

## Protected Agriculture

UF IFAS Emerging Agricultural Enterprises Summit 2019



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## Outline

1. Indoor Propagation
2. Small-scale hydroponics
3. Containerized ginger & turmeric



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## Commercial indoor growing installations



Main crop is leafy greens  
economics are challenging, new business models

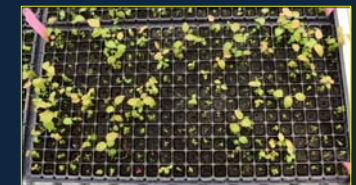


## Indoor propagation

- Greenhouse is not always the ideal environment for propagation, especially in the Florida summer



Tissue culture laboratory  
stage (4 weeks)



GH rooting stage  
(8-12 weeks)

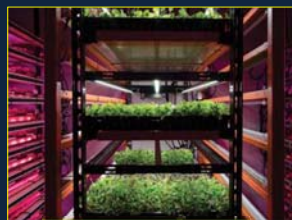
\$173 sales value/288 tray

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## Commercial indoor propagation



Shenandoah  
Growers VA



Battlefield  
Farms VA



Frontier Lab  
South Africa

- Very approximate cost figures:
  - ≈ \$0.70 to \$0.90 per square foot per week
  - ≈ \$5 to \$7 per tray for 4 weeks

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## UF Trials on lighting

Indoor white-red-blue LEDs



Research and commercial  
Greenhouses



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## UF Trials: Tissue culture blueberries

4 Weeks After Initial Planting of  
*Vaccinium corymbosum* 'Emerald'



Greenhouse

Indoor LED

- Break even to pay for lights:
- 17 more plants survive per 288 tray = 6%
- Observed 12% improvement

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## Grower Onsite "Light Cart" Trials



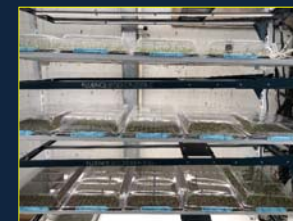
Gabriel Pelegrina and  
Joaquin Saavedra  
setting up at AgriStarts FL



Speedling FL



Spring Meadow MI



AgriStarts FL first trial

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## Indoor production – Next steps

- Research
  - Cost, scale, labor, & seasonality
  - Which crops are worthwhile? (high value, high shrinkage)
  - Technical: humidity, nutrition, lighting, pest & disease
- Extension
  - Gain experience, light cart trials, articles, conservative at this point
- Integrating Research and Extension
  - Grower/extension experience can drive research questions
  - Technical team (Environmental Hort, Hort Sci, AB Engineering, Plant Pathology, Entomology, Economics, multi-state)

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## 2. Small-scale hydroponics



Over **77% of U.S.** households are involved in **gardening activities** (NGA, 2018)

**30%** of those activities take place **indoors** (NGA, 2018)



**Indoor food gardening** was recently ranked as one of the **fastest-growing trends** in horticulture (GMG, 2017)

## Commercial vs. Small-scale Plant Production

### •Most research focused on:

- Maximizing profit (\$)
- Reducing inputs
- Increasing yield



### •Lack of information:

- Plant selection
- Lighting requirements
- Plant maintenance
- Nutrient solution management

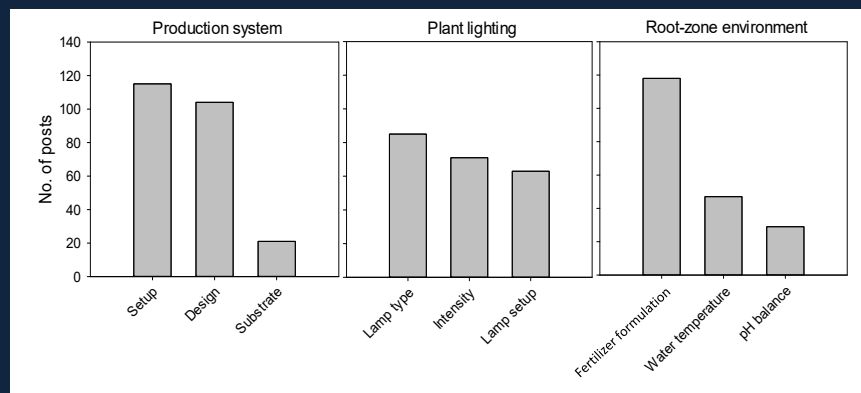


*Consumer success could increase with low-maintenance, easy-to-use, and robust systems*

## Data Mining on Reddit: Common consumer questions



Elisa Solis



r/hydro

25.1k  
Members

24  
Online



r/Hydroponics

18.4k  
Members

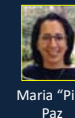
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Online



## Plug and play “resilient” transplants & growing systems



## Resilient lighting for indoor home gardeners



Maria "Pili"  
Paz

- How little light can be provided for consumer success



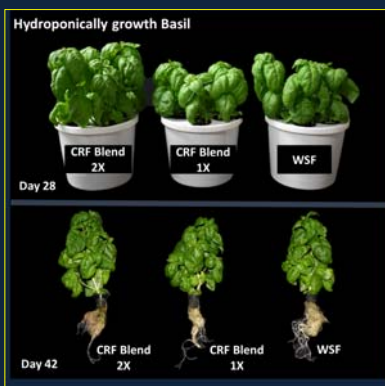
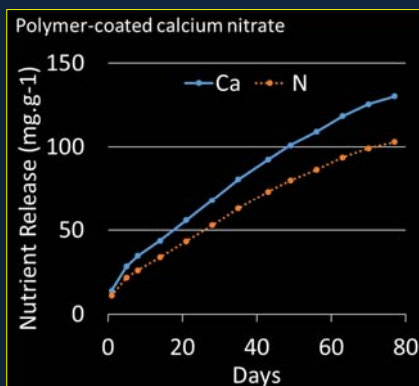
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## Resilient nutrient management programs



