

Hydroponic Growing Systems

Presentation by: Hannah Wooten

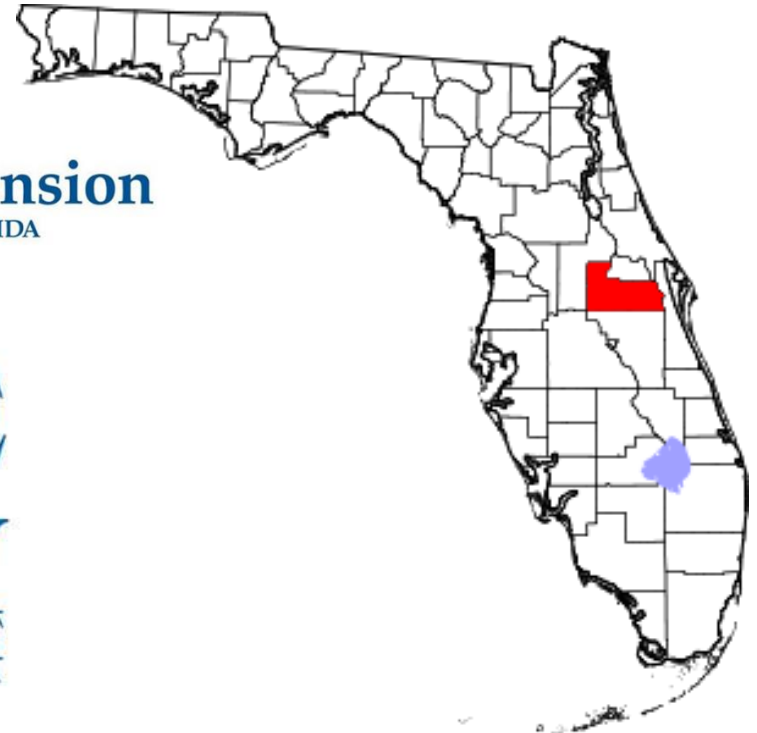


Welcome!



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Objectives

- Define the different types of hydroponic systems
- Determine the best hydroponic system or combination of systems that will suit your needs
- * This presentation is not intended to endorse or promote any specific product, but rather to educate clientele about various hydroponic growing systems.



The Systems- goals as a grower

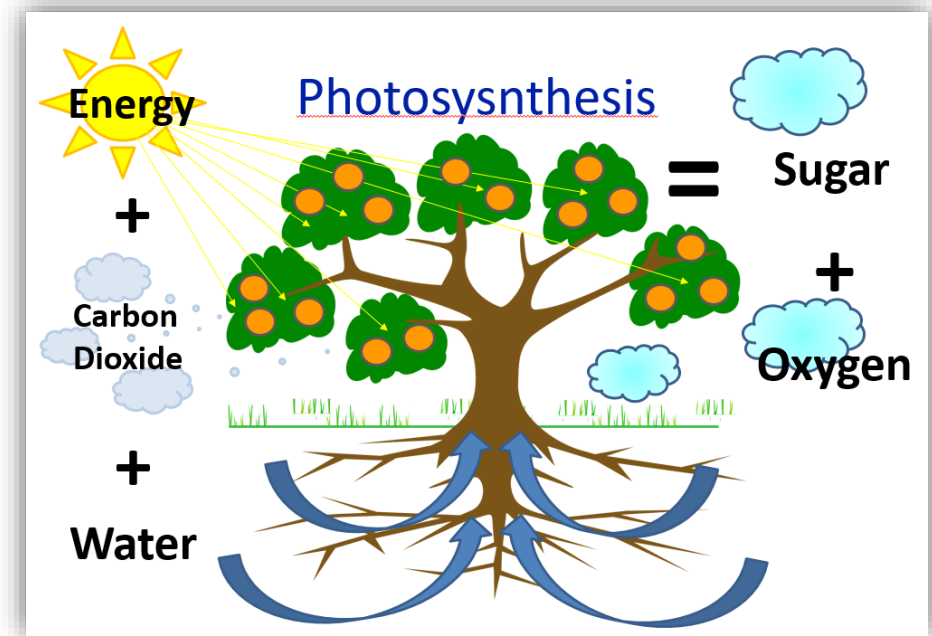
- The systems need to meet your goals as a grower with the resources that you have available
- Consider:
 - crops you or customer wants to eat
 - crops that will grow hydroponically in Central Florida
 - cost
 - suitable location
 - Space, light, airflow
 - Access to power or not
 - Access to water



This hydroponic lettuce was grown in an office under artificial lights! Hydroponics can be successful in many locations if you plan well.

