



Plant Propagation for Successful Hydroponic Production

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What is Hydroponics?

Hydroponics = *hydros* + *ponos*
Water labor

The cultivation of plants by placing the roots in liquid nutrient solutions rather than in soil; soilless growth of plants.

Why hydroponics?

- Crops can be produced on non-arable land including land with poor soils and/or high salinity levels.
- Efficient use of water and nutrients.
- High density planting = minimum use of land area.
- Year-round production.
- Local food.
- Direct and immediate control over the rhizosphere.
- Isolation from diseases or insect pests usually found
- Higher yield, quality and storability of products.
- Ease of cleaning the systems.
- No weeding or cultivation is needed.
- Transplanting of seedlings is easy.



Hydroponics Basics

Types of Hydroponics: Water vs. Substrate-base
Open vs. Closed

Types of Hydroponics: Water vs. Substrate-base

Water-based System



Deep water culture "Raft" system



Substrate-based System



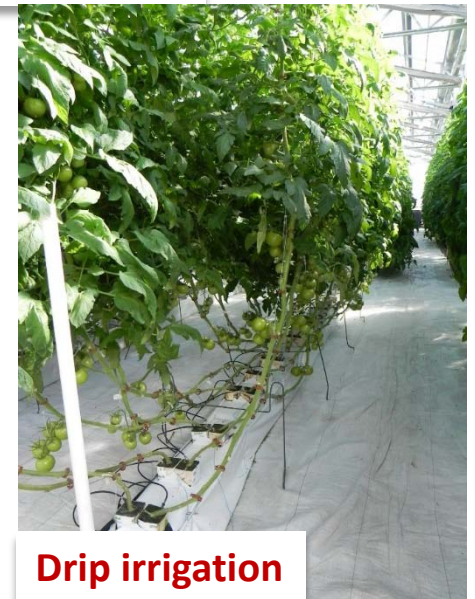
Ebb-and-flow



Nutrient Film Techniques (NFT)



Aeroponics



Drip irrigation

Types of Hydroponics: Water vs. Substrate-base

Water-based System

Deep water culture "Raft" system

Nutrient Film Techniques (NFT)

Aeroponics



Source: Chiwon Lee



Source: hydrocentre.com.au



Mobile channel system

Photos courtesy of Karlovec Media Group,
Faculty of Great Lakes Growers, Burton, Ohio

Types of Hydroponics: Water vs. Substrate-base

Water-based System

Deep water culture "Raft" system

Nutrient Film Techniques (NFT)

