



Home Hydroponics

What about soil?

Plants need water, air, light, nutrients and support to grow. **Hydroponics** is a method of growing plants using mineral nutrient solutions in water without soil. The nutrients that the plants normally derive from the soil are simply dissolved into water instead.

The plant's roots are suspended in, flooded with or misted with the nutrient solution so that the plant can derive the elements it needs for growth.

Aquaponics is similar to hydroponics except you add fish to the cycle.

Hydroponics Benefits

- Rapid plant growth. The growth rate is 30% to 50% faster than a soil plant.
- Greater control over production.
- A way to avoid soil-borne pathogens or insects.
- Allows crop production where there is no soil or contaminated soil (roof tops, abandoned buildings).
- Greater yield
- Uses less water use.

Hydroponics Drawbacks

- No power = no water.
- More cost associated with setup.
- Can require more management.



Hydroponic Systems

Active: Actively moves the nutrient solution, usually using a pump.

Passive: Rely on the capillary action of the growing medium or a wick.

Recovery systems or recirculating systems: Reuses the nutrient solution.

Non-recovery systems: The nutrient solution is applied to the growing medium and not recovered.

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The Wick System: A passive non-recovery type hydroponic system with no pump and no moving parts. Nutrients are stored in the reservoir and moved into the root system by capillary action often using a candle or lantern wick.

- Often uses sand or perlite, vermiculite mix and a growing medium.
- Easy and inexpensive.
- Keeps growing medium quite wet.

Floating Raft: Another passive system. Roots are saturated in water. Seedlings are started in soil-less media and transplanted into rafts.

- Low cost and low maintenance.
- Requirements: Root aeration, root darkness to avoid algae growth, and plant support.

The Ebb and Flow System: An active recovery system that uses a submersible pump in the reservoir with the plants in the upper tray. The nutrient solution is pumped to the upper tray and the root system of the plants. The pump should remain on for a 20 to 30 minute flood cycle. Once the water has reached a set level, an overflow pipe or fitting allows the solution to drain back to the reservoir.

- Low maintenance, highly effective.

Nutrient Film Technique (NFT): An active recovery type hydroponic system. NFT uses a reservoir with a submersible pump that pumps the nutrient solution into a grow-tube where the roots are suspended. The grow-tube is at a slight downward angle so the nutrient solution runs over the roots and back into the reservoir.

- Nutrients flow over roots up to 24 hours a day.
- Can be very unforgiving, with no growing medium to hold any moisture, any long period of interruption in the nutrient flow can cause the roots to dry out and the plants to suffer.



Growing Mediums

Rockwool: Stone wool made from basalt (lava rock), heated to 1,500°C, spun into threads, and cooled (1 m³ basalt = 90 m³ stone wool).

- 95% pore space, 80% water-holding capacity.
- Slightly alkaline, but no buffering capacity.
- Come in varying sizes to accommodate germination through maturity.

Perlite: Silica mineral mined from lava flows, heated to 760°C forming small, spongy, sterile, lightweight kernels.

- Holds 3x to 4x weight in water.
- No buffering or CEC capacity.
- No nutrient value.
- Rigid structure good for aeration.

Vermiculite: Mica mineral that expands at 1,100°C forming porous, spongy, sterile kernels.

- Lightweight and high water holding capacity.
- Unlike rockwool and perlite, has high CEC (contains some plant available Mg and K).

Expanded Clay Pellets

- Great for ebb and flow systems.

Expensive, but could be sterilized between plantings.

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Coco coir: Ground-up coconut palm husks.

- Good air capacity, capillarity and moisture retention.
- pH 6 with high CEC (from lignin and cellulose)
- Coir pith (part of the fiber) is a dust that can be converted into a hydroponic medium.
- A potentially sustainable, renewable resource though coconuts are from Southeast Asia.
- Could be recycled as a soil amendment.
- Many growers switching to this from rockwool.
- In theory, can be inoculated with beneficial microbes.

Other Considerations

Propagation: Could be seeds, transplants, cuttings or direct seeding into the media, which avoids root disturbance.

Water: Mature plants process a large amount of water. A fully grown tomato plant may use 2 to 3 gallons of water a day. It's a good idea to get water tested.

Light: The amount of light required varies. Most fruiting plants such as corn, tomatoes and peppers need 8 to 10 hours of sunlight a day.

- Foliage plants would survive on a little less light
- Artificial light will be needed for most food crops indoors.

Temperature: Warm-season plants perform best when the temperature is between 70°F and 80°F during the day and 60°F to 70°F at night. Example: tomatoes, peppers, basil.

Cool-season plants generally require temperatures approximately 10 degrees lower than those suitable for warm-season plants. Example: lettuce.

Air: Nutrient solutions must be aerated to get adequate oxygen for growth.

Nutrients: In traditional soil-based gardening, the plant receives fertilizer from the slow breakdown of organic materials and the release of mineral nutrients in the soil. Hydroponic plants must get all nutrients from the nutrient solution.

The elements needed for successful hydroponic growth are widely available in premixed form from gardening catalogs, garden centers, fertilizer companies or hydroponic supply companies. Follow the rate recommended on the label. Replace nutrient solution every 2 to 3 weeks.

- Primary macronutrients: nitrogen (N), phosphorus (P), potassium (K).
- Secondary macronutrients: calcium (Ca), magnesium (Mg), sulfur (S).
- Micronutrients: iron (Fe), manganese (Mn), boron (B), molybdenum (Mo), zinc (Zn), copper (Cu) and chlorine (Cl).

pH and EC: Must be tested and recorded regularly.

- pH: Concentration of H⁺ ions.
- EC: Concentration of nutrients in the solution (mS/cm).

Example Homemade System

- | Materials | |
|---------------------|--------------|
| • Plastic container | • Air pump |
| • Net pots | • Air tubing |
| • Media | • Air stone |

Resources

Hydroponics YouTube presentation:
<http://goo.gl/uWwBeP>

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CNS-17 Standard Hydro Recipe

| Photoperiod | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
|-----------------|----------------------|--------|------------|--------|--------|--------|--------|--------|------------------|--------|--------|--------|--------|--------|--------------------|----|----------|-------|----|
| Growth Stage | Seedlings/ Clones | | Vegetative | | | | | | Bloom Transition | | | | | | Flowering/Fruiting | | Ripening | Flush | |
| | Week 1 | Week 1 | Week 1 | Week 2 | Week 3 | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | | | | | |
| Number of Weeks | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CNS17 Grow | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CNS17 Bloom | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CNS17 Ripe | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Clearax | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

All measurements are listed in mL/gallon

CNS-17 Expert Hydro Recipe

| Photoperiod | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
|-----------------|----------------------|--------|------------|--------|--------|--------|--------|--------|------------------|--------|--------|---------|---------|---------|--------------------|---------|----------|---------|---------|
| Growth Stage | Seedlings/ Clones | | Vegetative | | | | | | Bloom Transition | | | | | | Flowering/Fruiting | | Ripening | Flush | |
| | Week 1 | Week 1 | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 | Week 11 | Week 12 | Week 13 | Week 14 | Week 15 | Week 16 | Week 17 |
| Number of Weeks | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CNS17 Grow | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CNS17 Bloom | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CNS17 Ripe | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liquid Karma | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sweet | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hydroplex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Silica Blast | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Hydroguard | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Vitamins | 2 | 3 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Pure Blend Tea | 1 | 2 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Clearax | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

All measurements are listed in mL/gallon