



Developing High Tunnel Systems to Address Critical Needs in Florida Vegetable Production

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December 10, 2019



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USDA-NRCS EQIP High Tunnel System Initiative

(<https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/?cid=stelprdb1046250>)

“High tunnel - an enclosed polyethylene, polycarbonate, plastic, or fabric covered structure that is used to cover and protect crops from sun, wind, excessive rainfall, or cold, to extend the growing season in an environmentally safe manner” (NRCS)

- ✓ Extend the growing season
- ✓ Improve plant quality and soil quality
- ✓ Reduce nutrient and pesticide transportation
- ✓ Improve air quality through reduced transportation inputs
- ✓ Reduce energy use by providing consumers with a local source of fresh produce



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Growing Interest in High Tunnel Production in FL

- Use of high tunnels in fresh fruit and vegetable industry

2001: ~0 acre reported → 2013: ~186 acres
(Hochmuth and Toro, 2014)

~88 acres for growing tomato, pepper, strawberry, cucumber, lettuce, leafy vegetables, and other vegetables and herbs.

- During 2010-2015, 110 high tunnels were constructed with EQIP assistance in FL (payment cap at 2,160 ft² per high tunnel; data source: NRCS office in FL)
- **Growing interest in organic high tunnel vegetable production in FL**

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Cultiva - A high tunnel farm in Jennings, FL

- Established in 2016
- 150 acres under 800 high tunnels for conventional production
- 70 high tunnels for organic production added in 2018

<https://www.growingproduce.com/vegetables/new-venture-has-baby-leaf-greens-booming-on-the-east-coast/>

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High Tunnel Organic Vegetable Systems Projects

Agriculture and Food Research Initiative - Food Security



- Dr. Eleni Pliakoni
- Dr. Cary Rivard

- Dr. Jeffrey Brecht
- Dr. Jerry Bartz
- Dr. Xin Zhao

Reducing losses of organic and other locally-grown produce while improving quality and extending shelf life

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- ✓ Tomato and spinach (two cultivars of each)
- ✓ High tunnel vs. open field
- ✓ Grafting for tomato production
- ✓ Microclimate conditions
- ✓ Plant growth and health
- ✓ Yield components and season extension
- ✓ Produce quality at harvest and during postharvest
- ✓ Economic analysis



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Foliar Disease Assessment

Open Field



High Tunnel



May 8, 2016

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Foliar Disease Assessment

Open Field



High Tunnel



May 26, 2016
Early blight (*Alternaria solani*)

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Foliar Disease Assessment

Open Field



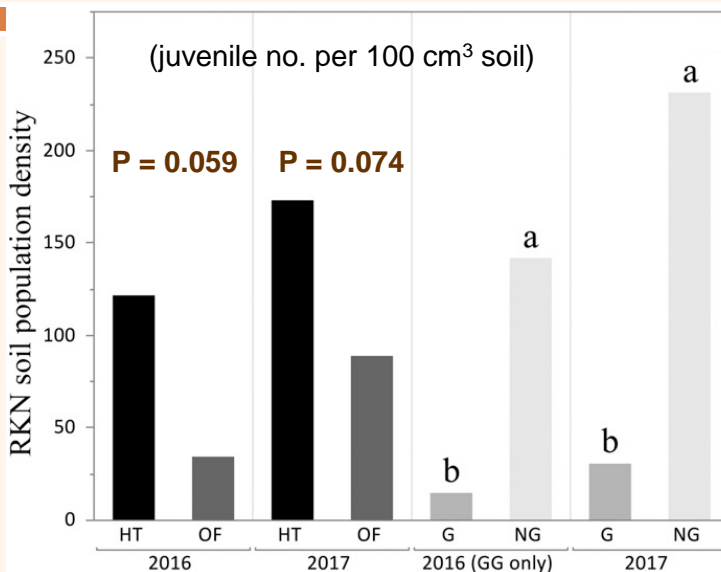
High Tunnel



June 13, 2016
Early blight (*Alternaria solani*)

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Root-knot Nematode Assessment



(Frey et al., 2019)

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Use of Grafted Tomato Plants

- Grafted tomato production may be more profitable in high tunnel vs. open field systems under organic production.
- The economic feasibility of grafted tomato production is also dependent on tomato cultivar and market price.



