



Foliar nutrition research update

By Rhuanito S. Ferrarezi, Alan L. Wright, Kelly T. Morgan, Philip A. Stansly, Monica Ozores-Hampton and Robert Ebel

Huanglongbing (HLB) or citrus greening is endemic in Florida, resulting in billions of dollars of losses since the state's first detection in 2005. The disease induces visual symptoms in leaves and branches, while severely impacting citrus fruit yield and quality. Fibrous root density decreases from 30 to 70 percent, reducing water and nutrient uptake and demanding more frequent and improved irrigation and nutritional management considerations.

Growers are conscious that mineral nutrients can influence the severity of HLB symptoms and have been testing different nutritional programs in an attempt to maintain production until a cure or tolerant variety becomes available. The University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) has obtained promising research results as well as inconclusive responses from evaluation of nutritional programs in HLB-affected trees.

Current recommendations encourage frequent, soil-applied fertigation to improve nutrient use efficiency and reduce leaching and application cost as compared to infrequent, dry granular fertilization. More frequent fertigation programs result in higher fruit yield. Controlled-release fertilizers have been compared to readily available,

water-soluble fertilizers to evaluate the efficacy of matching nutrient supply and plant demand over time.

Foliar nutrition can be a complement to soil-applied fertilizers, which alone cannot adequately support optimal tree growth or continuously satisfy crop nutrient requirements due to nutrient mobility issues and compromised root systems. Although boron and zinc have limited mobility, and calcium, copper, iron and manganese are considered immobile, much depends on the form of the nutrient; nitrates are the most soluble followed by sulfates. Nevertheless, foliar application should be considered only as a supplement (not as a replacement) for soil-applied fertilization.

This article presents the latest updates about foliar nutrition on grapefruit at the UF/IFAS Indian River Research and Education Center (IRREC) in Fort Pierce and on oranges at the Southwest Florida Research and Education Center (SWFREC) in Immokalee.

INDIAN RIVER GRAPEFRUIT TRIAL

Enhanced foliar nutrition is considered to have potential to improve the health of trees affected by HLB. In a recent trial, IRREC researchers

tested a wide variety of foliar fertilizers in mature grapefruit groves to determine effects on tree health/growth, HLB incidence, fruit yield, quality and postharvest storage properties. This project was conducted at a commercial grapefruit grove in Saint Lucie County planted with Ruby Red grapefruit on sour orange rootstock of approximately 6 years of age.

The six tested treatments were dipotassium mono and diphosphate (DKP), potassium nitrate + urea (KN), potassium phosphite (KPite), micronutrients (M), calcium nitrate (CaNO_3) and an untreated control applied three times per year at 2 gallons/tree. All trees received the same granular and fertigation program, of which foliar applications represented only a small percentage of the overall fertilizer program.

After two years of evaluation, we observed important increases in the number of fruit per tree and fruit size, resulting in increased gross income using some of the enhanced nutritional programs (ENPs) evaluated in comparison to the control. Despite positive results for most variables evaluated, significant differences were difficult to observe due to high variability among HLB-infected trees. There were only a few individual treatment effects of the

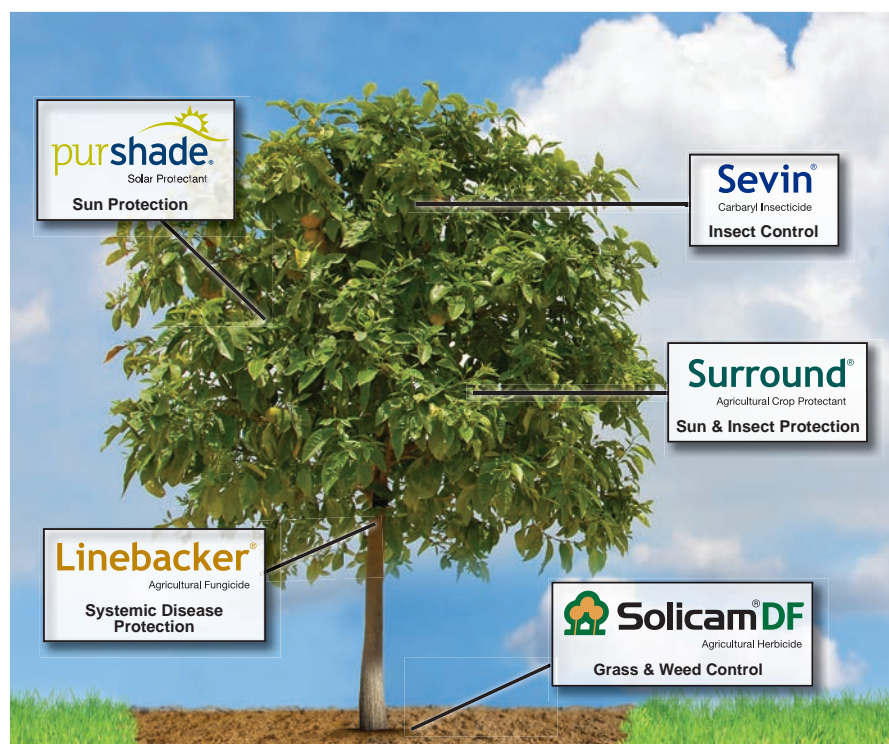
ENPs on postharvest fruit quality, suggesting that the nutritional program did not enhance nor harm fruit quality during storage.

