Photo by Alex Hernandez

Figure 1. University of Florida graduate student Tanyaradzwa Chinyukwi takes canopy measurements on HLB-affected orange trees in Lake Alfred.

Effect of nutrients on canopy response and yield

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The development of an efficient nutrition program for citrus trees provides the essential elements for optimum tree growth and yield. Tree performance is reduced when an essential element is deficient, while an excessive amount leads to plant toxicity and hinders overall tree performance. In citrus production, adequate fertilization rates help improve tree growth and fruit yield (Obreza et al., 2020). This article highlights a study done to evaluate the effect of varied fertilization rates of potassium (K), calcium (Ca), zinc (Zn) and iron (Fe) on tree growth and fruit yield.

THE STUDY

The study was conducted on 5- to 6-year-old Valencia orange trees on Swingle rootstock on the Central Ridge at the Citrus Research and Education Center (CREC) in Lake Alfred, Florida, and on a southwest Flatwoods site near Clewiston, Florida. The experimental design for the orange trees was a randomized complete block factorial design.

The study included an evaluation of macronutrients K and Ca at a) 220 pounds per acre K and 40 pounds per acre Ca (1x macronutrients) and b) 440 pounds per acre K and 80 pounds per acre Ca (2x macronutrients). Micronutrients (Zn and Fe) were evaluated at a) 5 pounds per acre (1x micronutrients), b) 10 pounds per acre (2x micronutrients) and c) 20 pounds per acre (4x micronutrients) based on the current University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) fertilization guidelines (Obreza and Morgan, 2008; Morgan and Kadyampakeni, 2020).

The treatments were as follows:

- Treatment 1: Control with standard fertilization via fertigation of nitrogen, phosphorus, sulfur, molybdenum and copper according to UF/IFAS guidelines. No extra potassium, magnesium, calcium, manganese, iron, boron and zinc.
- Treatment 2: Standard fertilization + 1x macronutrient (MA) + 1x micronutrient (MI)
- Treatment 3: Standard fertilization + 1x MA + 2x MI
- Treatment 4: Standard fertilization + 1x MA + 4x MI
- Treatment 5: Standard fertilization + 2x MA + 1x MI
- Treatment 6: Standard fertilization + 2x MA + 2x MI
- Treatment 7: Standard fertilization + 2x MA + 4x MI

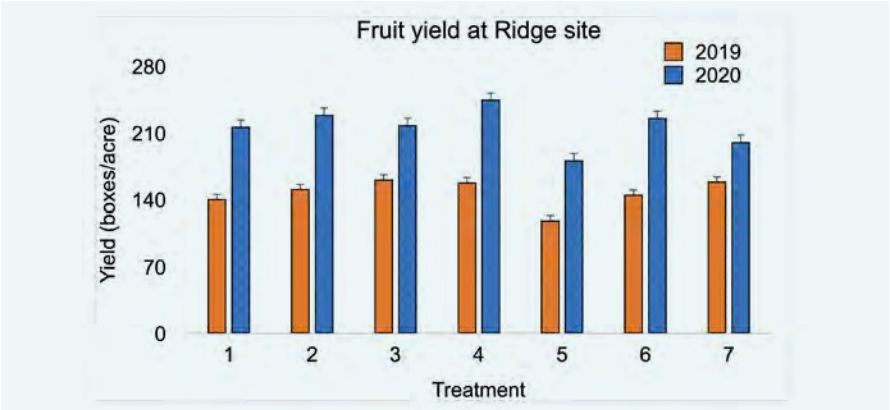

Figure 2. Fruit yield at Ridge site as a function of different fertilizer application rates on HLB-affected Valencia orange trees.

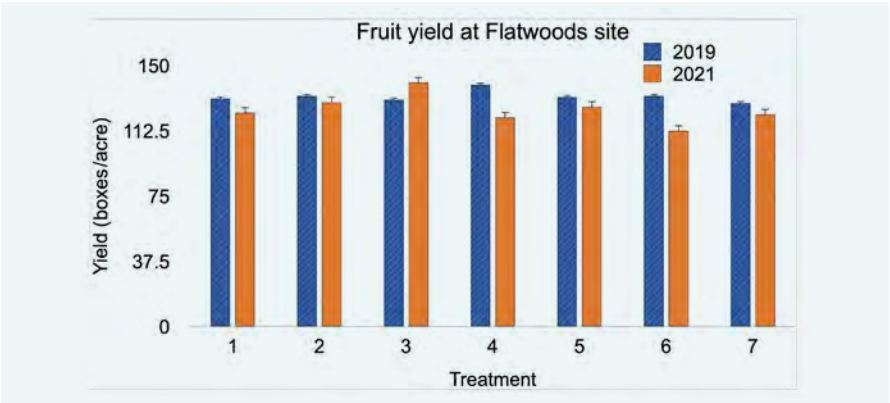

Figure 3. Fruit yield at Flatwoods site as a function of different fertilizer application rates on HLB-affected Valencia orange trees.

A tree growth assessment was done by measuring the trunk cross-sectional area (TCA) and canopy volume (see Figure 1, page 16). Fruit yield was evaluated yearly in March and April of 2019, 2020 and 2021.

THE FINDINGS

The results obtained showed that TCA and canopy volume at the Ridge site increased from May 2019 to July 2020. Trees that received Treatment 4 showed the greatest TCA and canopy volume. Similarly, there was an increase in fruit yield at the Ridge site from 2019 to 2020 with Treatment 4 having the greatest yield and yield increment in 2020 (see Figure 2). This can be attributed to increased potassium availability at an increased fertilization rate, thus enhancing functions such as fruit formation and resulting in increased crop yield (Obreza, 2003). Additionally, an increase in micronutrient fertilization rates helped raise fruit yield.

However, TCA and canopy volume decreased from May 2019 to July 2020 at the Flatwoods site. Treatment 1 (control) had the greatest TCA and canopy volume. Yield at the Flatwoods site also decreased from 2019 to 2021 (Figure 3). This shows that further observations are needed to confirm the yield trends since this was within two to three years of starting the experiments, and nutrient responses take some time in young trees.

In conclusion, overall tree performance improved at a moderately higher fertilization rate for macronutrients and at very high fertilization rates of the micronutrients Zn and Fe. However, these results need to be confirmed for an additional two years to account for temporal variability and alternate bearing.

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