

UC Master Gardeners of Orange County

The Presentation Will
Begin Shortly



Photo credit: Erin Nelson



UC Master Gardeners of Orange Co

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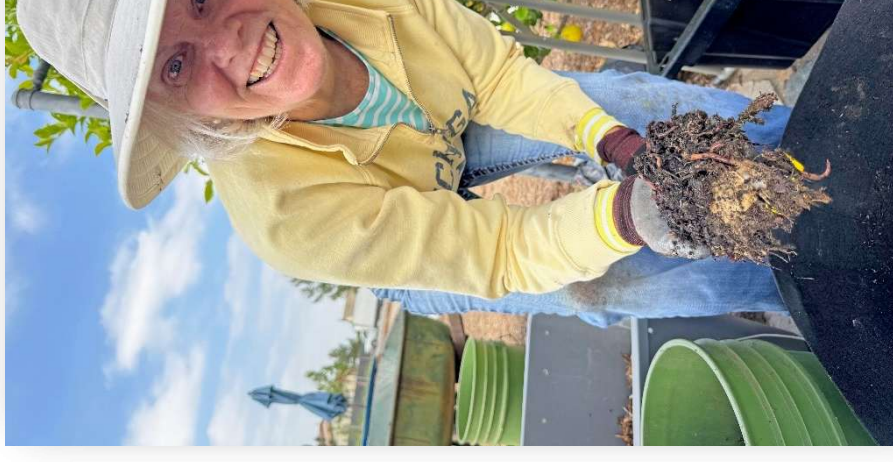


Photo Credit: Kathleen Dyke



UC Master Gardeners– Orange County



Home
Horticulture



Integrated Pest
Management



Sustainable
Landscape



Hydroponics for the Home Gardener



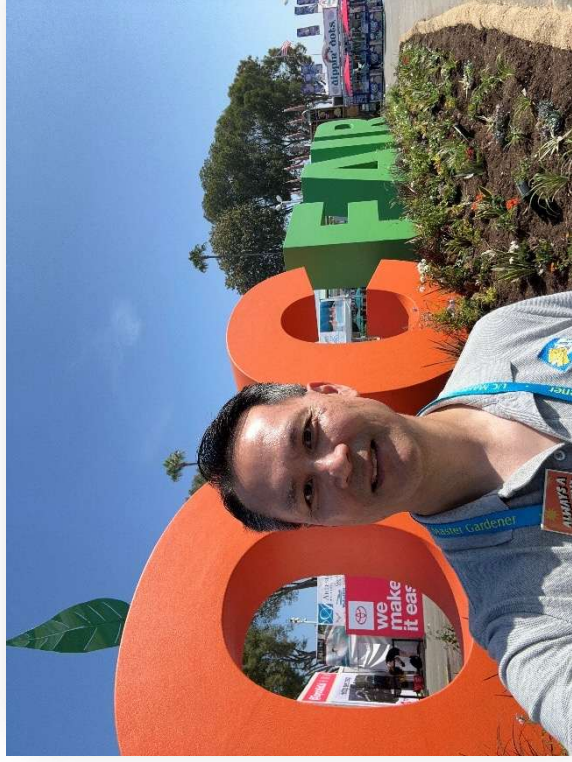
Presented by Alvin Lam and Sally Richards
UC Master Gardeners of Orange County

April 11, 2026



UCM
University of California
Master Gardeners

Today's Speaker: Alvin Lam



- Former Sales Engineer
- CA native & in HB for over 10 years
- 3rd year Master Gardener
- Hydroponics team co-leader
- Composting
- Houseplants
- Fruit trees and bushes

Today's Speaker: Sally Richards



- Started gardening at age 8
- Joined OC Master Gardeners
- DJ at KUCI 88.9 FM on the Thursday morning show: In Garden
- Lives in San Clemente
- Grows veggies hydroponic hoop house

History

- 600-500 BC - Hanging Gardens of Babylon
- 300 BC - Egyptian hieroglyphs showed plants in water culture
- 1200 – Marco Polo described “floating gardens” in China
- 1300’s – Aztecs created artificial islands called “Chinampas” to grow
- 1627 – Francis Bacon book outlines growing plants in water, not soil
- 1937 - Dr. W.F. Gericke coined the term hydroponics
 - Greek: hydros - water & ponos – work
- 2004 – Dr. B.A. Kratky research paper published
- Today – NASA’s on-going program to establish food production on Mars



What is Hydroponics?



