An update on citrus nutrient BMP research and irrigation management of HLB-affected citrus trees

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Citrus Expo 2024 Seminar
August 21-22, 2024

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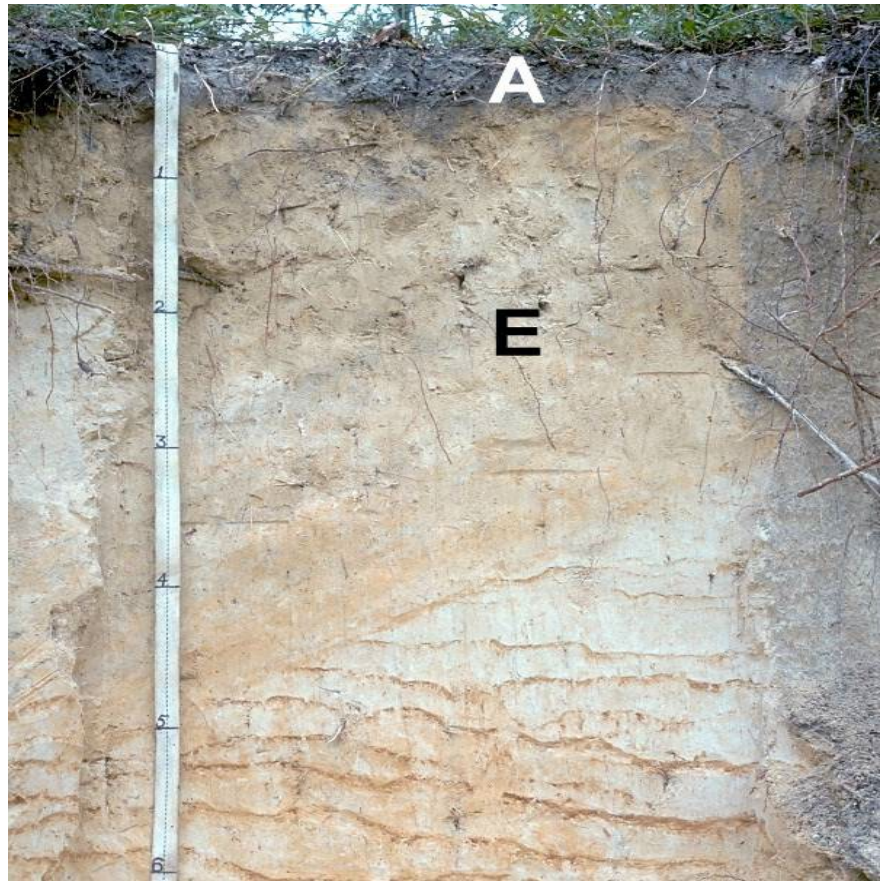
Take home messages

- About 50% of soil NH_4-N was less than the topsoil (0-6 inch) and only 25% accumulated in the middle (6-12 inch) and bottom (12-18 inch) soil horizon.
- Soil NO_3-N showed on average about 30% between consecutive soil horizons indicating probable soil nutrient leaching from the topsoil horizon.
- Soil NO_3-N showed no treatment effect but more accumulated in the 0-6-inch soil layer than the 6-12-inch and 12-18-inch soil depths.
- High to excess levels of P but optimum to high for N in Cold Hardy Citrus in leaf analysis.
- Our findings indicated that there were no yield differences regardless of treatment effect and nutrient application rates, but fruit quality analysis is still under way.
- Improved water management resulted in better root mass, water/nutrient use for HLB-affected citrus trees.

The case for citrus best management practices

- 100% endemic HLB situation in contrast to pre-HLB era
- Sandy soils (>95%) with
  - low organic matter
  - low cation exchange capacity
  - low water holding capacity



Profile of Astatula sand, an Entisol, showing surface (A) and subsurface (E) horizons.

Sources: SL253, Obreza and Morgan, 2008

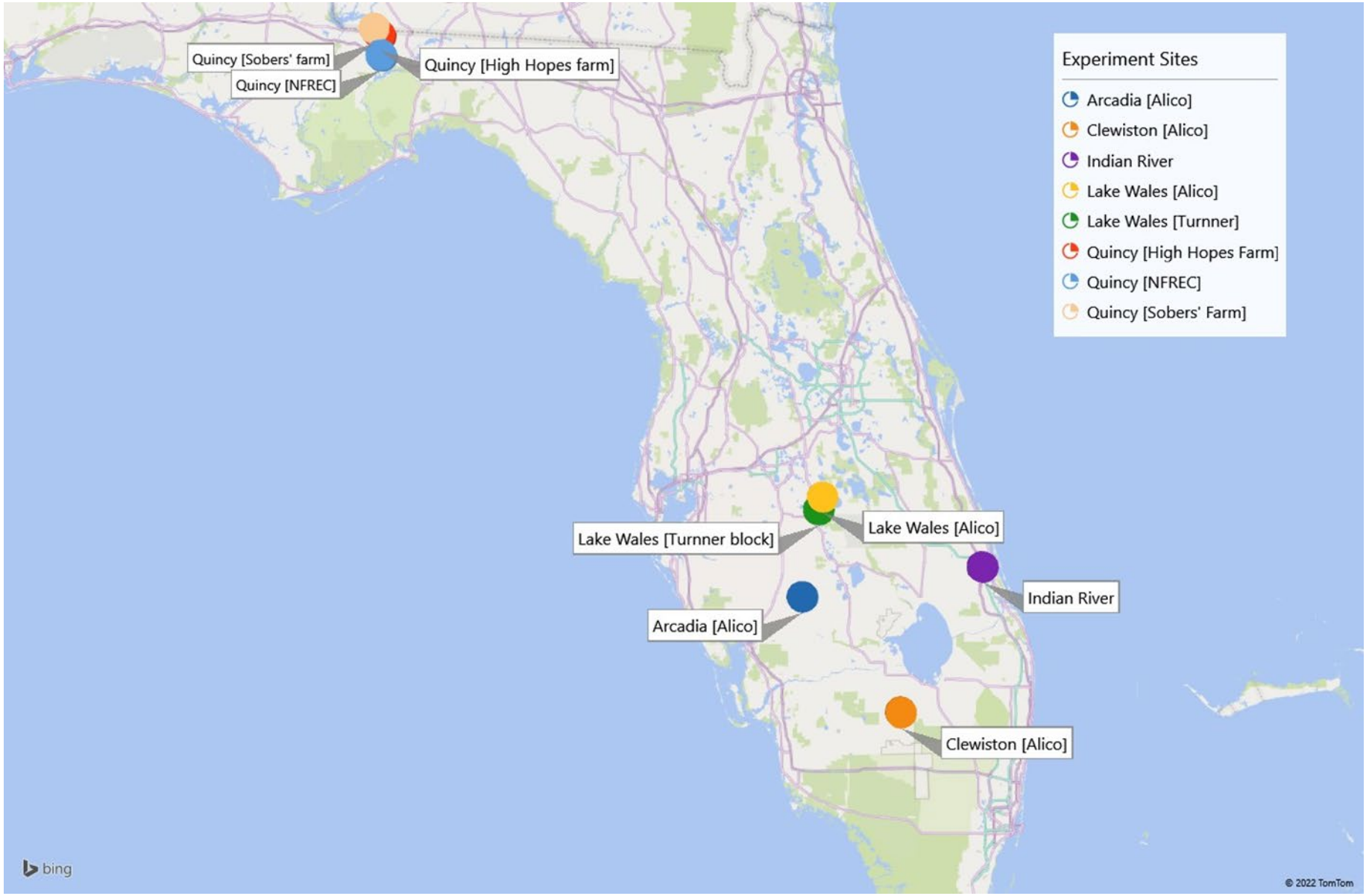
The case for citrus best management practices (2)