The Systems- needs of the plant

- Must satisfy:
 - **Water**- pH balanced nutrient solution
 - **Carbon Dioxide**- in the air
 - **Light**- from sun or artificial
 - **Support/ anchor** for roots and plant
 - **Oxygen/ air** in the nutrient solution for the roots



The Systems

- Deep Water Culture
- Nutrient Film Technique (NFT)
- Ebb and Flow
- Drip and Dutch buckets
- Wick
- Aeroponic
- Vertical Towers
- A few other innovative growing systems
 - Trench Systems
 - Zip Towers
 - Grow Boxes: Farm Daddy & Earth Box



Starting Successful Hydroponic Business workshop in Live Oak at Suwannee Valley Ag Extension Center every Spring!



Systems can be media based or solution based

Media Based

- Plants grown in soilless media
 - Perlite, rockwool slabs, coconut coir, expanded clay balls, gravel, sand, vermiculite, composted pine bark, rice hulls
 - Media is inert- contains no nutrients
 - Grower must supply nutrients
- Serves two purposes:
 - Retain nutrients and water
 - Provides physical support

Solution Based

- Plants grown directly in nutrient solution
 - Physical support is typically provided by a net cup and/ or the small rootball of the seedling



Systems can be media based or solution based

Media Based

- Ebb and Flow
- Drip and Dutch Buckets
- Wick
- Vertical Towers
- Trench systems
- Grow Containers



Solution Based

- Deep water Culture
- Nutrient Film Technique
- Aeroponic
- Vertical Towers
- Zip Towers



Growing Media: Grow Cubes

- Good for starting seeds or cuttings
- Can transplant into other systems as they mature

Rockwool

- Made from melted volcanic rock spun into fibers
- BEST OPTION for recirculating systems because media remains in tact






Oasis

- Made of foam similar to floral foam for flower arrangements



Growing Media: Soilless Media

- Different types of soilless media:
 - allow the plant to anchor its roots
 - provide good balance of water holding capacity and porosity (air space for the roots)

Perlite	Vermiculite	Sand	Gravel
Made from heated, crushed volcanic lava ore	Heated and expanded micaceous material-good in germination mixes	Traditional hydroponic medium	Traditional hydroponic medium
			

Growing Media: Soilless Media

Hydroton Expanded Clay Balls	Coco Fiber/ Coir	Composted Pine Bark	Soilless Potting Media
Well drained. Require cleaning.	Coconut fibers available in range of textures (fine holds more water, coarse is more well drained).	Well drained. Must be composted for best results in hydroponics.	Mix of mediums with specific qualities (ex: germination mix, multipurpose mix, etc.)
			

Systems must provide air to the roots

Passive

- No electricity required to provide air and oxygen to the roots
- Needs are typically satisfied with an air space for the roots
- Systems that can be passive include:
 - Deep Water culture
 - Wick
 - Grow Container: Farm Daddy

Active

- Electricity required to provide air and oxygen to the roots
- Needs are typically satisfied with:
 - Air stone/ aerator
 - Pump
- Systems that can be active include:
 - Deep Water Culture
 - Nutrient Film Technique
 - Ebb and Flow
 - Drip and Dutch Buckets
 - Aeroponic
 - Vertical Towers
 - Trench Systems
 - Zip Towers
 - Grow Containers*: Earth Box, Grow Box

Net Cups



- May be needed for providing support in some solution based hydroponic systems



Aerator Pumps and Air Stones

For all active systems, the grower will need to add air to the nutrient solution with either:

- Aerator pumps connected to air stones
- OR
- Pumps to move the nutrient solution through the system



