Crops Management in Soilless Systems

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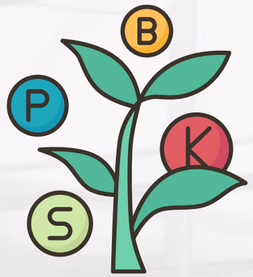
OUTLINE

- Crops requirements
- Crops selection
- Main crops
- Plants health and management practices

Crop requirements



Macronutriens and Micronutrients

Light

pH: 5.2- 6.5

Temperature: 18-30 °C but also 8-20 °C

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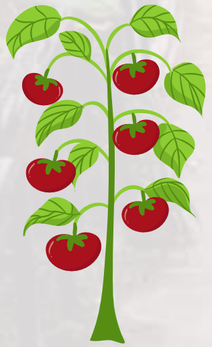
Crop Selection

Choose accord to the cultivation system

Leafy Green Plants

Most of the systems



Fruiting Vegetables

Require more space and proper substrate for anchoring

Root Crops

Ok in deep media beds

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Example

Tomato in NFT

- A proper water flow must be provided to avoid wilting;
- Large grow pipes;
- Large distance because of the growth and higher light requirements;
- Being a long cycle plants, manutention could be problematic.

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Main crops

Lettuce

pH	6.0 – 7.0
Plant Spacing	18 - 30 cm
Germination	3-7 days at 13-21 °C
Growth Time	24 - 32 days
Temperature	15 - 22 °C
Light Exposure	Full sun
Hydroponic Method	Media culture, NFT and DWC, Floating System

From Resh, 2022

Basil

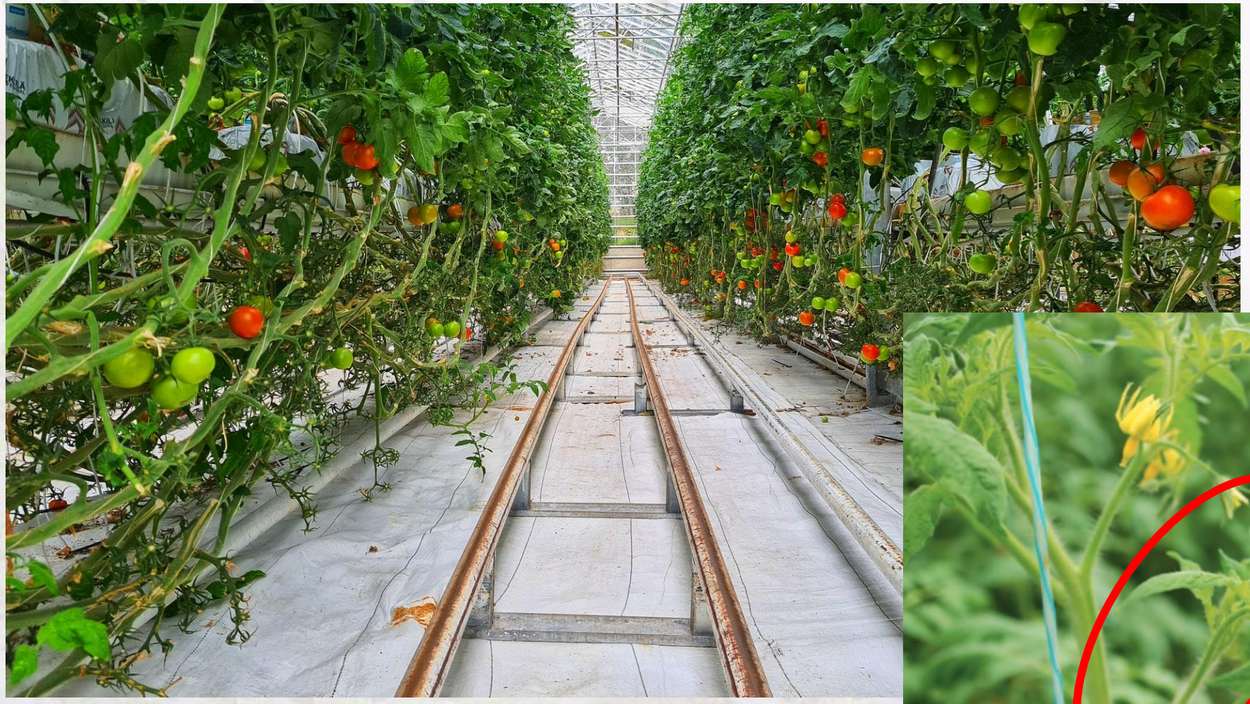
pH	5.5 – 6.5
Plant Spacing	15 - 25 cm
Germination	6 -7 days at 20-25 °C
Growth Time	35 - 42 days
Temperature	18 - 30 °C
Light Exposure	Sunny or slightly sheltered
Hydroponic Method	Media culture, NFT and DWC, Floating System