- Severe defoliation
- Root loss in young presymptomatic and symptomatic trees (30-38% root loss) and fully symptomatic trees up to 80% root loss

Schematic of root loss.

Source: Graham et al. 2013; Johnson et al. 2014; 2021; Photo Credit: UF/IFAS Communications

Project sites



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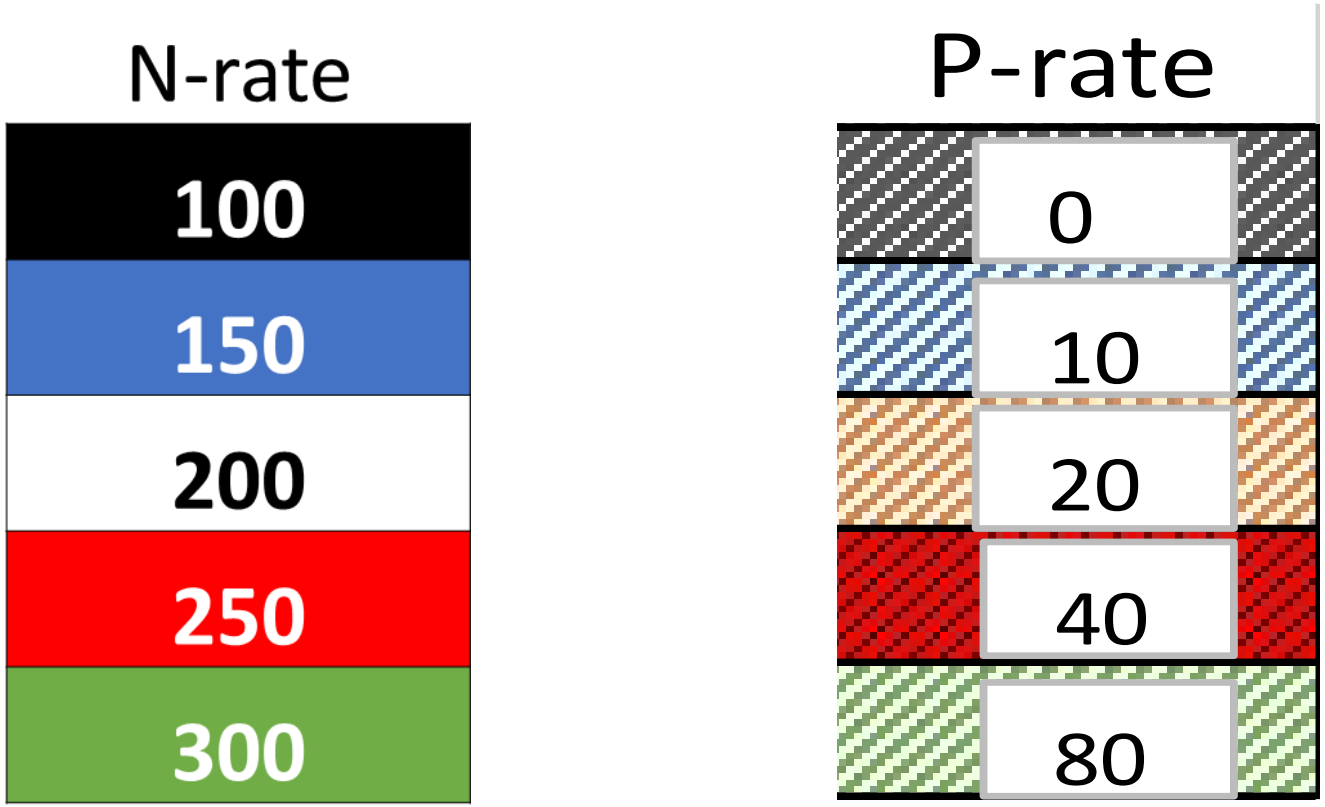
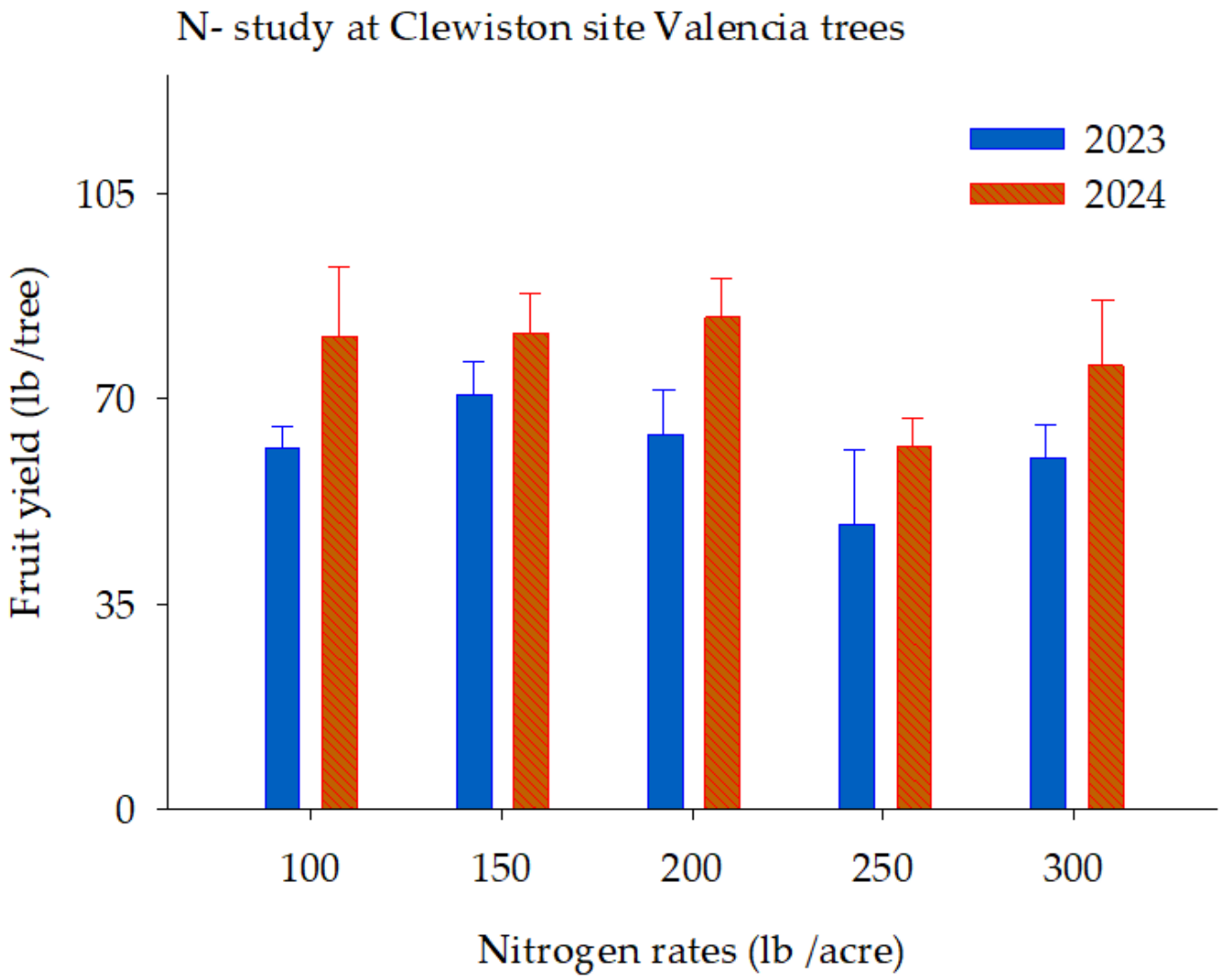
Fertilizer treatments