Just4Growers.com

Pumps

- Consider pump capabilities in Gallons per Minute (GPM)
- Consider how high the pump can push water vertically

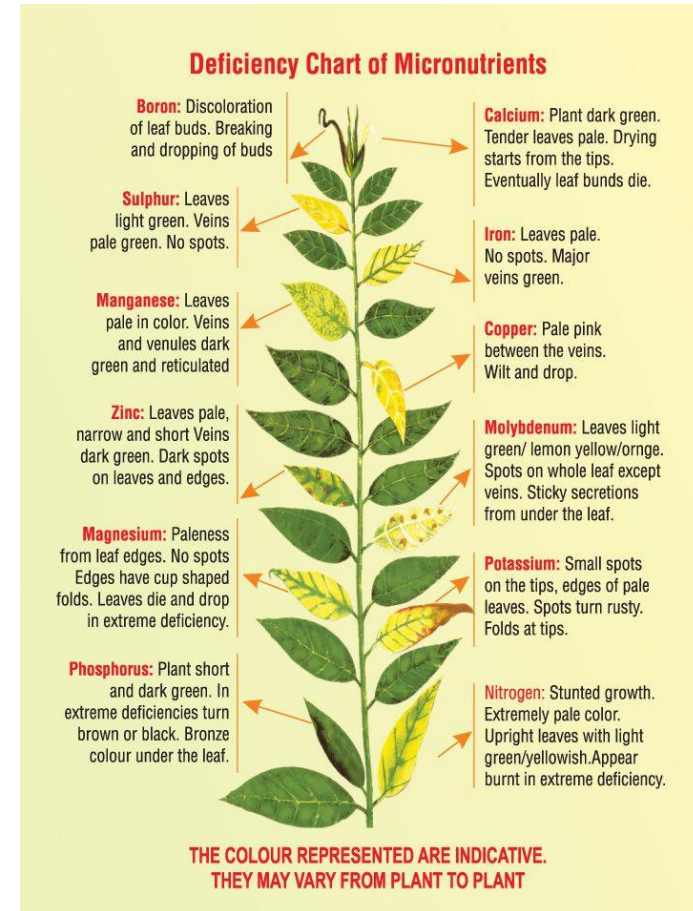


Reservoir Tank



Nutrients

- Select complete hydroponic fertilizers
 - Liquid
 - A and B solutions
 - Granular
 - Slow release granular
- Can follow fertilizer label for short term crops and “read” plant for signs of deficiency
- Meters (EC and TDS) recommended for flowering and fruiting crops and for commercial production

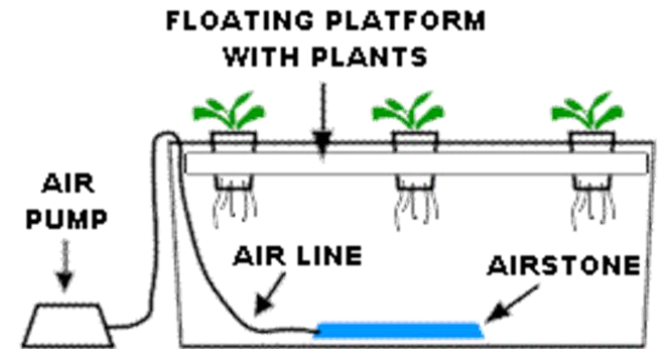


Deep Water Culture

- Deep Water Culture aka DWC
- Simple hydroponic system
 - Solution based system
 - Active or passive
 - Active- must add sufficient air stones to nutrient solution
 - Passive- must leave air space in root zone
- Best for shorter term, smaller profile crops like lettuce
- Can purchase systems ready to use, or DIY