Photo credit: Sheree Wiener

- Growing plants in nutrient-rich water
- No soil or garden plot needed
- May use growing media
- Flexible locations
 - Small spaces
 - Condos, apartments
 - Balconies, decks, patios
 - Indoors
 - Outdoors
 - Greenhouses



Why Grow Using Hydroponics?

PROS

- Minimal gardening space needed
 - Vertical gardening
 - Reduced water use
 - Less fertilizer needed
- Up to 30% more growth & yield
 - No soil-borne diseases
 - No crop rotation
 - Weed-free
- Re-purpose used materials
- Grow out-of-season vegetables*
- Far less pest issues*

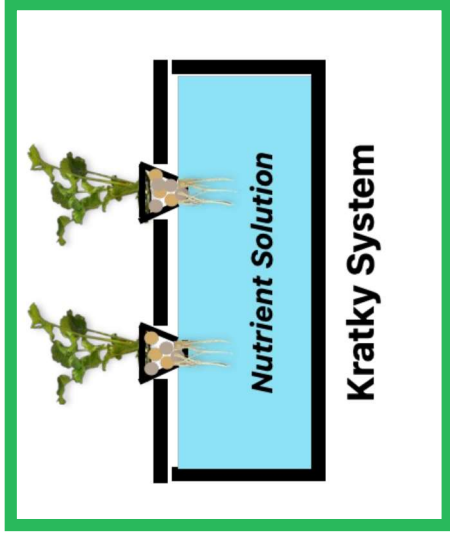
CONS

- Possible up-front costs
- Some assembly required
- Disease & pests can spread faster*
- Electricity needed for lighting*