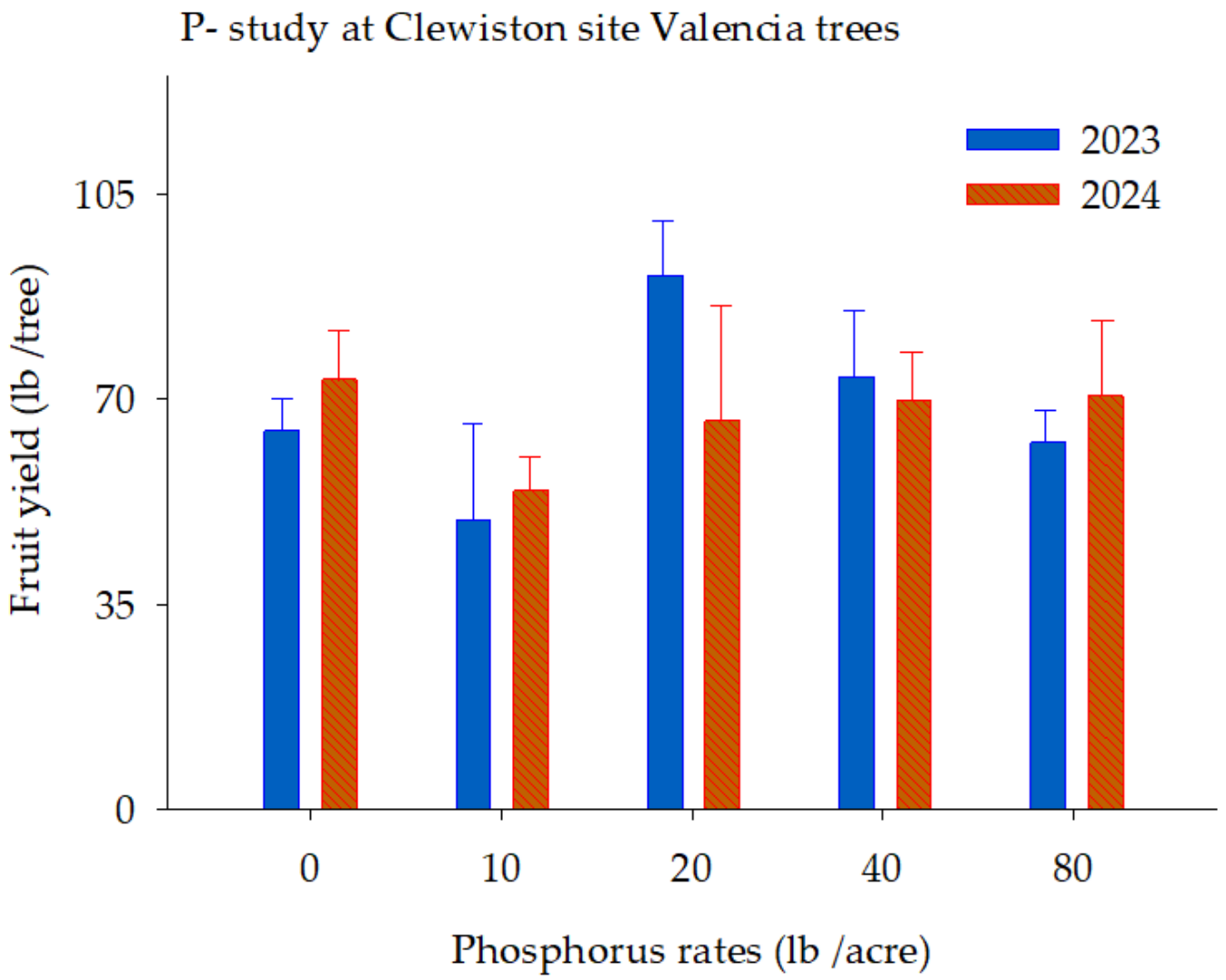
Each treatment is replicated 5 times.

