

Integration of nutrition and crop protection products

By Davie Kadyampakeni and Evan Johnson

In the era of citrus greening disease (huanglongbing, HLB), maintaining optimal nutrition and disease/pest management strategies is critical for avoiding adverse effects on tree performance. Use of the right fertilization rate, timing and placement are important for optimal citrus production.

In a University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) research study, soil fertilization along with application of pesticide via chemigation appeared to remediate soil, root and tree health by reducing disease pressure, elevating nutrient levels in leaves and roots, and maintaining canopy density and fruit yield. Improved fertilizer blends are commercially available along with crop protection products for mitigating pests and diseases.

STUDY DESCRIPTION

A study near the Citrus Research and Education Center (CREC) in Lake Alfred, Florida, was conducted over the past four years to determine if plant nutritional fertilizer sources coupled with specific crop protection chemicals help mitigate HLB and other citrus diseases.

The trees in the study are Valencia oranges on Swingle rootstock planted in February 2013 at a density of 290 trees per acre. The treatments are listed in Table 1 (page 19).

Program 1 is a fertilizer blend with calcium nitrate, triple superphosphate (TSP), potassium sulfate and KMag with a grade of 9-1-14, 11Ca, 7.6S, 2Mg, 0.08Zn, 0.04Mn and 0.025B applied at 180 pounds nitrogen per acre per year.

Program 2 is a fertilizer blend with N:P:K in the ratio 16:2:16 and other nutrients added to match the blend of program 1, excluding Ca and Mg.

The fertilizers were applied in four splits of 20% in February, 20% in April, 30% in June and the remaining 30% in September 2018, 2019, 2020 and 2021.

Asian citrus psyllid control was done following grower practices as needed. Additional pest control products Aliette and Velum were



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Table 1. Study treatments

No.	Nutrient Sources	Crop Protection	Micronutrients (Soil Applied)
1	Program 1	Psyllid control only	In the blend
2	Program 2	Psyllid control only	Additional sources
3	Program 1	Psyllid control, Aliette soil	In the blend
4	Program 2	Psyllid control, Aliette soil	Additional sources
5	Program 1	Psyllid control, Velum Prime soil	In the blend
6	Program 2	Psyllid control, Velum Prime soil	Additional sources
7	Program 1	Psyllid control, Aliette and Velum	In the blend
8	Program 2	Psyllid control, Aliette and Velum	Additional sources

added. Aliette was applied once per month in May, June, July and August following the manufacturer's label. Velum was applied twice in April and May each year.

ROOT DENSITY AND GROWTH EVALUATIONS

Fibrous root density was sampled

prior to the first fertilization application in January and September in 2018, 2019, 2020 and 2021. Minirhizotrons have been installed and scanned monthly since Jan. 30, 2018. Summarized cumulative root growth and dieback data have been analyzed.

Treatment effects of cumulative growth and dieback are masked by the

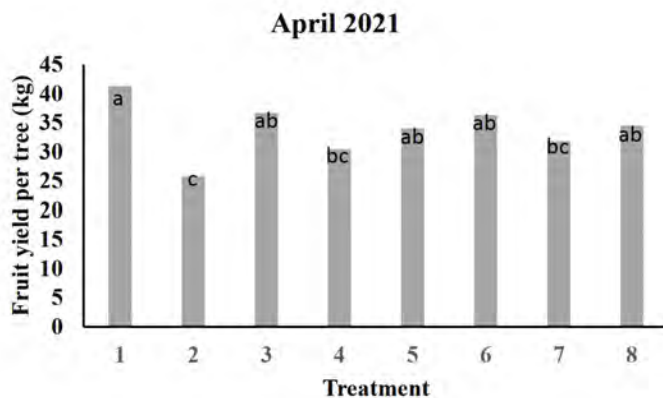
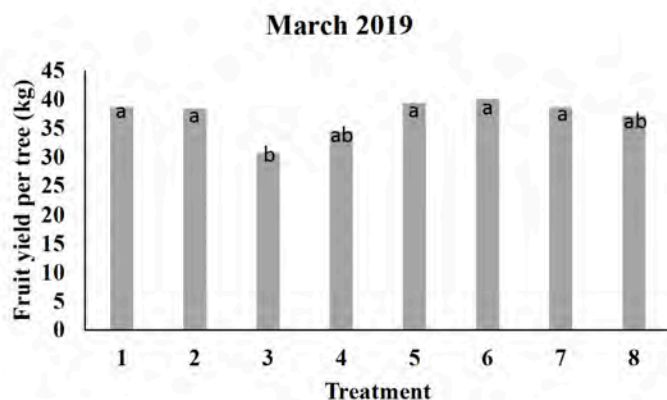
high tree-to-tree variability. It is likely that root longevity and the temporal dynamics of root flushes and dieback will provide more information about root health and function. Root densities have improved since treatments were initiated, with some treatments returning to pre-HLB root densities (>1.7 grams per liter). This is probably