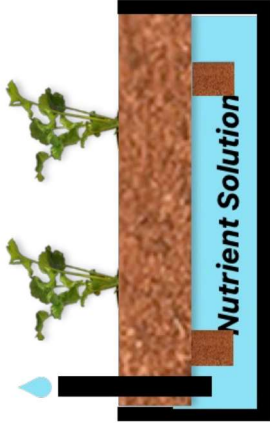
Note: * Applies when growing indoors

Hydroponic Systems



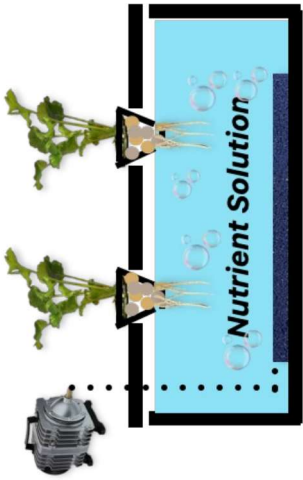
Kratky System

Today's Focus

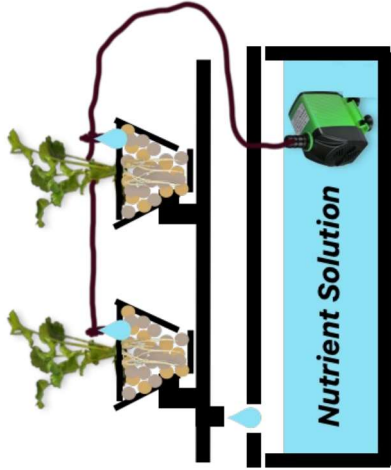


Wicking System

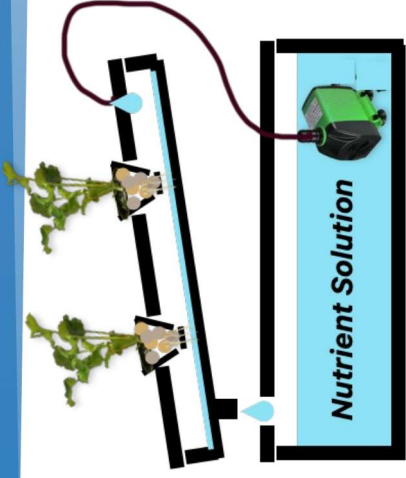
*Increasingly
Complicated*



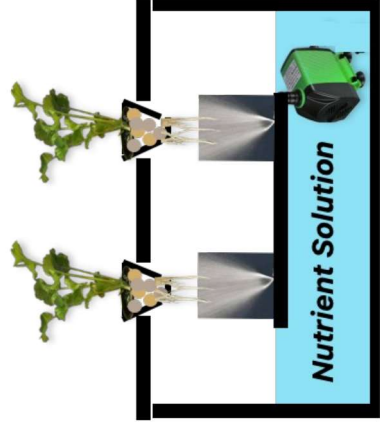
Deep Water Culture (DWC)



Bato Bucket or Drip System



Nutrient Film Technique (NFT)