Aeroponics

- Excellent aeration
- 65% less water use than other hydroponic systems



Traveling plant,
Epcot Center, Disney World

Source: <http://www.mosesong.com/>



Types of Hydroponics: Water vs. Substrate-base

Substrate-based System

Drip irrigation



Ebb-and-flow

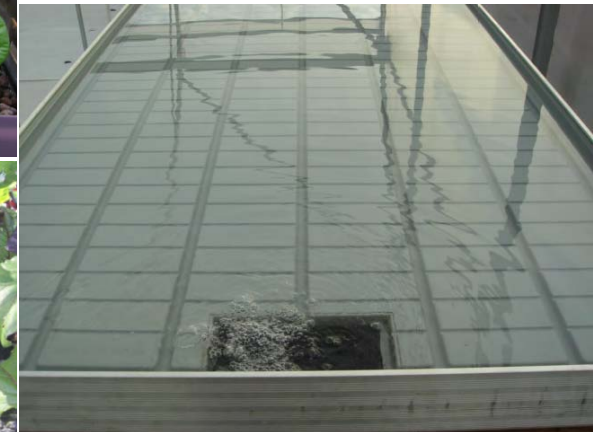
Gravels, Coco Coir Croutons



Clay-balls

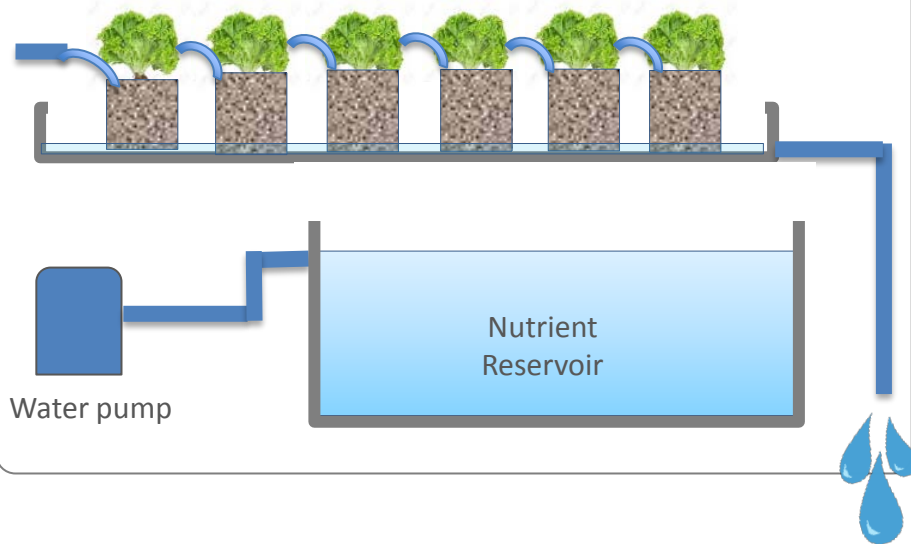


Lava-rocks

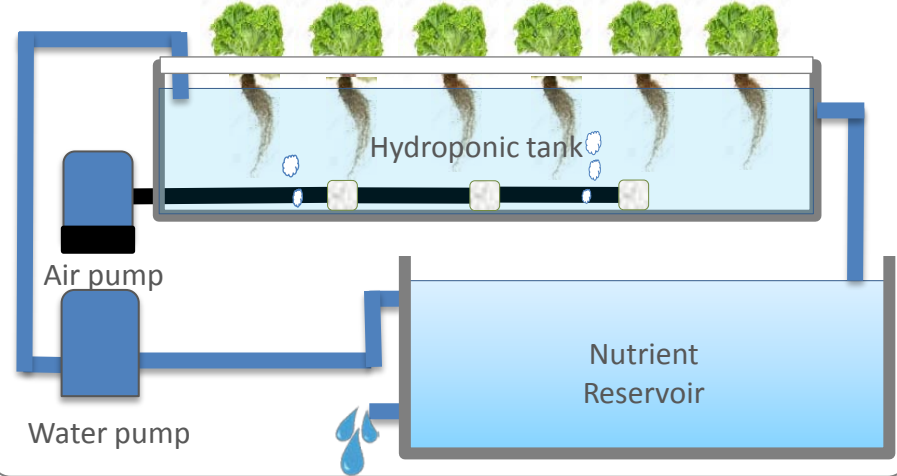


Types of Hydroponics: Open vs. Closed

Open (Drain to Waste) system
e.g. drip irrigation



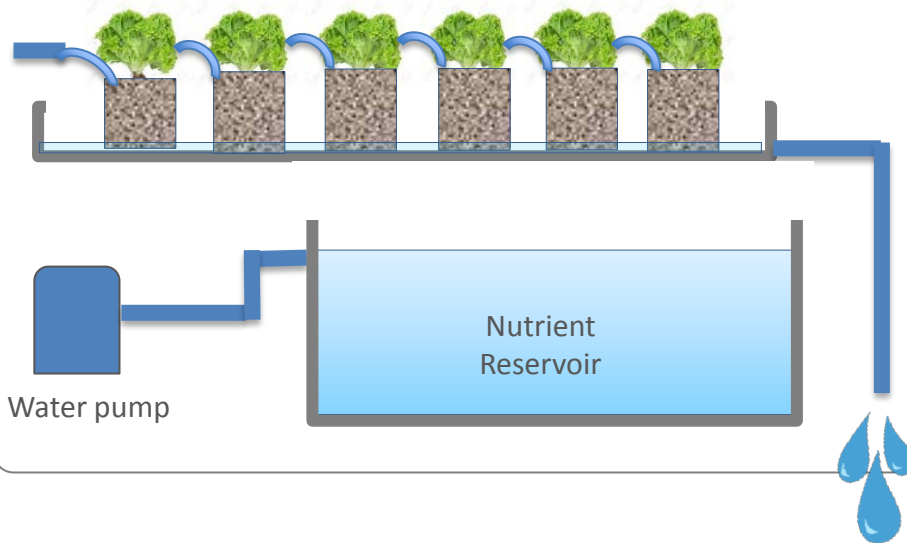
