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—Scientific Note—

Root Growth and Nutrient Uptake of HLB-affected Grapefruit on Florida Flatwood Soils

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Root growth and development is an understudied yet essential component in Florida citrus production. Currently, the greatest challenge in the industry is the bacterial disease, Huanglongbing (HLB; citrus greening). The disease causes a slow decline and eventual death of the trees. Additionally, research has shown that one of the early symptoms of HLB is the reduction of fine root mass and root life span. With no cure for HLB commercially available and nutrient uptake of affected trees compromised due to loss of root biomass, nutrient management guidelines may need to be revised. The objectives of this study were to identify which application methods and rates lead to increased micronutrient uptake in HLB-affected grapefruit (*Citrus ×paradisi*) trees and further explore how increased nutrient rates impact root growth and development.

A large-scale field study consisting of six-year-old HLB-affected 'Ruby Red' (*C ×paradisi*) grapefruit trees grafted on sour orange rootstock was conducted at the University of Florida, Institute of Food and Agricultural Science (UF/IFAS) Indian River Research and Education Center in Fort Pierce, Florida. Eight different treatments consisting of four liquid and four solid fertilizers with, 1×, 2×, and 4× the current UF/IFAS recommended rates of boron (B), zinc (Zn), manganese (Mn), and iron (Fe) were applied. The soil, root, and leaf nutrient analyses were conducted every six months during the two-year study. Additionally, root density and titer were collected at the same time as nutrient sampling. Higher rates of B, Zn, and Mn were observed in the soil of plots treated with liquid fertilizers with 2× and 4× the micronutrient recommendations. Root and leaf micronutrient analysis revealed significant differences in B, Zn, Mn, and Fe among treatments which varied between seasons, but no consistent patterns were observed. No significant differences were observed in root density but differences in root titer were observed.

Our preliminary results showed that increased micronutrient rates increased soil nutrient levels. No consistent patterns have been established for the first two years between increased micronutrient fertilizer rates and root and leaf micronutrient content. It is important to note that the trees used in this study were grown in a high HLB incidence environment since the time they were planted. All trees showed moderate to severe HLB symptoms and were HLB positive before the experiment began. The results may show that rehabilitation of severely HLB-affected trees using overdoses of micronutrients is limited by both tree age and years the tree has been exposed to HLB. Additionally, physiological responses due to increased micronutrient fertilizers may take many years to become evident, longer than the two years that this study was conducted.

Future studies on the use of micronutrients for HLB-affected tree management are needed to reevaluate current nutritional guidelines. These studies should focus on different rates and ground application methods for macro and micronutrients as well as explore the integration of foliar nutritional sprays into nutrient management. These studies should be conducted in the field for long periods of time to account for a lag in tree response.

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