Strategies to Nutrient Deficiency of Doubled Diploid Citrumelo 4475: A Prospective Study Based on Structural, Ultrastructural, Physiological and Biochemical Parameters

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Abstract : Nowadays, the objective of durable agriculture, and in particular organic agriculture, is to reduce the level of fertilizer inputs used in crops. Limiting the quantity of fertilizer inputs would optimize the economical result and minimizing the environmental impact. Nutrient deficiency, particularly of a major nutrient (N, P, and K), can seriously affect fruit production and quality. In citrus crops, rootstock/scion combinations. In citrus crop, scion/rootstock combinations are used frequently to improve tolerance to various abiotic stresses. New rootstocks are needed to respond to these constraints, and the use of new tetraploid rootstocks better adapted to lower nutrient intake could offer a promising way forward. The aim of this work was to determine whether a better tolerance to nutrient deficiency could be observed in a doubled diploid seedling and whether this tolerance could be observed in common clementine scion if used as rootstocks. We selected diploid (CM2x) and doubled diploid (CM4x) Citrumelo 4475 seedlings and common clementine (C) grafted onto Citrumelo 4475 diploid (C/CM2x) and doubled diploid (C/CM4x) rootstocks. Nutrient deficiency effects on the seedlings and scion/rootstock combinations were analyzed by studying anatomical, structural and ultrastructural determinants (chlorosis, stomata, ostiole and cells and their organelles), photosynthetic properties (leaf net photosynthetic rate (P_{net}), stomatal conductance (g_s), chlorophyll a fluorescence (F_v/F_m)) and oxidative marker (malondialdehyde). Nutrient deficiency affected differently foliar tissues, physiological parameters, and oxidative metabolism in leaves of seedlings depending on their ploidy level and of common clementine scion depending on their rootstocks ploidy level. Both CM4x and C/CM4x presented lower foliar damages (chlorosis, chloroplasts, mitochondria, and plastoglobuli), photosynthesis processes alteration (P_{net}, g_s, and F_v/F_m), and malondialdehyde accumulation than CM2x and C/CM2x after nutrient deficiency. Doubled diploid Citrumelo 4475 can improve nutrient deficiency tolerance, and its use as a rootstock allows to confer this tolerance to the common clementine scion.

Keywords : nutrient deficiency, oxidative stress, photosynthesis, polyploid rootstocks
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