Closed (Recirculating) system
e.g. deep water culture, NFT, aeroponics



- Closed systems use 20–40% less water and fertilizer than open systems
- Consistent monitoring and maintenance of electrical conductivity (EC) and pH is required.

Types of Hydroponics: Open vs. Closed

Open (Drain to Waste) system
e.g. drip irrigation



Bag or pot

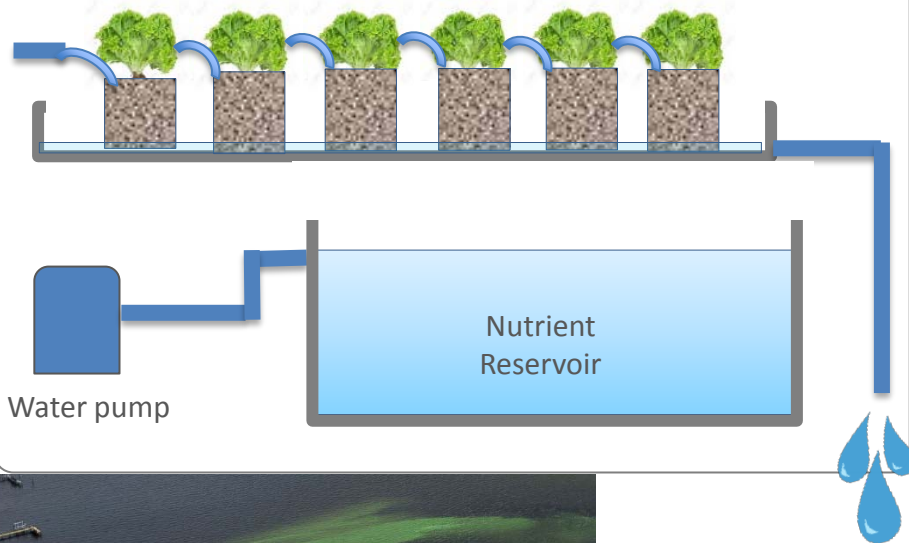
Slab

Trough

Source: Grodan

Types of Hydroponics: Open vs. Closed

Open (Drain to Waste) system
e.g. drip irrigation



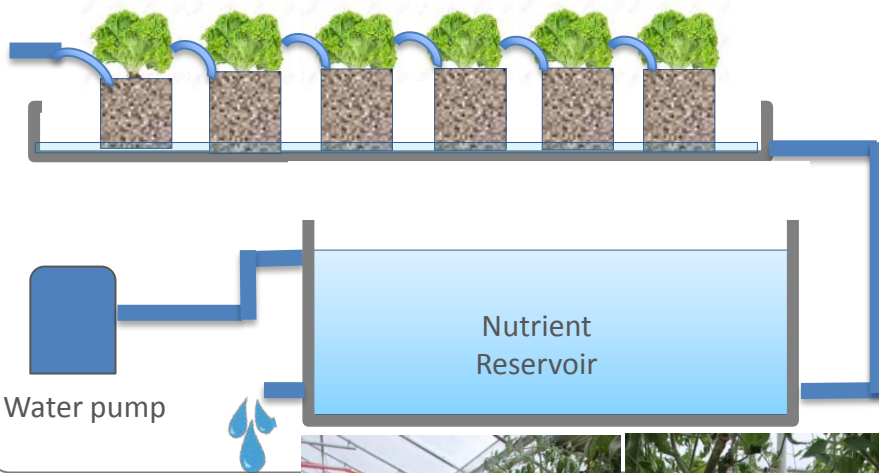
Greg Lovett/The Palm Beach Post via AP Source: abcnews.go.com