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Fruit yield per tree in 2019 (left) and 2021 (right). Similar letters denote where there were no differences between treatments. No yield per tree was determined in 2020 due to the COVID-19 lockdown.

as a result of improved soil-applied fertilization along with disease/pest management tactics.

YIELD AND QUALITY MEASUREMENTS

Fruit yield and juice-quality parameters were determined in

March 2019, April 2020 (no yield per tree and juice parameters were determined in 2020 due to COVID-19 restrictions) and March 2021.

Yield differences were observed per tree basis but not cumulative yield per acre. Researchers noted a 46% to 61% decline in yield in 2020 compared to

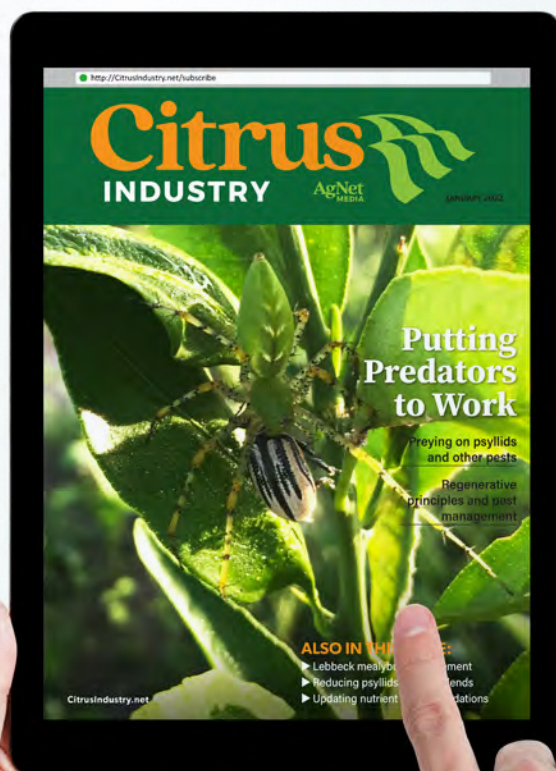
2019, which is possibly due to alternate bearing associated with late-maturing Valencia oranges.

Fruit yield per acre increased in 2021 from 41% to 60% in both blends with or without Aliette or Velum. Researchers did not observe juice quality differences in terms of pound solids per box for

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Brix, acid and ratio. However, Brix for treatments for both blends containing either Aliette or Velum were around 10.5, which is the recommended minimum for top-quality juice.

Promising results on fruit yield, juice quality, root growth and canopy density suggest the potential for improving tree performance through integrated use of nutrition and crop protection products.

OTHER RESULTS

After approximately four years of treatments, researchers have not observed any significant treatment differences in leaf, root and soil nutrient concentrations for most of the nutrients because all nutrients were kept in the optimum or high sufficiency range of leaf concentration. No differences were observed in leaf, soil and root nutrient concentration in 2018, 2019, 2020 and 2021 during spring and fall sampling times.

As expected, no significant differences were observed in canopy volume and trunk cross-sectional areas in December 2017, September 2018, March and October 2019 or March and September 2020. Dense canopies were maintained in all treatments throughout the study.

CONCLUDING SUMMARY

The results from the study are consistent with maintaining nutrient availability and tree health over time in an HLB-endemic world. Promising results on fruit yield, juice quality, root growth and canopy density suggest the potential for improving tree performance through integrated use of nutrition and crop protection products. 🍊

Davie Kadyampakeni is an assistant professor, and Evan Johnson is a former research assistant scientist, both at the UF/IFAS CREC in Lake Alfred.



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