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High Tunnel Organic Vegetable Systems Projects



Organic Agriculture Research and Extension Initiative

Partnership to explore integrated systems for sustainable high tunnel organic vegetable production in the Southeast region

Adapting and expanding high tunnel organic vegetable production for the Southeast

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Research Team

University of Florida

- ❖ **Dr. Xin Zhao** (Horticultural Sciences)
- ❖ **Dr. Mickie Swisher** (Family, Youth and Community Sciences)
- ❖ **Dr. Zhifeng Gao** (Food and Resource Economics)
- ❖ **Dr. Nicholas Dufault** (Plant Pathology)
- ❖ **Dr. Amanda Hodges** (Entomology and Nematology)

Other Collaborators

- **Florida Organic Growers**
- **Georgia Organics**

University of Georgia

- **Dr. Timothy Coolong**
(Horticultural Science)
- **Dr. Juan Carlos Díaz-Pérez**
(Horticultural Science)

Florida A&M University

- **Dr. Alex Bolques**
(Extension Crop Specialist)

USDA-ARS

- **Dr. Jesusa Legaspi**
(Research Entomologist)

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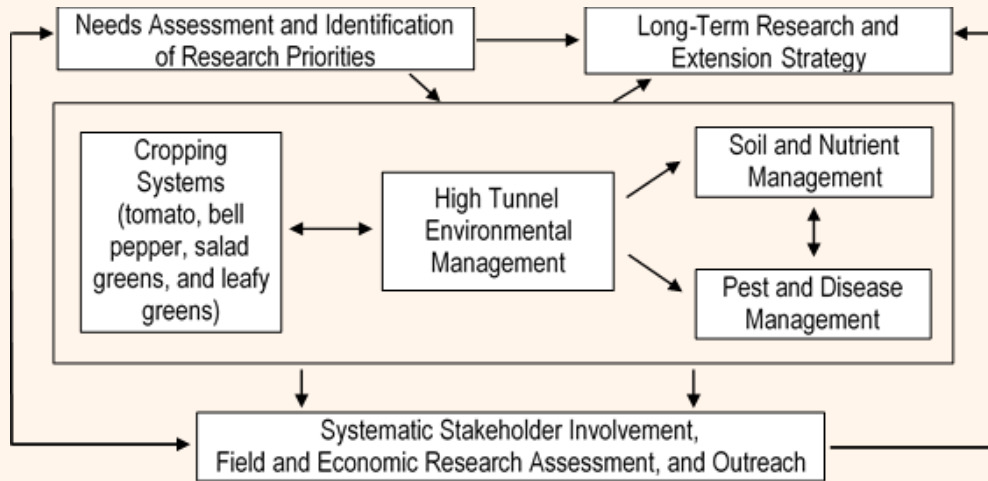
Comprehensive Telephone Interviews and Follow-up Questionnaire

Six major research needs identified by expert panel

1. **pest and disease management (36)**
2. **crop rotations, crop selection, and cover crops (33)**
3. **soil fertility management (32)**
4. **attracting pollinators and beneficial insects (27)**
5. **economic issues (23)**
6. **ventilation and temperature management (17)**

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Project Research and Outreach Model



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Project Research Objectives

- **Objective 1:** Assess the efficacy of **environmental control measures** including shading, ventilation, and other cooling approaches on crop growth, yield, and quality of organically grown solanaceous vegetables and leafy greens under high tunnels.
- **Objective 2:** Optimize **planting time** for high-tunnel produced tomatoes and leafy greens for early production and season extension and examine its impacts on nutrient availability and dynamics in organically managed high tunnel systems.
- **Objective 3:** Determine the influence of **integrated nutrient management** practices on nutrient use efficiency and soil quality in high tunnel organic vegetable production.

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Project Research Objectives

- **Objective 4:** Monitor and characterize **plant pathogens** infecting high priority organic high tunnel crops, and integrate biological products and cultural practices into organic vegetable **disease management** for high tunnels.
- **Objective 5:** Monitor population of **arthropod pests and beneficials** in high tunnel organic vegetable cropping systems.
- **Objective 6:** Develop cultural and biological alternatives for **managing whiteflies and aphids**.
- **Objective 7:** Analyze **on-farm economic viability** of high tunnel organic vegetable production and identify the factors influencing high tunnel adoption among organic growers.

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High Tunnel Vegetable System Opportunities and Challenges



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Moving Forward with Effective Research and Extension Integration Programs



Research

- Continue to assess production situation and identify critical needs by grower
- High tunnel system working group
- Prioritizing focus areas
- Research roadmap

Partnership
Building

Innovation

Extension

- Research dissemination venues
- Technology transfer and research showcase
- Network establishment
- Training materials
- Grower feedback system

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