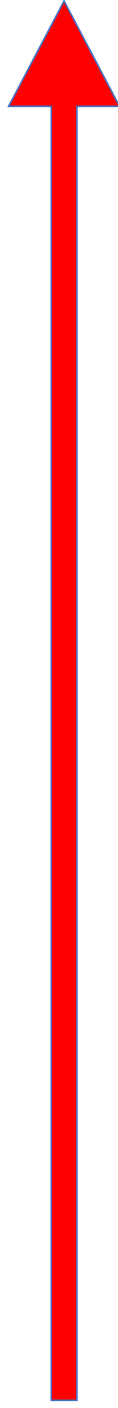
Aeroponics



Ebb and Flow



Aquaponics



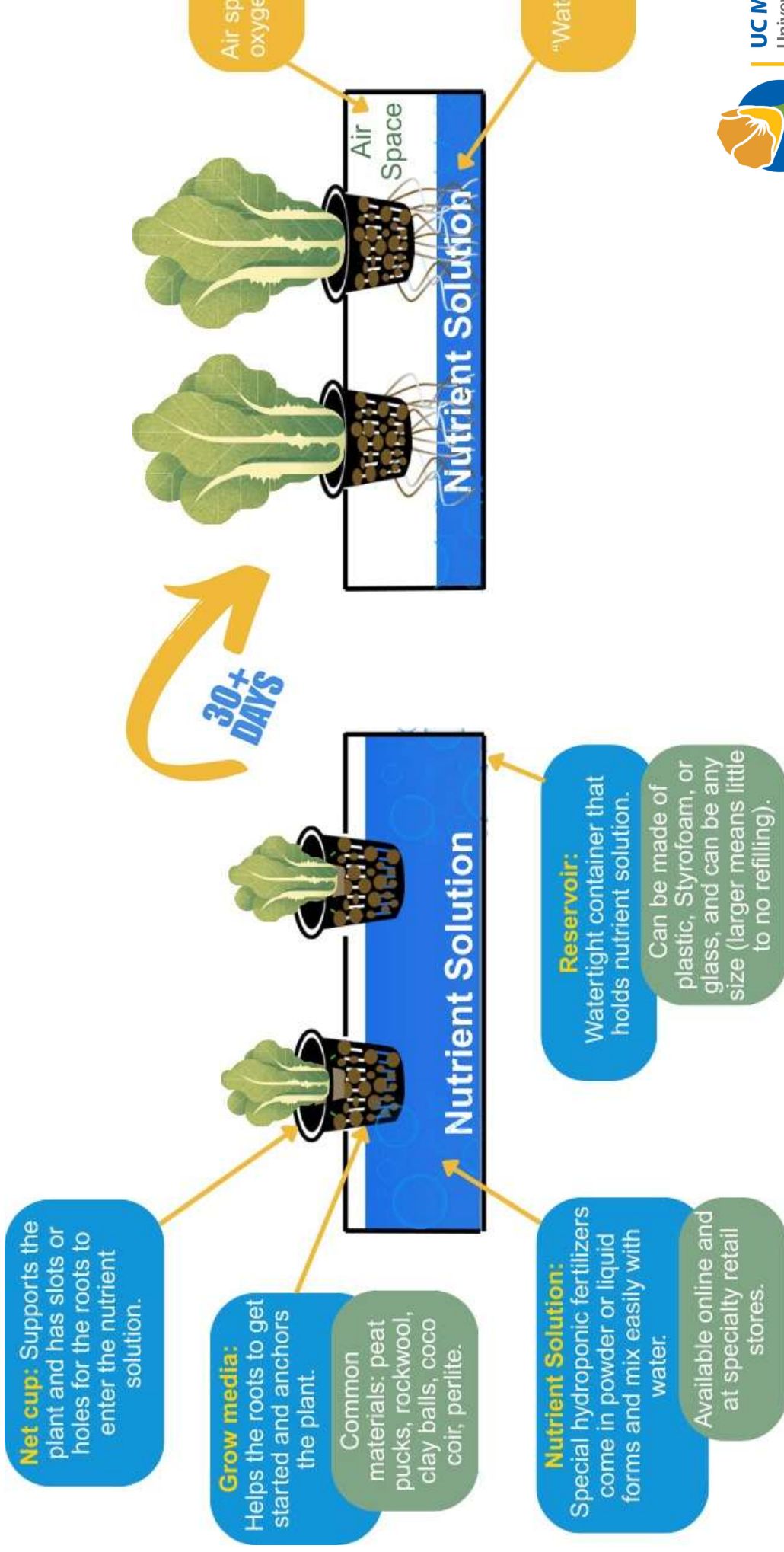
Kratky System



Photo Credit: Sheree Wiener

- Dr. Bernard A. Kratky
- University of Hawaii professor
- Simplest system to put to use
- No pump or moving parts
- Most affordable system
- Minimal maintenance
- Harvest in 30 days
- Great for beginners

Kratky Hydroponic System Overview



Kratky Hydroponic System (After 45 Days)



Photo credit: Alvin Lam

What Can We Grow?

| BEGINNER | INTERMEDIATE | ADVANCED |
|-----------------------|--|--|
| Leafy greens Herbs | Tomatoes Cucumbers Peppers Cabbage Carrots Beets Garlic Onions Strawberries Flowers | Squash Melons Potatoes Other berries Houseplants |



- **Key considerations**
 - Vegetables you like
 - Growth pattern - single head, leaves, vining, is support needed?
 - Mature size - height, width, and root ball size
 - Harvest – in weeks or months?
 - Grow from seed or use nursery starts



Hydroponic Materials

• Anchoring the plant

- Growing media - peat pucks, rockwool, oasis cubes, clay balls, coco coir, perlite, pool noodle
- Net cups or net pots - 1" to 8"
- DIY – yogurt cups

• Choosing the right reservoir

- Plastic, glass, styrofoam
- Paint or cover with dark or reflective material
- How many plants per reservoir
- Mature plant size
- Buy or DIY
- Food-grade is recommended

