Ionomic analysis of citrus scion–rootstock combinations: implications for sodium chloride stress tolerance

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The objective of the present study was to assess the impact of 30 and 60 mM of sodium chloride (NaCl) stress on sweet orange cultivar Pusa Sharad (PS) grafted on 11 different citrus rootstocks, i.e., Jatti Khatti (JK), X-639 (X9), CRH-12 (C12), NRCC-1 (N1), NRCC-2 (N2), NRCC-3 (N3), NRCC-4 (N4), NRCC-5 (N5), Troyer citrange (TC), CRH-47 (C47) and Cleopatra mandarin (CM) compared with control treatment. The nitrogen (N) concentration in leaves and roots decreased by 10–40%, phosphorus (P) by 11–34%, potassium (K) by 7–49%, calcium (Ca) by 4–43% and magnesium (Mg) by 8–29% as the NaCl in the irrigation water spiraled from control to 60 mM of NaCl stress depending upon the sensitivity of rootstocks. The PS grafted on C12 and JK, N4 and N2 had greater Cl^- and Na^+ in the root as compared to leaf. However, The PS grafted on CM and X9 had least Na^+ and Cl^- concentration in leaf and root at 30 and 60 mM of NaCl concentration thus suggesting that CM and X9 rootstocks are more tolerant to salt stress than JK, C12, N4 and N2 and have potential for imparting tolerance in the sweet orange scion cv. Pusa Sharad.

Keywords: Citrus, correlation, ionomics, PCA, salinity, scion–rootstock.

from several biotic and abiotic stresses. Citrus exhibits remarkable sensitivity to salinity, with its critical salinity level set at 17 mM NaCl[2]. Elevated soil salinity has been reported to adversely affects the growth and development of citrus plants by disrupting their water and nutrient equilibrium due to the excessive accumulation of ions (specifically Cl^- and Na^+) within plant tissues[3]. The accumulation of excessive salts within the root zone leads to osmotic stress, impairing vital physiological processes and causing cellular damage[4]. Compared to non-grafted plants, grafted citrus plants show a greater degree of tolerance to NaCl stress. Sour orange rootstock has been reported to be a chloride (Cl^-) accumulator, transporting greater amounts of Cl^- into the scion leaf tissue than sodium (Na^+)[5]. Conversely, the tetrazyg rootstock effectively restricts the movement of Cl^- and Na^+ from the Valencia leaf[6]. Since salinity is emerging as a global problem, the present study reports the effect of NaCl stress on the sweet orange cultivar Pusa Sharad (PS) grafted on different citrus rootstocks.

Materials and methods

Plant materials and treatments