Passive System



Active System

Deep Water Culture



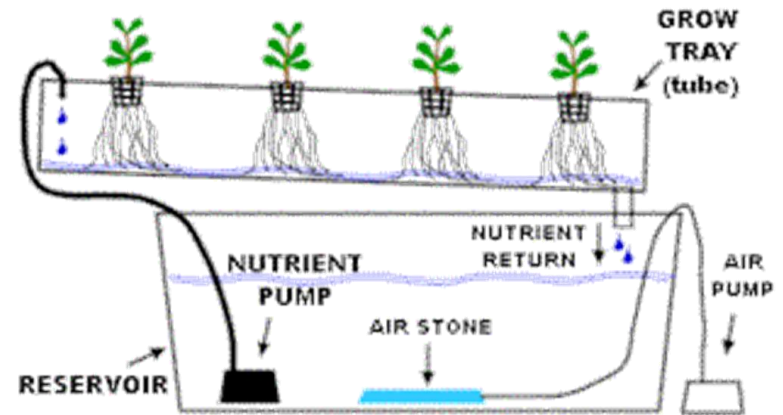
Deep Water Culture

Easy and successful to DIY. Select low profile short term crops, and grow in season.



Nutrient Film Technique

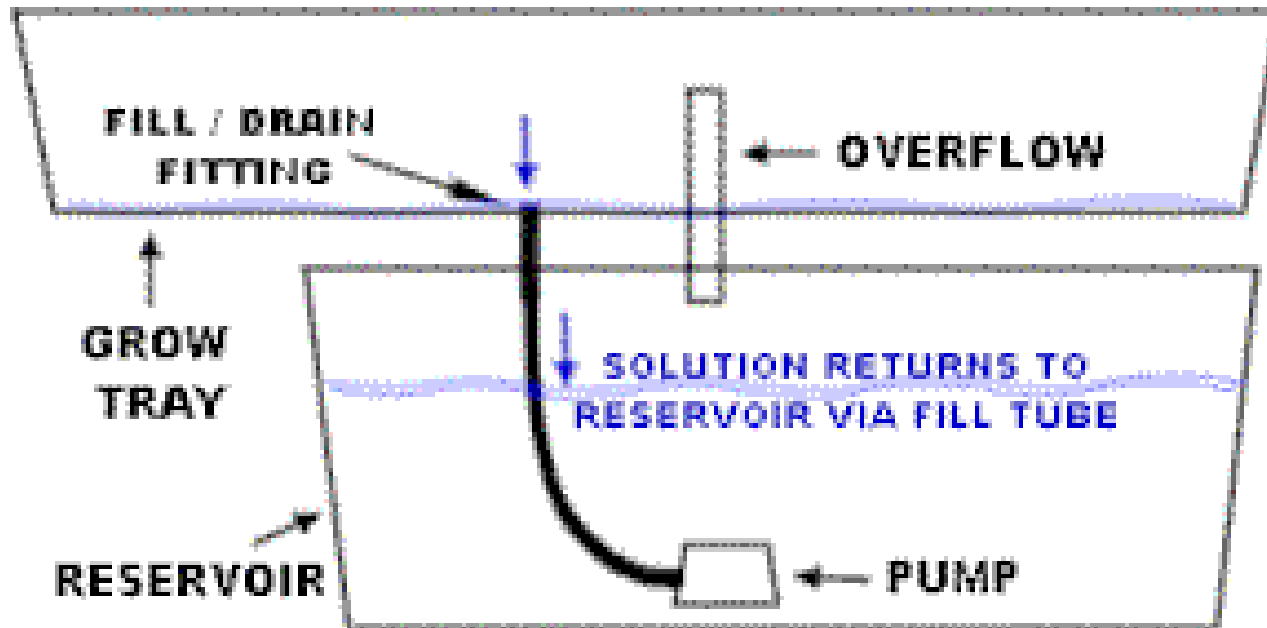
- Nutrient Film Technique aka NFT
- Common hydroponic system
 - Solution based system
 - Active
 - Continuously pumps nutrient solution through microtubes and into grow troughs flowing through plants' roots and returning to the reservoir
- Plant can be suspended in net cup or placed directly in trough
- Lettuce, leafy greens, and other small crops are best in NFT
- Power outages or pump failures can devastate an NFT system since there is not media to help retain moisture