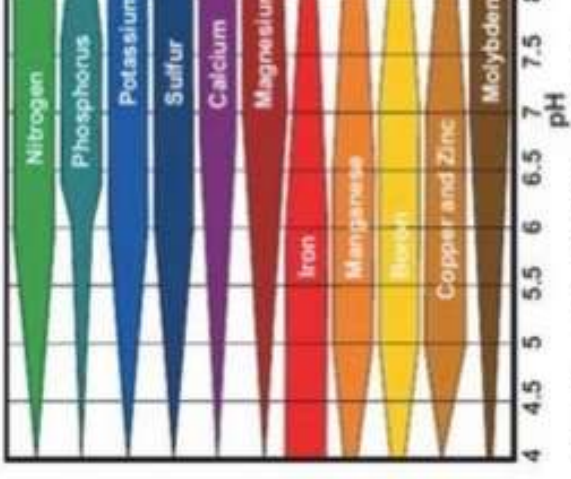


Hydroponic Fertilizers + pH



- **Specialized hydroponic fertilizers**

- **Macro nutrients** (NPK & Calcium, Magnesium, Sulfur) + **Micro nutrients** (Boron, Chlorine, Copper, Iron, Manganese, Molybdenum, Zinc)
- Granulated or liquid forms (Liquid is usually more costly)
- Organic versions are available
- Follow the directions



Nutrient Availability at Different pH

- **Target pH 5.5 to 6.5 range**
- **Test using pH meter or test solutions**
- **Adjust using pH up or down solutions**



Indoor Lighting

- **Mimics the sun on a very small scale**
- **Color spectrum**
 - Cool blue light – vegetative growth & seed germination
 - Warmer red light – bud formation, flowering & fruiting
 - No UV
- **LED (Light-Emitting Diodes) preferred**
- **South-facing window is usually not enough**
- **What your eyes perceive as bright, might not be enough for the plants**
- **Plants collect light energy over time**

REGULAR HOME LED LIGHTS

- **Not wide spectrum (blue or red)**
- **Low intensity**
- **Requires height adjustability**
- **Energy efficient**
- **Use what you have**
- **Low cost**



- **Target >2500 lumen output**
- **5000K blue light for leafy greens**
- **3000-4000K red for flowering/fruiting**