Source: Petrus Langenhoven

Drip irrigation

Types of Hydroponics: Open vs. Closed

Open (Drain to Waste) system
to Closed system



Drip irrigation

Plant material preparation

- Choice of Crops and Cultivars
- Growing Media
- Hydroponic Propagation Methods

Preparation of plant materials

Choice of Crops and Cultivars

- The most popular crops grown in hydroponics: tomatoes, cucumbers, lettuce, herbs, peppers, and strawberries

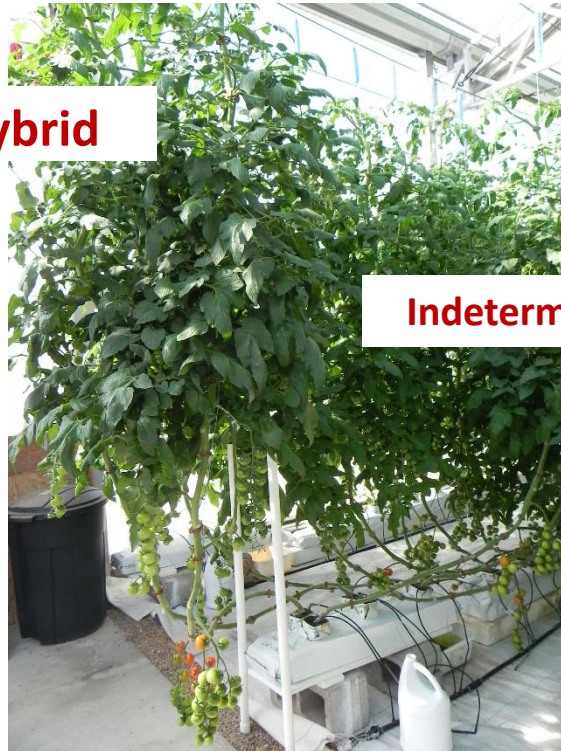


F1 Hybrid



Leafy vegetables and herbs

Planting density: 20-25 plants/m²



Indeterminant growth



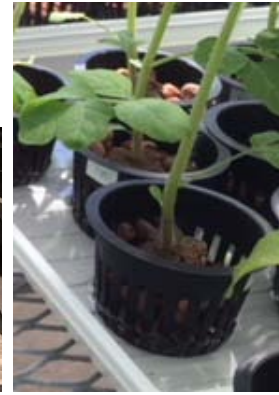
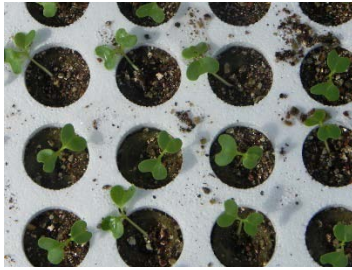
High-wire or vine plants

Planting density: 4-8 plants/m²

Types of Growing Media

Substrate choice for hydroponic seedling production

- Substrates can be used alone or in mixture with other substrates.
- Consider physical and chemical properties (air, water, and solid space; EC and pH), cost, local availability, compatibility with the production system
- Good physical contact with seeds