Impacts of N rate on fruit yield – ‘Valencia’ orange



Increases in the second year but no differences between treatments.

Impacts of P rate on fruit yield – ‘Valencia’ orange

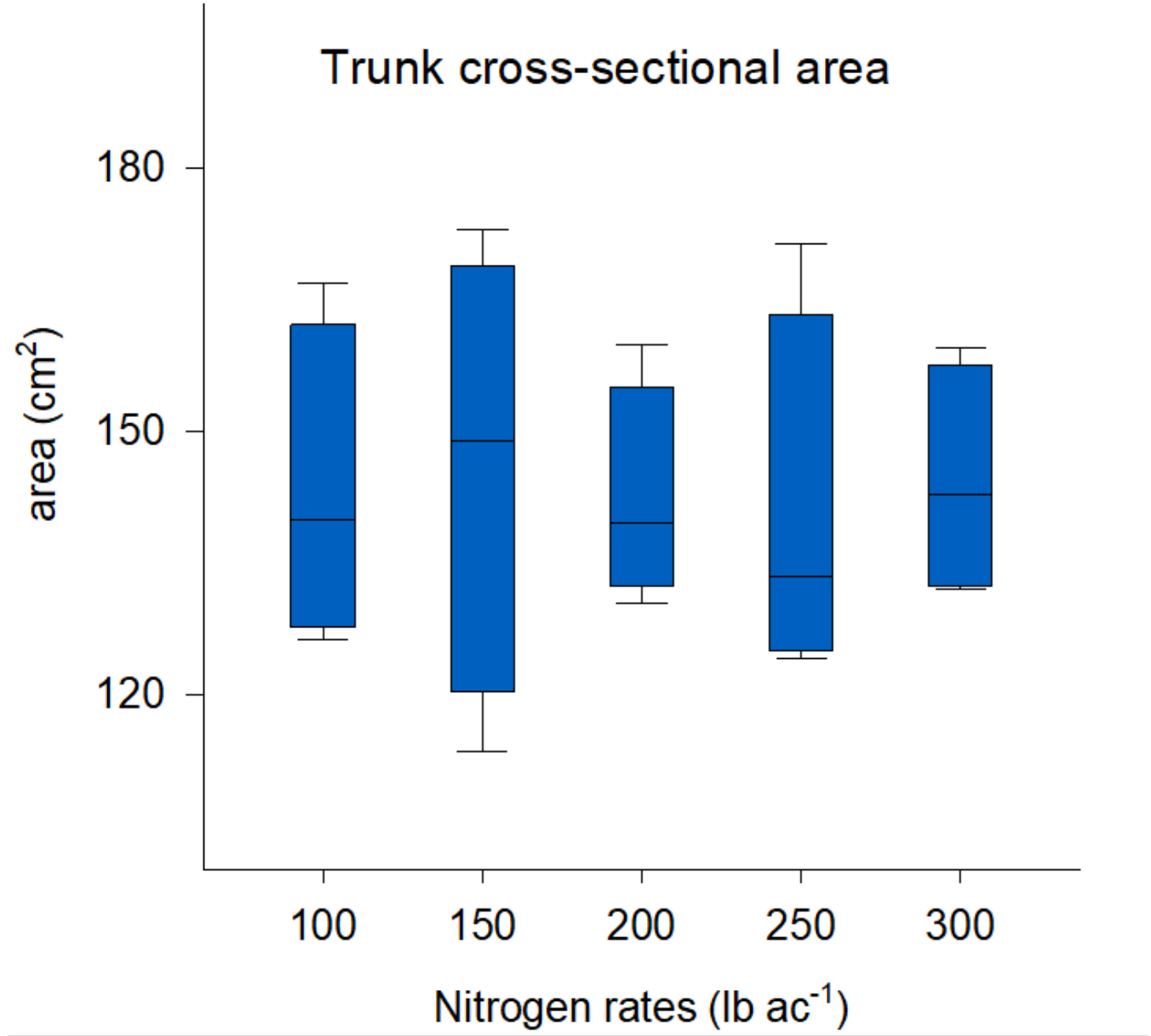


No change in fruit yields from first to second year and no differences between treatments.

Impact on canopy size

- No differences in canopy volume and trunk size.
- No differences in fruit yield in the first 2 years.

Some of these results may take about 36 months to show effect in HLB-affected trees.



