Workshop on BMP Research and Extension Priorities for Horticultural Crops Temperate and Tropical/Subtropical Fruits

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Background

Temperate Fruits

- Blueberry, ~3,000 A, estimated worth $39 million.
  - Range in farm size <5 to >100 acres, mean = 20 acres.
  - Counties: Alachua, Polk >, Hillsborough, Hernando, Hardee and others.
  - Rapid growth of the industry.
- Stone fruit
  - Stone fruit (peach, nectarine and plum), approx. 300 acres.
  - Muscadine grape (approx. 300 acres), and persimmon (approx. 200 acres).
  - Counties throughout north and central Florida

Situation – temperate fruits

- Grown on sandy soils.
- Irrigation source – deep wells into the Floridian aquifer.
- Blueberry pine bark soil system is excessively drained with low nutrient holding capacity.
- There has been no documentation on nutrient leaching or ground water contamination from the temperate fruit production systems now used.
- High and low volume irrigation is needed for optimum production.

Blueberry irrigation and nutrient management

Soil management systems

- 1° Pine bark bed culture*
- 2° Amended soil culture
- 3° Soil culture

Irrigation systems

- Low volume systems
  - microsprinkler
  - drip
- High volume overhead
  - Irrigation and cold protection

- Irrigation management*
  - Mostly subjective – monitor on-farm weather conditions
  - Crop phenology, critical periods -
    - Fruit development period (Feb-May)
    - Post pruning (June-Oct.)
- Nutrient management*
  - Leaf analysis
  - Predominant N sources are ammonium salts and urea. Some slow release forms used.
  - Forms – dry, granular blends
  - N rate range for soil cultures, 90-120 lbs/N/A/yr (split 5 appl.)
  - N rate range for pine bark culture, 150-225 lbs/N/A/yr (split 8-10 appl.)

Peach irrigation and nutrient management

Irrigation systems

- Low volume systems
  - microsprinkler
  - drip
- High volume overhead
  - Irrigation and cold protection
- Irrigation management
  - Mostly subjective – monitor on-farm weather conditions
  - Crop phenology, critical periods -
    - Fruit development period (Feb.-May)
    - Summer growth flush

Nutrient management

- Leaf analysis
- Soil analysis
- N rate 100 lbs/N/A/yr (split 2-3 appl.)

Major challenges/issues and vision for temperate fruit crops

Challenges

- Developing an improved soil management system for more extensive rooting in blueberry.
- Managing irrigation more precisely in pine bark blueberry system to prevent leaching of nutrients.
- Developing more precise information on plant nutrient needs and application methodology.

Vision

- Improved soil management systems increase root depth and extensiveness.
- More precise ET-based and soil moisture management systems for soil/pine bark soil irrigation management.
- Development of improved nutrient application rates, sources, and materials to reduce nutrient losses.

Current BMP research on temperate fruits

- Effect of irrigation rate and method on nutrient leaching in blueberry pine bark soil system.
- Effect of nitrogen rates on blueberry leaf nutrient levels, production, and fruit quality.
- Effect of pine bark amended soil, pine bark beds, and soil planted blueberry plants on rooting depth and water use efficiency.
- Use of *V. arborium* as a rootstock for commercial blueberry production.
- Determination of blueberry plant crop factors for use in ET-crop factor irrigation management of blueberry production.
- Hybridization of deeply rooted *Vaccinium arborium* with Southern Highbush blueberry to improve water use and nutrient use efficiency of commercial blueberry plants.
- Preliminary feasibility and technology for zero discharge blueberry production systems.

Strategic areas of future research with good to excellent potential for improving BMPs for blueberry

Approach to improve water use efficiency and quality	Research area
Investigate media and soil nutrient and water holding characteristics.	Infiltration, water and nutrient holding capacity of pine bark and alternative soil systems for blueberry.
Investigate water use.	Low-volume irrigation rates and scheduling (ET, crop factor, soil moisture probes).
Nutrient use and fertilizer rates and frequencies.	Leaf nutrient levels for optimum production. Plant nutrient demand/use with crop growth stage. Investigate nutrient application rates, materials, and methods.

Strategic areas of future research with good to excellent potential for improving BMPs for stone fruit and muscadine grape

Approach to improve water use efficiency and quality	Research area
Nutrient use and fertilizer rates and frequencies.	Leaf nutrient levels for optimum production. Plant nutrient demand/use with crop growth stage. Investigate nutrient application rates, materials, and methods.
Investigate water use.	Low-volume irrigation rates and scheduling (ET, soil moisture probes).

Background
Tropical/subtropical fruits

- Tropical/subtropical fruit, ~13,000 A, estimated worth ~$137 million.
- Range in farm operations, <1 to >1,000; mean = 50 acres, mode ~ 10 acres.
- Counties: Miami-Dade (85%), Lee, Palm Beach, Broward, Collier, Indian River, St. Lucie, Martin, Charlotte, Pasco, and Sarasota.
- The major crop is avocado (~7,400 acres).
- Secondary crops include longan (850 acres), mango (600 acres), banana (500 acres), mamey sapote (500 acres), lychee (500 acres), guava (400+ acres), papaya (400 acres), carambola (200 acres), pitaya (100 acres), and passion fruit (50 acres).
- Numerous minor crops (e.g., sapodilla, black sapote, white sapote).