A summary of the results of this study suggest that not all of the fertilizer components affected trees in the same way. Most treatments containing KPite tended to produce positive results in large fruit yield. The four most productive ENPs in terms of number of fruit and gross packing value contained a source of

macronutrients (KN or DKP) and KPite. Micronutrient applications significantly increased the concentrations of manganese, boron and zinc in the leaves, but the effect of these increases was not reflected in more canopy growth during the experiment.

The ENPs generally failed to enhance leaf area index and canopy growth. Commercial grapefruit production in Florida is primarily focused on the fresh market, where the price per box is related to the size of the

fruit. The recommended ENPs should be focused on increased production of large-size fruit that generates higher gross income for the producer. Taking this into account, the most prominent treatment in terms of fruit production was DKP + KPite + M, which had a significantly higher proportion of large fruit and boxes/tree than the untreated control. These results indicate that the application of this ENP has the potential to increase the profitability of grapefruit production.



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SOUTHWEST FLORIDA ORANGE TRIAL

Positive tree growth and yield effects of foliar micronutrient applications were found in a 5-year study on Valencia oranges at the SWFREC. A 5-year-old planting of Valencia on Swingle citrumelo was treated foliarly with four rates of manganese (Mn), zinc (Zn) or boron (B). The three nutrients were applied separately as Mn or Zn sulfates or phosphites, or B oxide to replicated plots, three times per year following growth flushes in the spring (March), early summer (June) and late summer (September). Current UF/IFAS micronutrient recommendations allow for application of 3 to 5 pounds of Mn, 5 pounds of Zn and 0.25 pounds of B per acre per year.

Growers have applied micronutrients multiple times per year. To simulate grower practices, the treatments based on recommended UF/IFAS annual rates were applied three times per year. The four rates applied were as follows based on 5 pounds per acre of Mn and Zn and 0.25 pounds B per acre as 1) no micronutrients, 2) half the current UF/IFAS recommended amounts, 3) full UF/IFAS recommendations and 4) twice the recommended amounts. The four treatments applied three times per year resulted in a yearly total of 0, 1.5, 3 and 6 times the current UF/IFAS recommendations.

No significant differences among treatments were found the first two years, although higher foliar applications of the micronutrients resulted in increases in canopy volumes. Over the period of 5 years, significant tree

growth and yield were observed with 3 times the UF/IFAS recommended amounts of manganese and zinc, but not boron. As indicated in Figure 1, tree growth and yield at 3 times the UF/IFAS recommendations was significantly greater than all other rates.

Therefore, it is recommended that micronutrient applications be made at least three times per year when flush leaves are present at rates 3 times the current UF/IFAS rate. For example, the current UF/IFAS recommendation of manganese and zinc is 5 pounds metallic per acre per year. Using these updated recommendations, no more than 15 pounds metallic per acre should be applied foliarly.

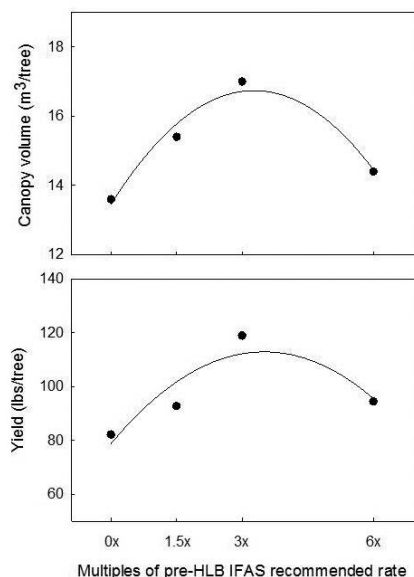


Figure 1. Relationship of foliar application of MnSO_4 at different application rates on yield of HLB-affected trees.

CONCLUSION

Short-term results from addition of foliar micronutrients within the overall fertilization program typically result in inconsistent improvement of citrus growth, yield and fruit quality. This is particularly true for micronutrient studies of HLB-affected groves. The inconsistent results stem from the relatively small amounts of micronutrients required by the trees. Long-term foliar applications of manganese and zinc resulted in greater growth and yield of oranges. However, excessive applications should be avoided as they can cause increased tree growth at the expense of reduced yield.

Therefore, leaf test concentrations must be used as a guide to foliar applications. If leaf concentrations of nitrogen, potassium, manganese and zinc are in the optimal range, current grower practices should not be changed. Research on a combination of foliar and ground-applied nutrient management recommendations for improved growth are ongoing and should result in additional recommendations when completed. 🍊

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