Nutrient Film Technique



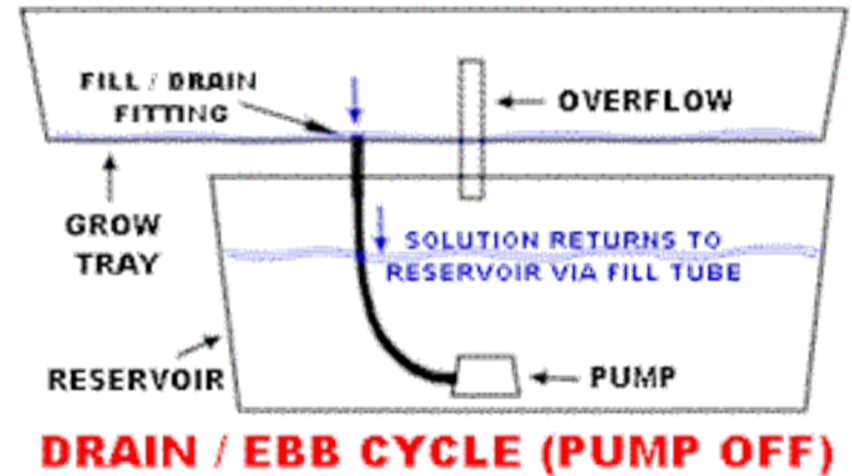
Ebb and Flow



DRAIN / EBB CYCLE (PUMP OFF)

Ebb and Flow

- Ebb & flow aka Flood & Drain
 - system floods the grow tray with the nutrient solution
- Media based system
- Active system
 - Pump is on a timer
 - Timer turns on a few times per day for a given amount of time to flood the grow tray
 - Nutrient solution drains out of grow tray via gravity
- Suitable for plants of many shapes and sizes
- If using a medium with a higher water holding capacity, system failure is less likely due to pump failure or power outage

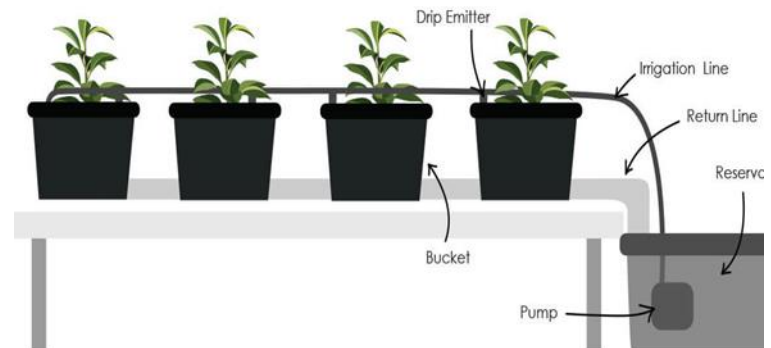
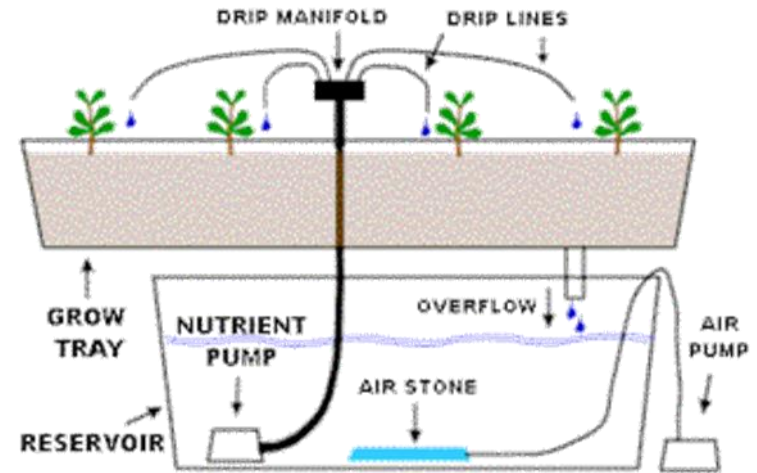