Parsley

pH	6.0 - 7
Plant Spacing	15 - 30 cm
Germination	8 - 10 days at 20 - 25 °C
Growth Time	20 - 30 days
Temperature	15 - 25 °C
Light Exposure	Full sun; shade at extreme temperatures
Hydroponic Method	Media culture, NFT and DWC, Floating

Tomato

pH	5.5 – 6.5
Plant Spacing	40 - 60 cm
Germination	4-6 days at 20-30 °C
Growth Time	50 - 70 days
Temperature	16-26 °C
Light Exposure	Full sun
Hydroponic Method	Media culture



Lateral Sucker

Eggplant

pH	5.5 – 5.7
Plant Spacing	40 - 60 cm
Germination	8 - 10 days at 25 - 30 °C
Growth Time	90 - 120 days
Temperature	15 - 26 °C
Light Exposure	Full sun
Hydroponic Method	Media culture

From Resh, 2022

Plants Health

Insects Pests

- Jeopardize plant production
- Carry disease
- Take advantage of controlled environment

Plants Health

Physical, Mechanical, and Cultural Controls

- **Netting/screens**: mesh size of 0.15 mm to exclude thrips, 0.35 mm to exclude whitefly and aphids, and 0.8 mm for leaf miners
- **Trapping**
- **Monitoring:** record and set a threshold level.

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Plants Health

Physical, Mechanical, and Cultural Controls

- **Environmental management:** light, temperature, and humidity. Heating reduces the RH and cooling increases it.
- **Plant choice**
- **Indicator plants and «catch plants»**
- **Companion planting**
- **Spacing**
- **Sanitation**

Plants Health

Carbon Dioxide (CO2) Supplement

Advantages: 20–40% yield increase depending on the crop type.

Optimum CO2 concentration: depends on the stage of growth and species of crop.

For example: tomatoes 700–1000 ppm and lettuce 1000–1200 ppm.

On cool days: special heaters can supply CO2 while simultaneously raising temperatures.

Plants Health

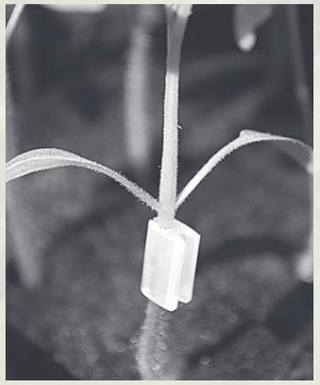
Chemical and Biological Control

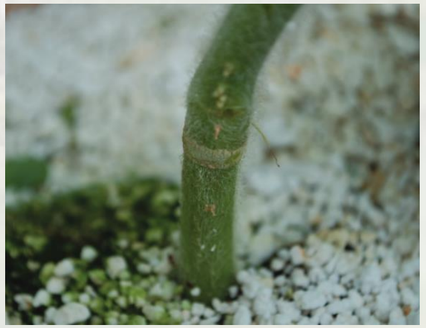
- **Biological control methods:** botanical pesticides and microorganisms *(Bacillus thuringensis and Beauveria bassiana*)
- **Beneficial insects:** predators and parasitoids
- **Chemicals as last option**

Plants Health

Disease Management

- **Environmental control:** reduce the risk of diseases outbreak.
- **Plant choice:** plant varieties have different levels of resistances to pathogens.
- **Nutrition:** healthier plants resist better
- **Grafting:** confers both vigor and disease resistance





Images from Resh, 2022

Plants Health

Biocontrol Case Study

Koppert

Az. Agricola Laffi (Bologna)

Banker plants

- Addition of plants into the protected crop, providing an alternative food source
- Application in soilless systems are under evaluation

