10.12 Use of Growth-Priming Agents to Extend the Growth of HLB-Affected Citrus

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Citrus greening disease, also called huanglongbing (HLB), associated with a fastidious, phloem-limited bacterium (Candidatus Liberibacter asiaticus-Las), is posing a major threat to the citrus industry due to its rapid spread and greatly reduced marketable yields. HLB-affected trees characteristically suffer from a damaged root system and nutritional disorder because of interrupted transport of photoassimilates from shoot to the root, and mineral nutrients/water from root to the shoot. In this study, greenhouse experiments were conducted to examine the effects of growth-priming agents [including root growth enhancer, trace element combination (Zn, Cu, and Mn), plant growth regulators, and sugar transporter alone or in combination] on the root growth, leaf chlorophyll, and leaf starch of HLB-affected citrus seedlings and periwinkle plants. The experiments were a factorial design with six replicates, and the growth-priming agents were biweekly applied by soil application in liquid. Visual observation of the root systems of citrus seedlings was conducted in 2 months, and the measurements of leaf chlorophyll and starch concentrations were performed in 3 months after the treatments. Periwinkle plants were harvested in 4 months, and biomass yields of root and shoot were recorded and root parameters (length, surface area, and diameter) were determined. When applied alone, root growth enhancer was most effective in promoting plant growth followed by trace element combination, as indicated by a significant increase in shoot and root biomass, particularly root length and surface area, as compared with the control. Plants that received root growth enhancer had higher contents of leaf chlorophyll. Sugar-transporter was efficient in reducing soluble starch in the leaves of Las-infected periwinkle. The combination of root growth enhancer or plant growth regulators with sugar-transporter significantly reduced leaf soluble starch and increased leaf chlorophyll contents of HLB-affected citrus. Observable recovery of root growth of the HLB-affected citrus occurred in 2 months after the treatments. These results indicate that the growth-priming agents, when applied in proper combinations, may be useful for extending the growth and production of HLB-affected citrus.

**Keywords:** Citrus greening disease, leaf starch content, plant growth-priming agents, root restoration