Characterization of the Adaptive Mechanisms of Grapevine Rootstocks to Iron Deficiency Induced by Lime Stress

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Abstract

Iron (Fe) deficiency is one of the important nutritional disorders for grapevine growing in alkaline and calcareous soils. Although Fe is an abundant element in soil, several factors limiting its availability, particularly the high levels of calcium carbonate or bicarbonate in soil, leading to a remarkable reduction in grapevine growth and productivity. The use of Fe chlorosis-tolerant rootstocks seems to be a cost-effective and efficient way to maintain Fe balance. Morphological and physiological changes occur in plants to cope with low Fe availability, including enhancement of ferric chelate reductase activity and altering root system by increasing lateral roots and root hairs. However, the mechanisms underlying these responses grapevine rootstocks are still unclear. Our study aimed to decipher the physiological and molecular mechanisms to prevent iron deficiency chlorosis under high lime conditions of different tolerant rootstocks. Our results confirmed different responses related to rootstock genotype (Fercal, 3309C) in root biomass, ferric chelate reductase activity and organic acid contents depending on direct (-Fe) or indirect (+Fe+BiC) Fe deficiency. Currently expression studies are performed to conclude on Fe uptake, transport and relocation, including their regulation signals e.g. transcription factors and phytohormones. Findings of this study will contribute to our knowledge on rootstock traits and optimize our strategy for vine nutrition.

Keywords: Fe deficiency, Chlorosis, Bicarbonate, Ferric chelate reductase, RNA-seq.