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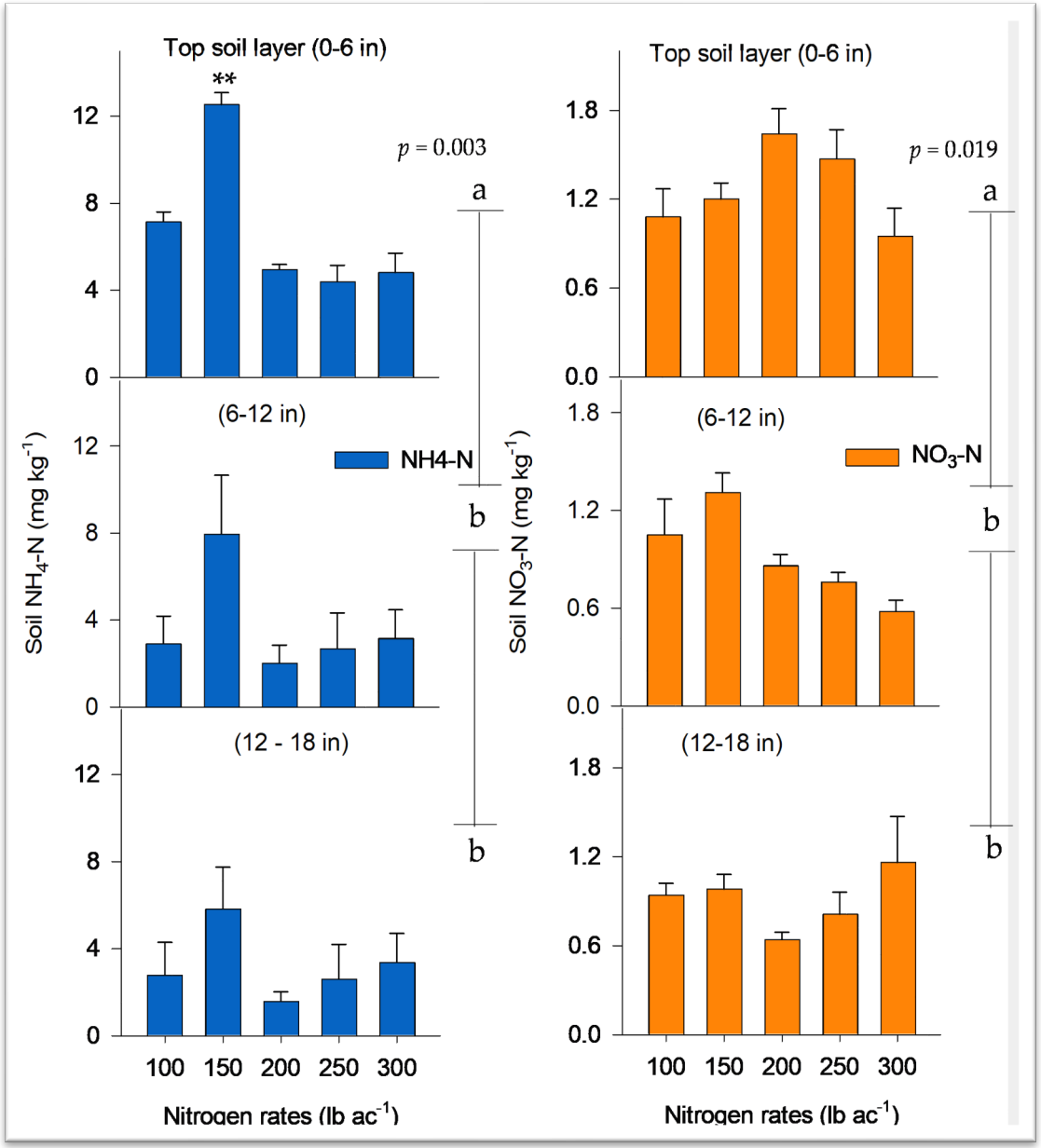
Soil nutrient analyses for ‘Valencia’ orange in Clewiston, FL

- Soil nitrogen (NH_4-N and NO_3-N) nutrient concentration at three soil horizons.
- Most ammonium and nitrate N retained in the top 0-12 inches.



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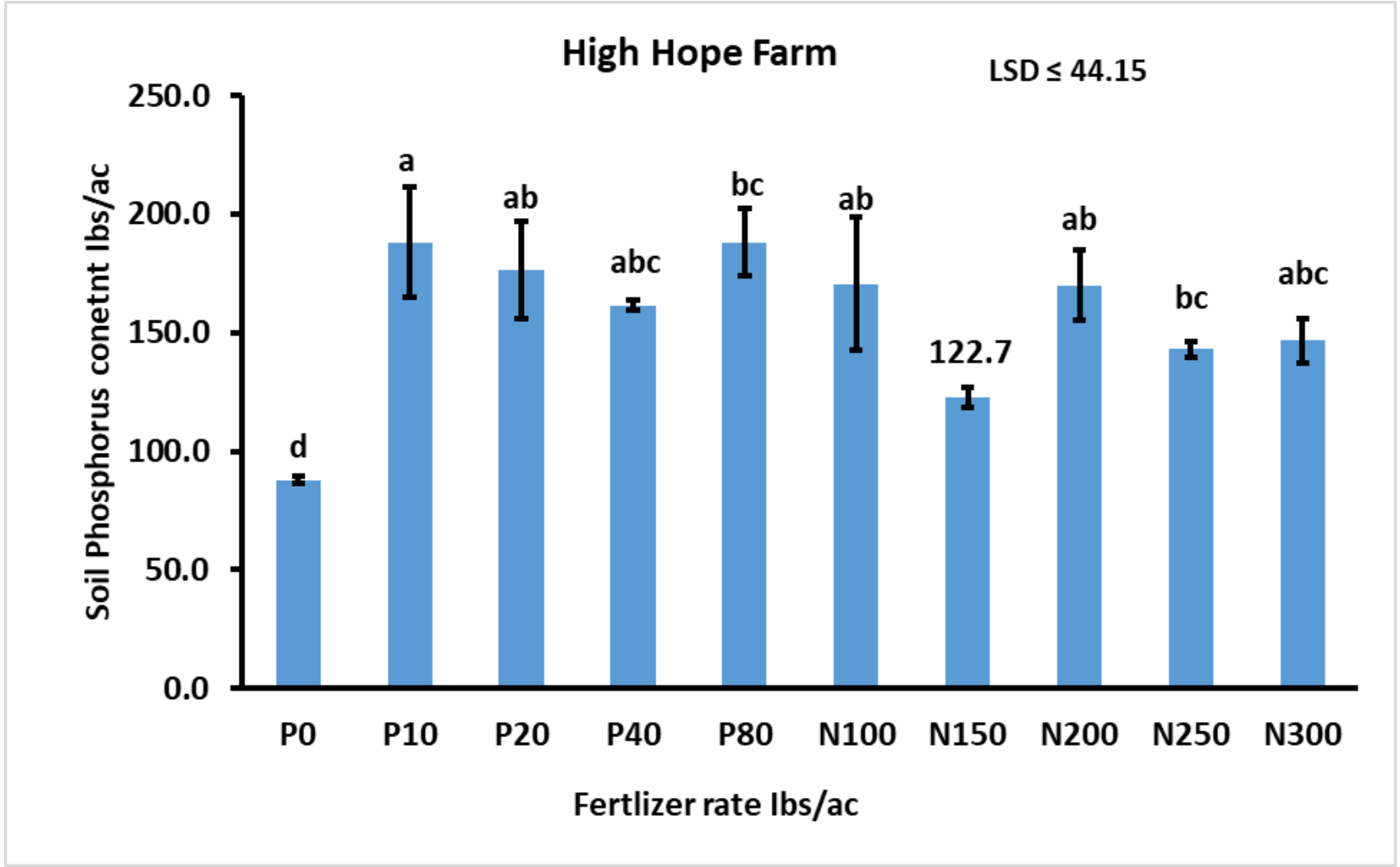
Soil phosphorus concentration in Cold Hardy Citrus