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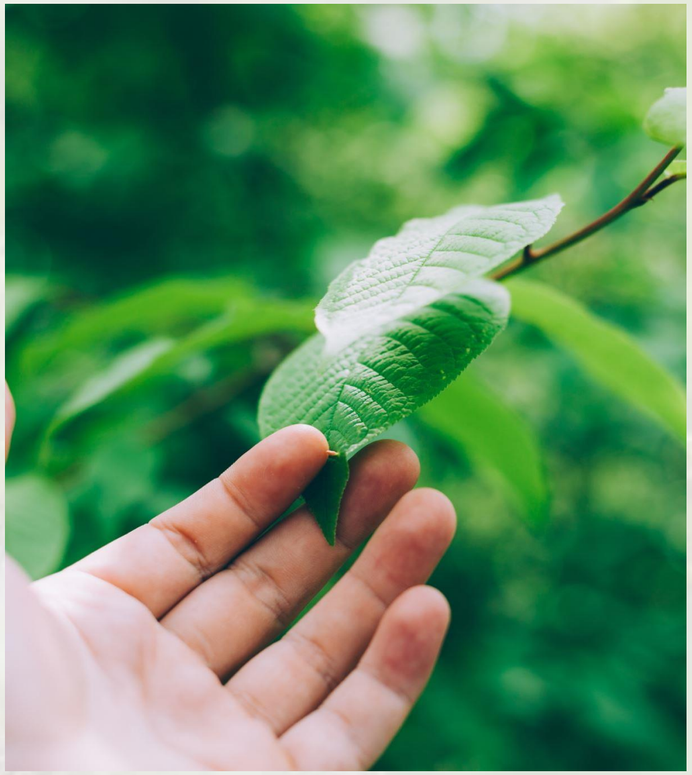
Plants Health

Good Practices

- Remove infected branches, leaves or the whole plant.
- Use disinfected tools.
- Monitor and record all symptoms and the progression of each disease.



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Conclusions

- Nutrition, planting techniques and design, and environmental management are pivotal to guarantee healthy plants.
- The focus should be on the environmental conditions, deterring pests, and on plant management as well as the use of organic remedies.

Plants Cycle Length

Species	*Planting and germination (days)*	*Period between Germination and transplant (days)*	*Transplant and harvest (days)*
Lettuce	5	15-18	25-30
Tomato	6	18-22	65
Cucumber	5	15-18	40
Eggplant	10	20-25	75
Onion	10	30-35	80
Chives	10	30-35	55
Pepper	12	30-35	80
Cabbage	7	30-35	90
Cauliflower	7	20-25	75
Okra	3	15	35
Coriander	7	20-25	40

Organic Repellents

Name	Ingredients	Preparation	Function
Neem	Green leaves: 2 kg; Water: 9 L. Vegetal soap: 100 ml	Grind the leaves or the fruit using a mortar and some water. Add some more water and leave to rest for three nights. Filter and dilute up to a final amount of 9 l. Then this solution shall be sprayed on plant.	White fly, aphids, caterpillars, nematodes
Ash	Wood ash: 0.5 cups; Water: 4 L; Kerosene: 6 soup spoon	Mix the ash with water and leave the solution to rest for 24 hours. Add 6 spoons of Kerosene. Mix strongly and spray on the plants.	Aphids, other sucking insects and leafminer
Garlic	85 g of chopped garlic; 50 ml of mineral oil (kerosene or vegetable oil); 10 ml of soap; 950 ml of water	Add garlic to vegetable oil. Allow mixture to stand for 24 hours. Add water and stir in the soap. Store in bottle container. Dilute, 50 ml of emulsion to 950 ml of water. Shake well before spraying.Spray thoroughly on the infested plant, preferably early in the morning.	Phytofagous insects, nematodes and fungi.

Name	Ingredients	Preparation	Function
Mexican Marigold	Leaf and stems of marigold: 1 kg; Water: 10 L.	Mix leaves and stem with water and boil for thirty minutes and then leave to rest for two days. Filter and spray the solution on the plants.	Aphids, acars, and some caterpillars.
Chili pepper	Chili pepper: 500 g; Water: 4 L; g Coconut soap: 5 soup spoon.	In a pot, boil ripe pods or chili seeds in water for 15-20 minutes. Take the pot from the fire and add 4 liters of water. Cool and strain. Add soap. Stir well. Then, spray on infested plants	Ants, aphids, caterpillars, flies and mealybugs
Black pepper	Grinded black pepper: 100 g; Coconut soap: 60 g; Alcohol: 1 L; Water: 1 L.	Leave pepper to soak in alcohol for 7 days. Dissolve the soap in boiling water, then remove it from fire and mix with the pepper-added alcohol. Filter the solution and store it. For use, dilute a glass of the preparation onto 10 l of water and spray on the plants in three events with a three days interval between them.	Aphids, mites, and scale insects

THANK YOU FOR YOUR ATTENTION!

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