Ebb and Flow



Drip Systems and Dutch Buckets

- Drip systems aka lay flat bags and slab systems and Dutch Bucket systems aka Bato Buckets
- Media based system or Slab systems
- Active system
 - Timer turns on pump to deliver nutrients to each plant via microemitter
- Recovery or Non-recovery
 - Recovery- collects excess nutrient solution (runoff) and recirculates through system
 - Requires more maintenance and monitoring of pH and EC
 - Non-recovery- does not collect runoff
 - Aim to keep runoff to a minimum
- Suitable for plants of all shapes and sizes, especially plants we can vine like tomatoes, peppers, cucumbers, and squash



Drip Systems and Dutch Buckets



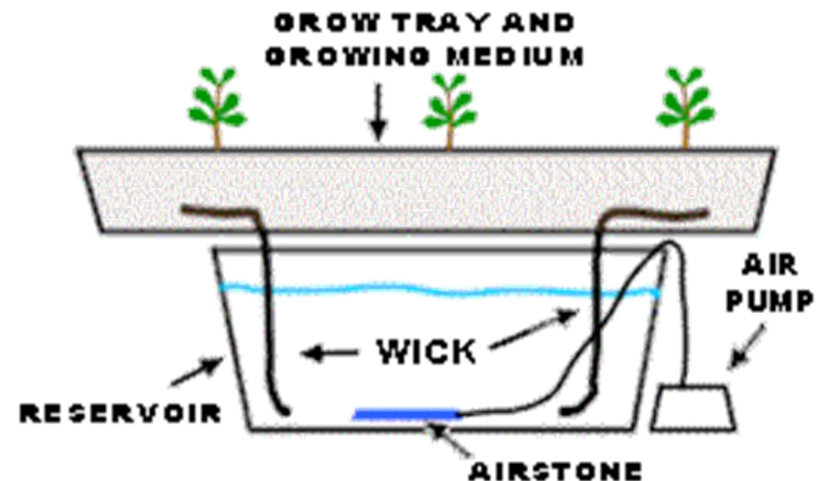
Recirculating Dutch bucket system



Rockwool or Coco slab system for commercial tomato, pepper, and cucumber systems

Wick

- Wick systems are very simple
- Media based system
- Passive system
 - Uses capillary action to move nutrient solution from reservoir to plants' roots with a wick
- Better for smaller plants that use less water
- Better for hobby growing, not commercial

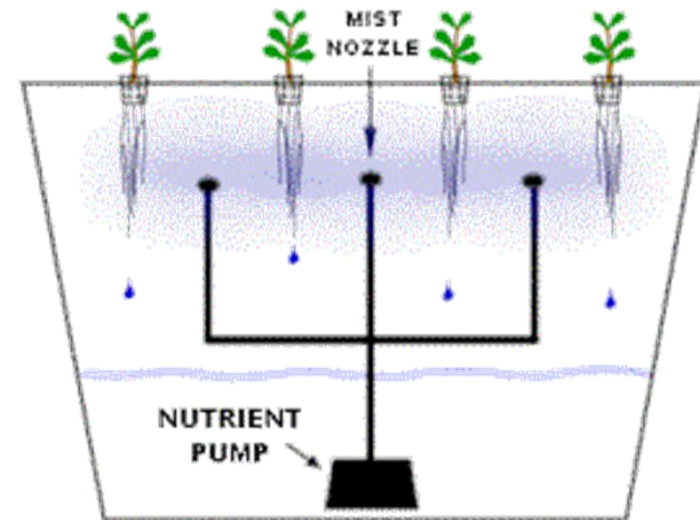


Wick



Aeroponic

- Aeroponic systems are high- tech and efficient
- Solution based system
 - Roots are misted with nutrient solution
- Active system
 - Nutrients are pumped through a mister on a timer that turns on for a few seconds and off for a few minutes throughout the day
- Can accommodate plants of many shapes and sizes
- Roots are periodically exposed to air, so power outages or pump failure can devastate a crop