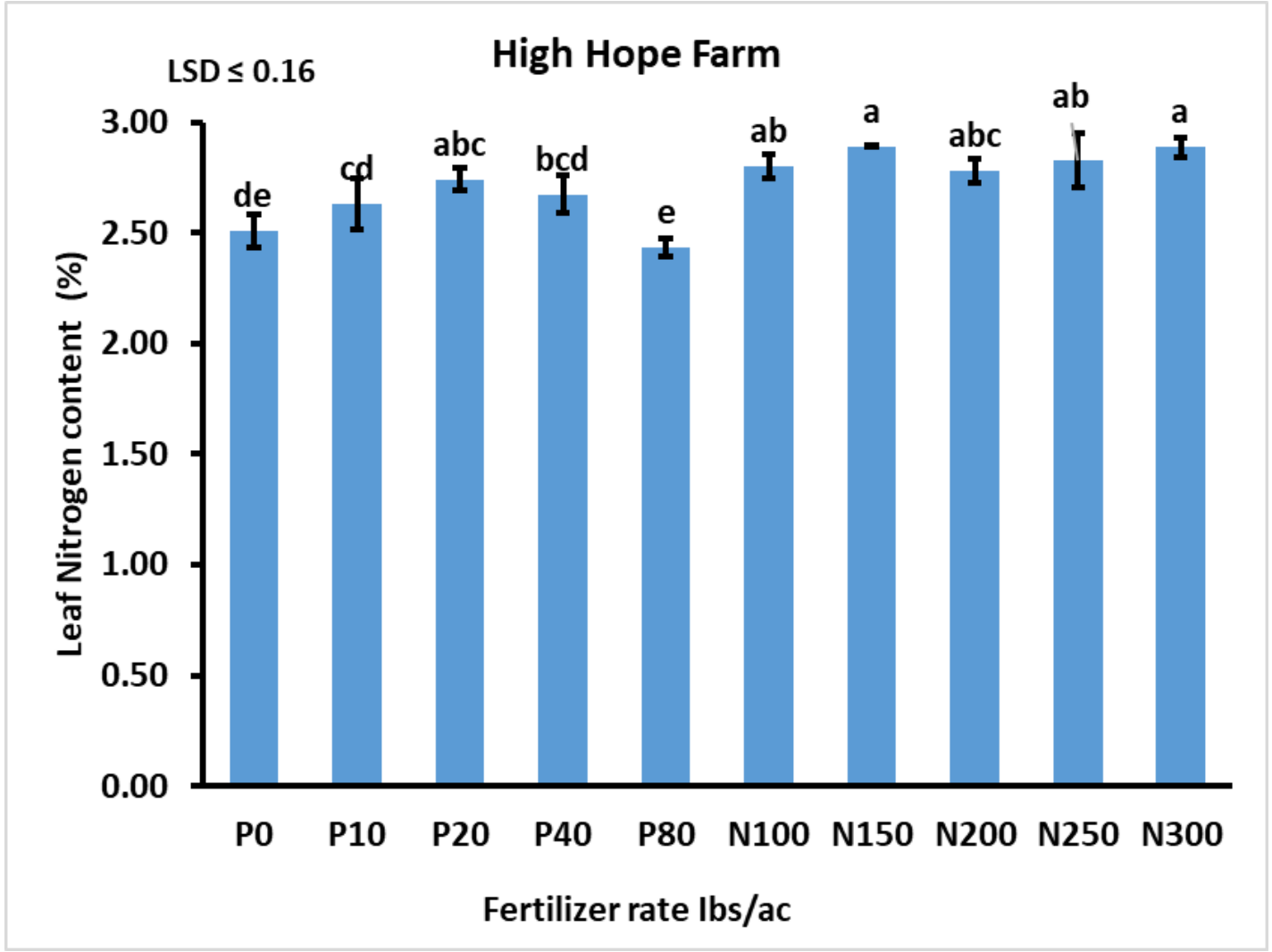
- Soil P levels in varying P and N rates.
- Soil P levels high even in controls probably due to residual