Substrates

Organic
components

Mineral
components

Conventional hydroponics

peat moss
coco coir
sand
sawdust
rice hulls

perlite
Vermiculite
Clay pebbles

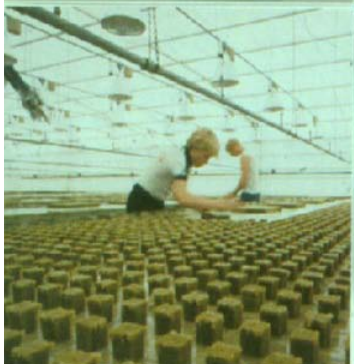
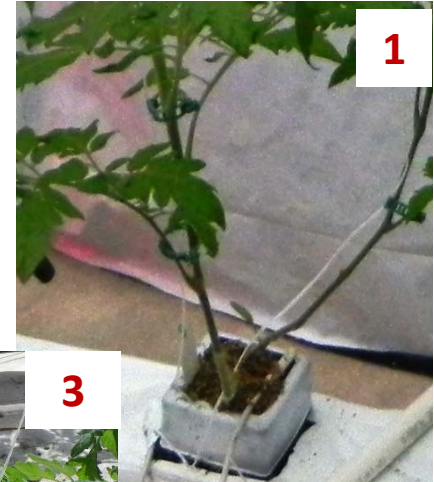
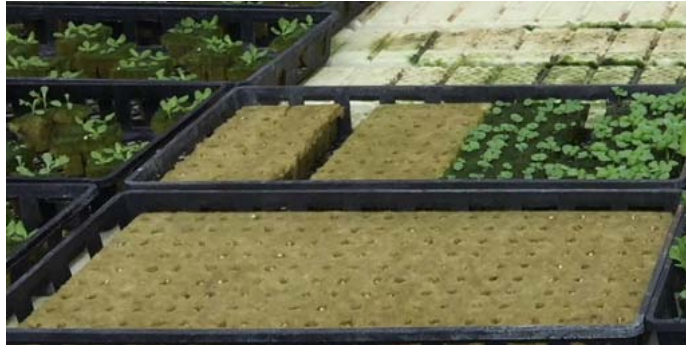
Synthetic media

(plugs, cubes, and blocks)

- polymer bound plugs (e.g. peat pellets, coir pellets, composted organic material plugs, Oasis Horticultubes, urethane foam plugs)
- Rockwool cubes & blocks
- coco coir cubes and blocks

Types of Growing Media

Substrates for hydroponic propagation



“Rockwool system”