Situation – tropical/subtropical fruits

- Grown predominantly on excessively drained crushed limestone-based soils and well drained sandy soils.
- Irrigation source – wells into Biscayne aquifer, Miami-Dade Co. (MDC); shallow wells and canals, other counties.
- A water quality survey of 6 public supply wells in the agricultural area of MDC found very few samples with elevated nitrate levels and detected 15 pesticides well below drinking-water standards. A leaching study of avocado, lime, and carambola groves in MDC found no significant leaching of nitrates or phosphates into the ground water under these groves.
- High and low volume irrigation systems are needed for optimum production.

Irrigation and nutrient management surveys found

Irrigation management

- Varies widely among farming operations.
- >50% wells capped and cased.
- ~67% farms have high volume and >75% have low volume irrigation systems.
- 26-50% utilized some type of soil moisture monitoring; 60-73% measured or monitored rainfall.
- 10% used water meters, 20% on-farm rain gages, 53% mulched, 24% kept records, 72% irrigated mainly in the morning or evening, and 30% have used the services of the USDA Mobile Irrigation Lab.

Nutrient management

- Varies widely among farming operations.
- 19% use soil analysis.
- 29-50% use leaf analysis.
- Granular NPK most common followed by NK fertigated.
- 60% of the producers use organic sources of nutrients (e.g., sludge, manures).
- Secondary and minor elements foliarly applied. Chelated iron soil applied in water.

Reported nitrogen, phosphate, and potash fertilizer application rates and frequencies for selected bearing tropical fruit crops.[z]

	Annual pounds per acre per year			
Crop	Nitrogen	Phosphate	Potash	Appl. per year
Avocado	36-288	4-72	36-288	2-6
Mango	54-288	0-72	192-288	2-3
Carambola	8-445	0-167	0-501	1-6
Lychee	24-320	12-360	24-360	1-8
Longan	5-242	14-91	41-273	1-6

Z, Li, Y., J. Crane, B. Boman, and C. Balerdi. 1999. Fertilizer management survey for tropical fruit crops in south Florida. Proc. Fla. State Hort. Soc. 112:172-176.

Major challenges/issues and vision for tropical/subtropical fruit crops

Challenges

- Improving irrigation management to prevent leaching of water and nutrients.
  - ET/crop factor development
  - Practical soil moisture monitoring
- Improve fertilizer recommendations
  - Develop/refine leaf nutrient analysis-based fertilizer management
  - Improve fertilizer formulas and application methodology

Vision

- ET/crop factors in conjunction with reliable/accurate soil moisture monitoring and crop phenology decrease potential leaching.
- Refined and developed leaf nutrient analysis based fertilizer management reduces annual application rates but optimizes production.
- Access to improved fertilizer formulas/blends and application methodology reduces rates and/or application frequencies.

Current BMP research on tropical/subtropical fruits

- Improving water quality at the watershed level by targeting high-return stakeholders – avocado and palm production.
- Foliar acid-iron applications to prevent iron deficiency in avocado, lychee, and carambola grown in calcareous soils.
- Development of transgenic, ringspot virus-resistant, papaya for the Caribbean Region.
- Effect of preplant papaya fertilizer rates on production.
- Effect of soil moisture and evapotranspiration monitoring on papaya growth, development, yields, and fruit quality.
- Demonstration of foliarly applied phosphorous acid on phytophthora root rot of avocado.
- Minor use pesticide registration (Inter-regional Project No. 4).

Strategic areas of future research with good to excellent potential for improving BMPs for tropical/subtropical fruit

Approach to improve water use efficiency and quality	Research area
Continue to investigate water use on avocado and carambola. Initiate water use studies on lychee, longan, mamey sapote, guava, banana, etc.	Low-volume irrigation rates and scheduling (ET, crop factors, soil moisture probes).
Nutrient use and fertilizer rates and frequencies for all tropical's (except avocado and mango).	Leaf nutrient levels for optimum production. Plant nutrient demand/use with crop growth stage. Investigate nutrient application rates, materials, and methods.
Continued IPM development.	Biological control, biopesticide, efficacy work, and registration trials.

Summary combining temperate and tropical/subtropical fruit crops

Major challenges/issues and vision for temperate, tropical/subtropical fruit crops

Challenges

- Improve soil/land preparation to facilitate water and nutrient management.
- Improving irrigation management to prevent leaching of water and nutrients.
  - ET/crop factor development
  - Practical soil moisture monitoring
- Improve fertilizer recommendations
  - Develop/refine leaf nutrient analysis-based fertilizer management
  - Improve fertilizer formulas and application methodology

Vision

- ET/crop factors in conjunction with reliable/accurate soil moisture monitoring and crop phenology more precisely manage plant irrigation needs and decrease potential leaching.
- Refined and developed leaf nutrient analysis based fertilizer management reduces annual application rates but optimizes/maintains production.
- Access to improved fertilizer formulas/blends and application methodology reduces rates and/or application frequencies.

Gaps in knowledge – temperate, tropical/subtropical fruit crops

- Most crops - optimum leaf nutrient levels as a major component for fertilizer management.
- Most crops – crop factors to be used along with ET as a major component for irrigation management.
- Most crops – organic production systems.
- Identification/development of reliable, efficient, economic, and accurate soil moisture monitoring probes.
- Most crops – enhance/develop integrated pest management systems.

Recommendation for priority funding – temperate, tropical/subtropical fruit crops

- Most crops – determination of optimum leaf nutrient levels to use as a major component for fertilizer management.
- Most crops – development of crop factors to be used with ET as a major component for irrigation management.
- Most crops - Improve efficiency of irrigation application methods in difficult-to-manage soil types or conditions.
- All crops – identify or develop reliable, efficient, economic, and accurate soil moisture monitoring probes.
- Most crops – enhance or develop integrated pest management systems.
- Some crops – development of organic production systems.