Credit: M. Shahid, UF/IFAS NFREC

Leaf nitrogen concentration in Cold Hardy Citrus

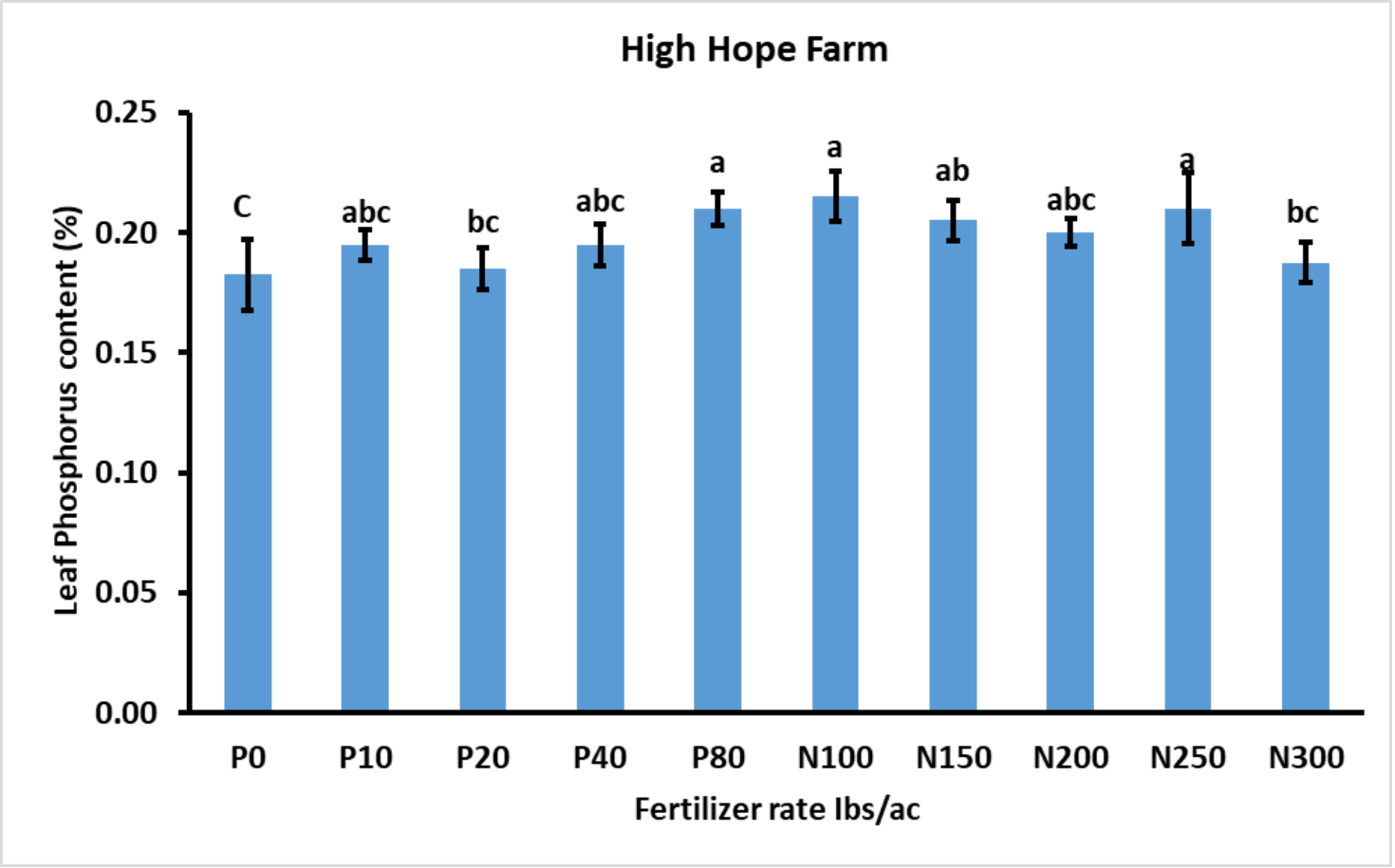
- Leaf N levels in varying P and N rates.
- Leaf levels mostly in optimum range.



Credit: M. Shahid, UF/IFAS NFREC

Leaf phosphorus concentration in Cold Hardy Citrus

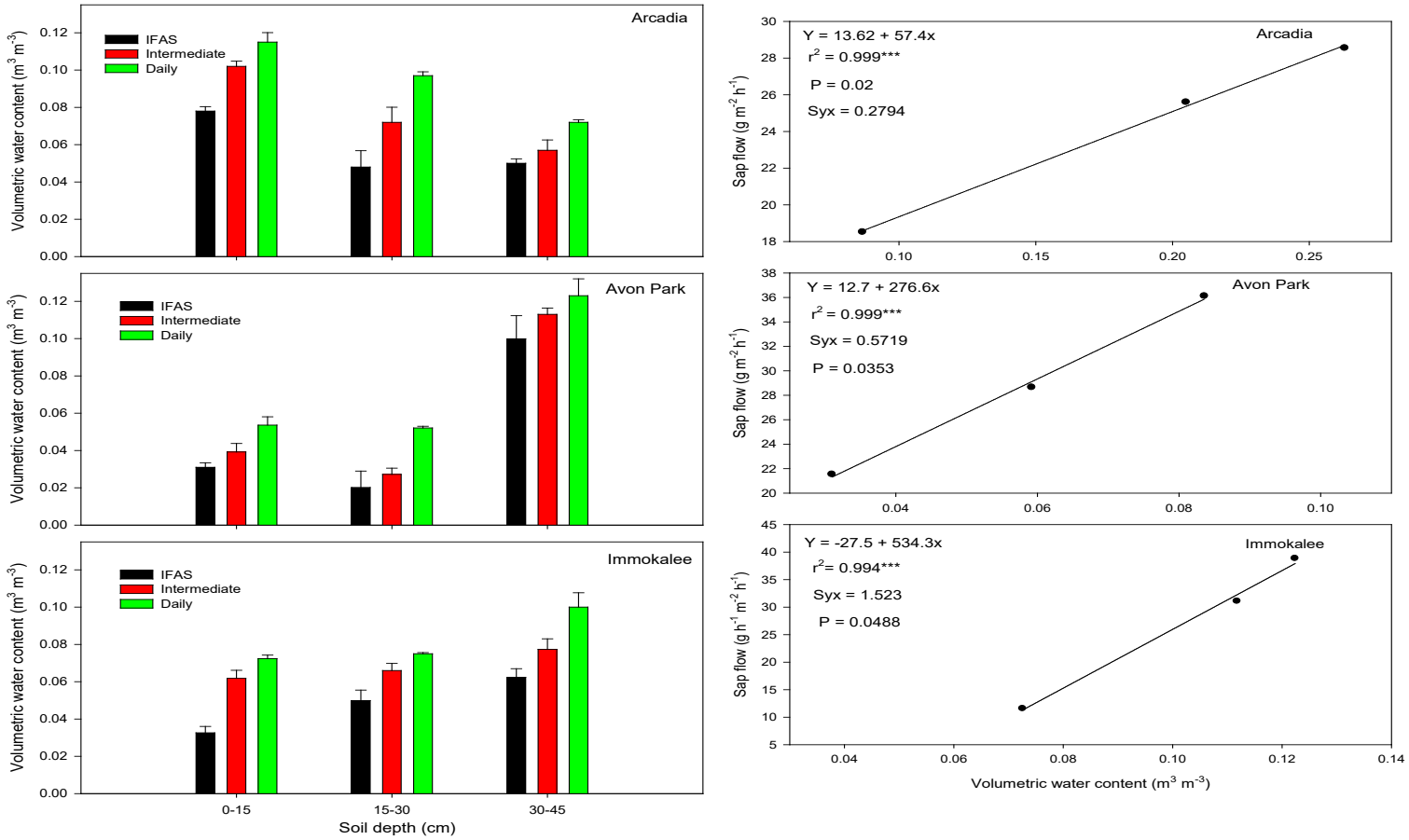
- Leaf P levels in varying P and N rates.
- Leaf P levels mostly in very high or excessive range including in the controls.