Long-term crops

Hydroponic Propagation Methods

Seed propagation



Leafy vegetables and herbs



Grafting



High-wire or vine plants



Division



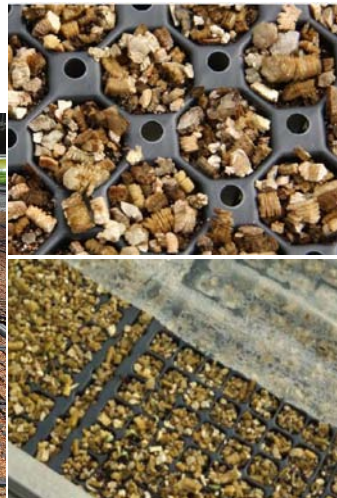
Hydroponic Propagation Methods

Seed propagation



Leafy vegetables and herbs

Large-scale seed propagation



Seed germination

- Relative humidity
- Temperature
- Light



Germination rooms



Hydroponic Propagation Methods

Seeding emergence

- Water and nutrient management
- Light: LED lights



EC: 0.5 mS/cm
pH 6



EC: 1.0 to 1.5 mS/cm
pH 6



EC: 2 mS/cm
pH 6

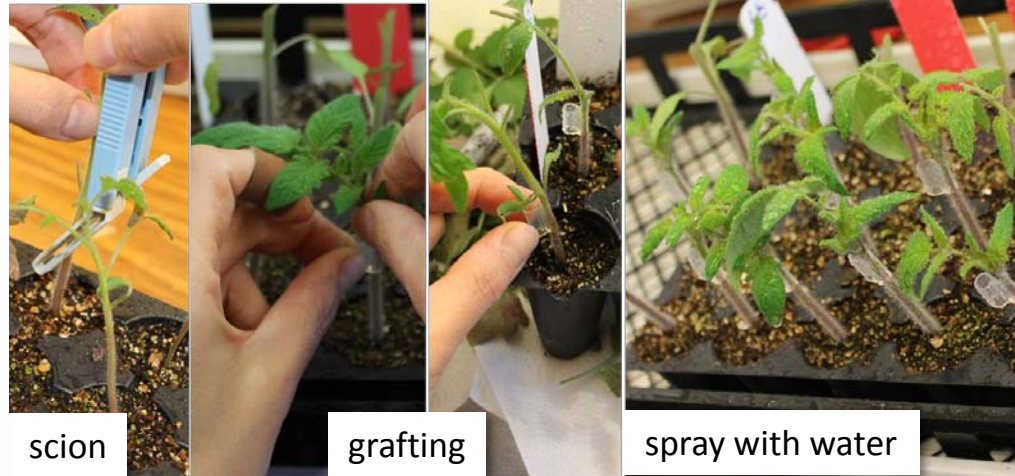
Hydroponic Propagation Methods

- Environment control for grafting success: water, light, and temperature
- Water management is a key issue during this process (particularly when an inert media is used).

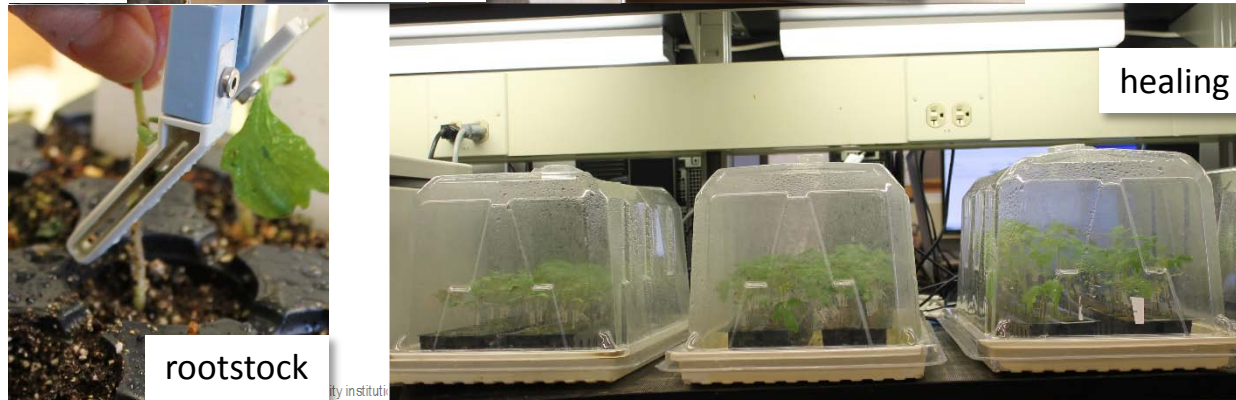
Grafting



High-wire or vine plants



Small-scale grafting-healing system



Hydroponic Propagation Methods

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Grafting



High-wire or vine plants

Large-scale grafting-healing system



Hydroponic Propagation Methods

Timeline and environmental control for grafting and healing

Major event			Grafting	Acclimation to indoor environment	Acclimation to production environment
	Germination chamber/greenhouse		Healing chamber		Greenhouse
Environment control	2-5 days	≈10-14 days	3-4 days	3-4 days or longer	≈ 7 days
Humidity	Seed propagation environment		85%-100%	Gradually decrease (≈ 60%)	Gradually decrease (40-60%)
Light intensity			Low light or heavy shade	Gradually increase	Gradually increase
Air temperature			25-30°C	Gradually decrease	–

Successful hydroponic production

... is all about
successful propagation!