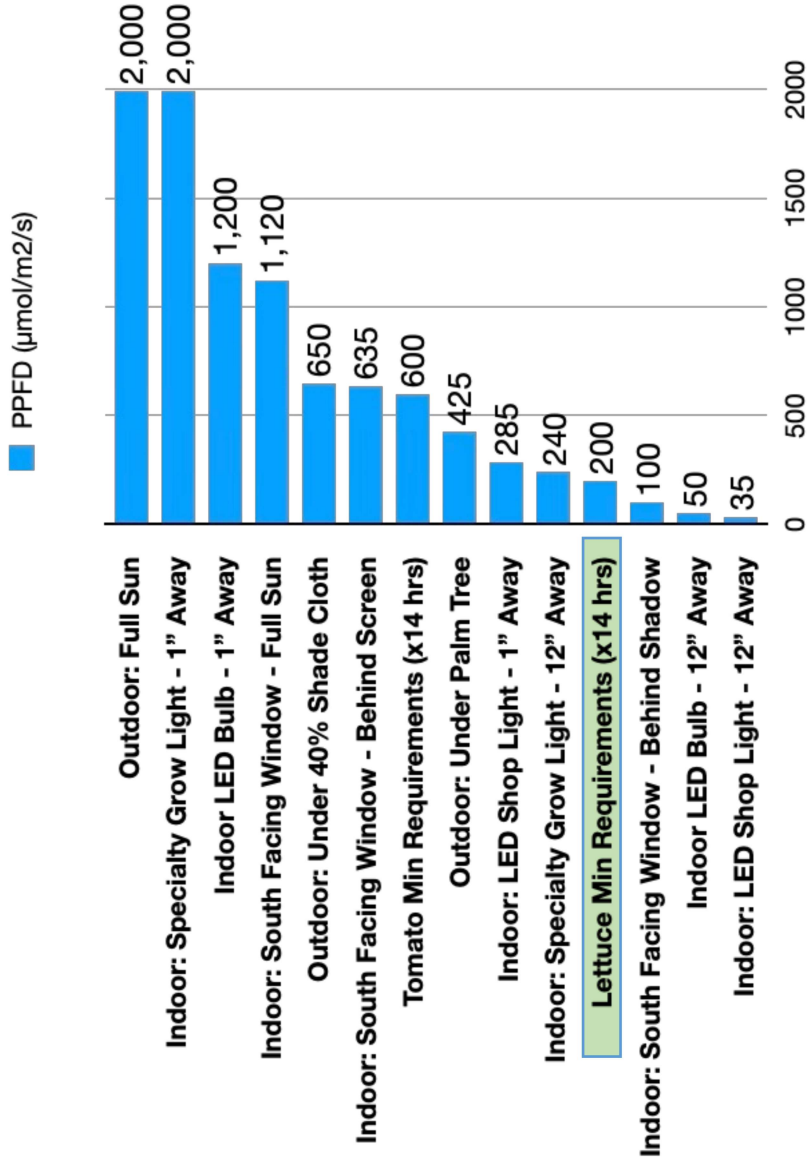
SPECIALTY LED

- **Wider spectrum**
- **Higher intensity**
- **Height adjustability**
- **Uses more energy**
- **Many options**
- **Higher purchase price**



Light Intensity Examples

Light Intensity Photosynthetic Photon Flux Density PPFd



Full Sun (2,000)



Under Palm Tree (425)



Window – Sun (1,120)



Window – Screen (635)

Note: Measurements from southern exposure using VBR-300 Quantum PAR meter – Source: Alvin Lam Mar 2025.



Estimated Hydroponic System Costs

- **Potential upfront costs**
 - Nutrient solution reservoir
 - Net cups
 - Plants
 - Grow media
 - Hydroponic fertilizer
 - Lights (indoor)
- **Estimated upfront system costs (<\$45)**
 - \$20 2.2lb Bag of hydroponic fertilizer (makes up to 150 gallons)
 - \$10 2" Net cups (50) — Clean and reuse
 - \$ 6 Peat pucks (36)
 - \$ 5 Seed packet
 - Free reservoir – Clean and reuse nut/coffee jars or water/milk/juice jugs (+\$10 for 5-g)
- ➔ Ongoing costs – 10 to 25 cents per plant (peat pucks, hydroponic fertilizer and electrical)



Indoors – What Do We Need?



- Location: dining room, garage, table, shelf, deck
- Sunny south facing window
- Artificial lighting (regular LED or specialty grow)
- Timer: 12 to 16 hours on per day
- Dark reservoir to prevent algae growth
- Light height adjustment needed
- Seeds vs nursery starts
- Leafy greens, herbs, or flowers



Outdoors – What Do We Need?



- Location: patio, balcony, deck, etc.
- Appropriate amount of sunlight
- Dark reservoir to prevent algae growth
- Rain prevention
- May require stakes or overhead support (tomatoes)
- Monitor pH, nutrient, and water levels regularly
- Seeds or nursery starts
- Fruiting vegetables

Integrated Pest Management (IPM)

Use least toxic methods of pest control to minimize adverse impacts on the environment



UCANR IPM Website



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Pest and Disease Prevention

- Clean tools after every use
- Remove dead or diseased plants immediately
- Wash and quarantine new plants before bringing indoors
- Cover reservoirs to:
 - Minimize mosquitos
 - Minimize algae growth
- Frequent monitoring of plants

Potential Issues With Hydroponics

- **Avoid using water from a water softener**
 - Salt level is too high
- **Nutrient solution level drops less than half, but plant not ready to harvest**
 - Add nutrient solution, but no more than halfway
- **Small flying insects**
 - Quarantine new indoor plants
 - Yellow sticky traps
 - Respond quickly to any signs of pests
- **Root rot**
 - Whitish roots are healthy; dark brown or black, or smelly roots are unhealthy (bacterial growth)
- **Algae growth in root zone**
 - Improve light blocking for container
- **Indoor lights - too close (heat damage) or too far (stunted growth)**
 - Regular lights should always be kept a couple inches away from top leaves and special grow lights need more distance - 6" t
- **Growing taller plants**
 - May need support from above
 - Secure plant and container against high winds
- **Sun heats up nutrient solution too much**
 - Block/reflect sunlight