Credit: M. Shahid, UF/IFAS NFREC

Coupling plant-based sensors and soil moisture sensors

- Keeping water in the top 0-30 cm improved water use for HLB-affected trees.
- Greater moisture content beyond the root zone (at 45 cm).
  - Immokalee: could be due to capillary rise since the soils have a high-water table
  - Avon Park: could be due to deep percolation because soils are well drained.



Moisture contents (left) and significant relationships with sap flow (right)

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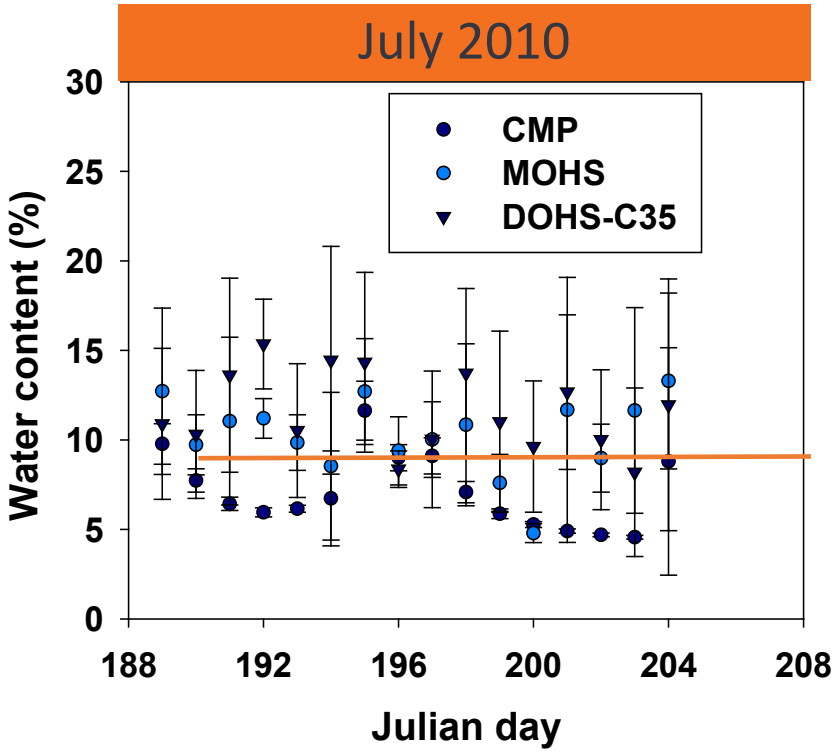
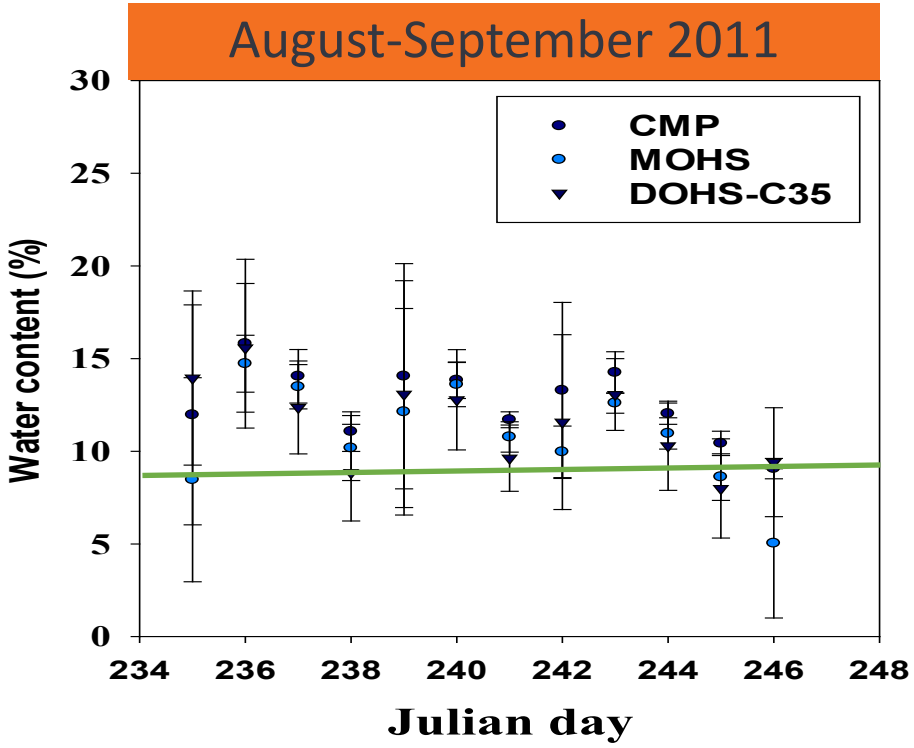
For more information, Hamido et al. 2017a. HortScience 52(6):916-921.

Soil moisture sensor data for irrigation management





CMP-Conventional microsprinkler irrigation
MOHS-Microprinkler open hydroponic system with daily irrigation and weekly fertigation
DOHS-C35-Drip open hydroponic system with daily irrigation and fertigation

Soil moisture at 10 cm (4-inch) depth was close to or slightly above field capacity in the range of 7 and 15%.

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Source: Kadyampakeni et al. 2014a, b. Soil Science Society of America Journal 78:645–654; 78:1351–1361.

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Acknowledgements

- Dr. K. Morgan and Dr. T. Obreza (UF/IFAS, SWESD, Gainesville)
- Dr. A. Wright, Dr. L. Rossi and Dr. M. Ritenour (UF/IFAS IRREC)
- Dr. M. Shahid (UF/IFAS NFREC)
- Dr. Kim Morgan (UF/IFAS SWFREC)
- Dr. M. Zekri, C. Oswalt, D. Williams
- My Lab Team Members: Drs. A. Atta, S. Kwakye, Ghoveisi; W. Pihilla, J. Prieto, D. Sambani and several visiting scholars.

- Florida Department of Agriculture and Consumer Services for funding
- ALICO Inc for collaboration
- Cold Hardy Citrus Growers in the Florida Panhandle including Hope Farm

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Acknowledgements

Water and Nutrient Lab At CREC

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https://crec.ifas.ufl.edu/people/faculty/davie-kadyampakeni/publications/

Scan the QR code to learn more about the Kadyampakeni research program.

Photo Credit: T. Weeks, UF/IFAS CREC

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Thank You

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