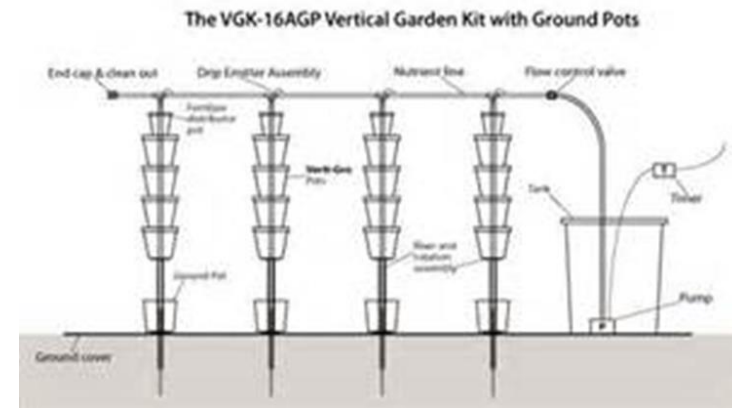
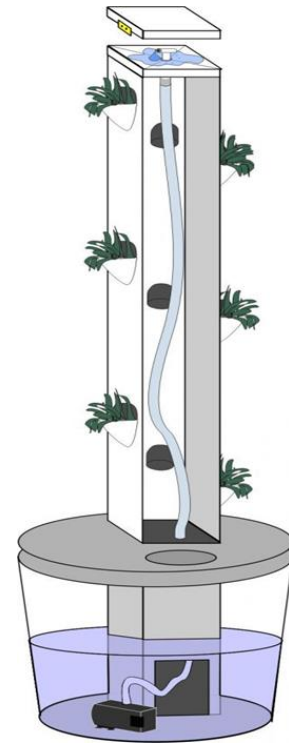


Aeroponic



Vertical Towers

- Vertical towers are popular systems for residential and commercial use
- Solution or media based systems
 - Solution based systems are aeroponic
 - Could dry out
 - Media based systems are drip
 - Media costs money and needs periodic replacement
- Active systems
 - Pump nutrient solution to top of system
- Can get a lot of plants per square foot
- Suitable for many types of plants, but must account for space and light requirements



Vertical Towers



Vertigro



Mr. Stacky



Tower Garden

Vertical Towers



ZipGrow

Trench Systems Under High Tunnel



SEARCH UF EDIS
**Protected Culture for
Vegetable and Small
Fruit Crops: The Soilless
Trench System**

Grow Containers



Farm Daddy
(completely self watering)



The Grow Box



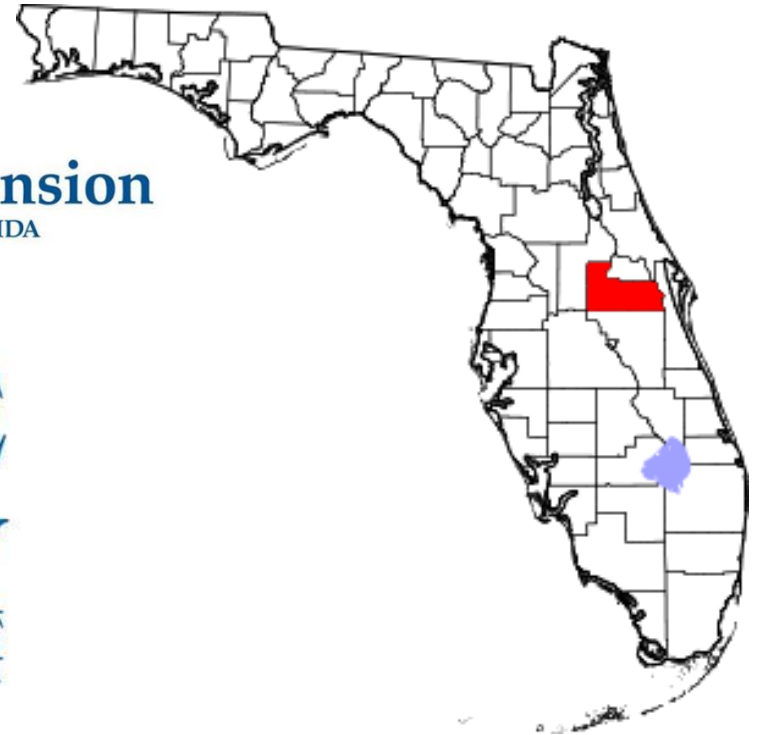
Earth Box

Thank you! Questions?



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