FAQs

- **Won't the plants drown in the nutrient solution?**
 - No, the container is filled just high enough for the roots to be dangling in the solution and as the plants absorb up the nutrient solution, air roots develop just above the water line. Usually, when the plant has used up the solution, it is ready to harvest.
 - If it's a small container, need to keep water level high enough for half the roots to be submerged.
- **Do I have to add more nutrient solution when it is used up?**
 - Anything that is mature and ready to harvest, you don't need to refill the container, i.e. lettuce in a 40oz container.
 - If you are growing something for more than 30 days (herbs, tomatoes, etc.), you will need to add more solution every 2-3 days (more than half of the container height. Try to keep the level around 50%.
- **Do you get mosquitos (in an outdoor system)?**
 - No, as long as it's a closed system or has moving water. If reservoir has an opening like a hole or crack, use a mesh or screen to keep mosquitos out.
- **Can I grow root crops hydroponically?**
 - Yes, but you can't grow directly in nutrient solution. Using the wicking method, you can grow onions, garlic, ginger, etc. in the grow media above the nutrient solution.



UC Master Gardeners of Orange County

[UC Master Gardeners of Orange County - Hydroponics Website](#)



[Master Gardener Expo - Hydroponics Presentation](#)



[Hydroponics Starter Instructions](#)



[Kratky Hydroponics: Soil-Free Growing Method Handout](#)



[Sally Richards - Hydroponics Radio Interview on KCIU](#)



All files available only until



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Questions?



Photo Credit: UC Regents



Hydroponics Class Survey

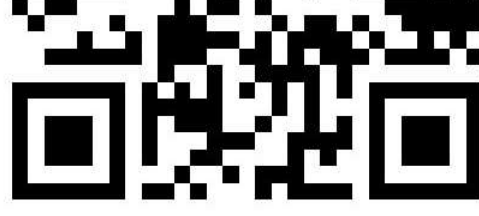


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Workshop Registration Survey

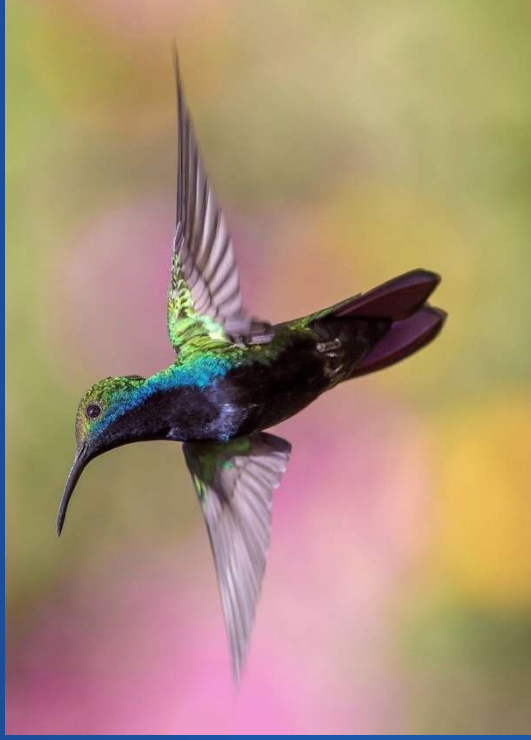
Today's presentation: *Hydroponics for the Home Gardener*
Date: April 11, 2026



Photo credit: Erin Nelsen

COMING EVENTS

- Apr 12 – Bees, Butterflies & Other Pollinators



- Apr 15 – Compost Basics 101



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Photo credit: KA Dawson