Fernanda  
Trientini

- Simplifying nutrition for the home consumer market
- Controlled release fertilizer blends for one-time fertilizer application (tea-bag or value-added plug)



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## Small-scale hydronics/edible food – Next steps

- Research
  - Nutrition and lighting
  - Growing system
- Extension
  - Perfect link to target home grower
- Integrating Research and Extension
  - Growing resilient plants / Why do plants fail?
  - Mix of technical, social, and economic



Vanessa Campoverde

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### 3. Ginger (*Zingiber officinale*), galangal (*Alpinia galanga*), and turmeric (*Curcuma spp.*)



Dr. Rosanna Freyre



Sofia Flores



Marlon Retana



Dr. Celina Gómez

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### Added-value products a.k.a. "Superfoods"



In 2017, import values of spices reached \$1,801 million (USDA, 2018)

Ginger (\$117M in 2018) and turmeric (\$87M in 2018) among top imported spices

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### Product potential

- Low value as commodity, global average \$2.25 / kg
- High value as local fresh (baby ginger) or value-added product



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### Conventional propagation – seed rhizomes



Rhizomes are susceptible to soil-borne pathogens such as *Fusarium*, *Pythium*, *Ralstonia*, nematodes and other soil-borne diseases.



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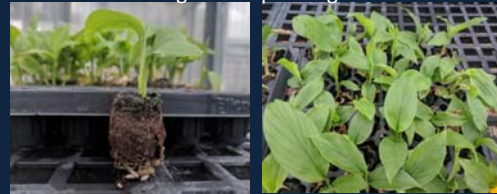
## Tissue-culture transplants



Lower yield during the first production cycle



Pathogen-free planting material



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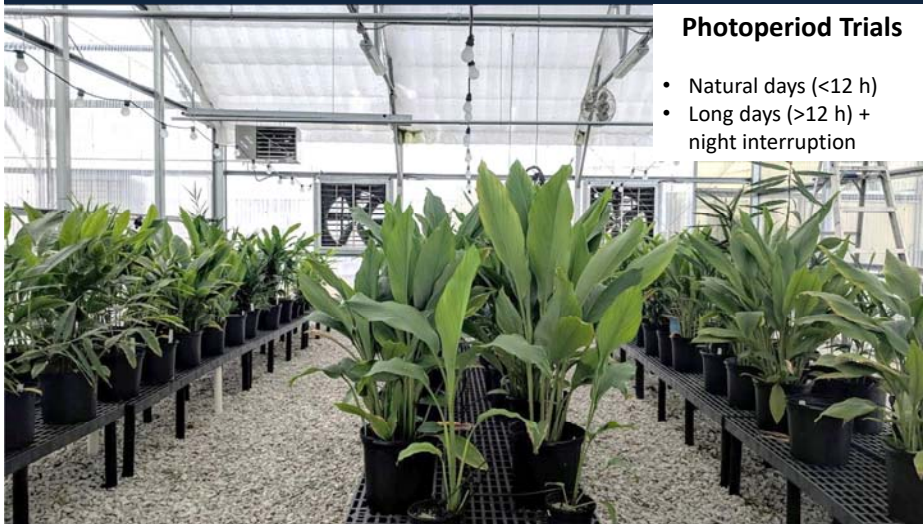
## Photoperiodic



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## Photoperiod Trials

- Natural days (<12 h)
- Long days (>12 h) + night interruption



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## Galangal & Ginger Yield

### Natural days



Galangal tc



Ginger Bubba baba



Ginger tc



Ginger rhizomes  
2<sup>nd</sup> generation tc

### Long days



Galangal tc



Ginger Bubba baba



Ginger tc



Ginger rhizomes  
2<sup>nd</sup> generation tc

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## Turmeric Yield

### Natural days



Yellow tc



Yellow rhizomes  
2<sup>nd</sup> generation tc



White tc

### Long days



Yellow tc



Yellow rhizomes  
2<sup>nd</sup> generation tc

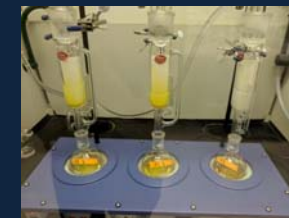
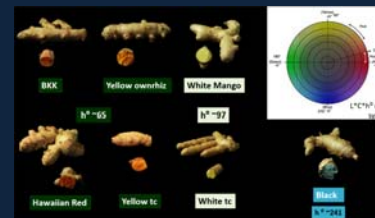


White tc

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## Additional studies

- Field (shade vs full sun)
- Season extension
- Density
- Organic production
- Kaolin
- Postharvest
- Active ingredients



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## Ginger / Turmeric – Next steps

- Research
  - Young Plants – adequate supply, season extension
  - Economics & Marketing
  - Which are most profitable opportunities?
- Extension
  - Small farming potential
- Integrating Research and Extension
  - Specialty Crops Block Grant application in works
  - Multi-disciplinary

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