**Introduction:** This example describes the basic steps for setting up and growing a type of home-built hydroponic garden, i.e., an aeroponic garden, in which the roots of the growing plans are bathed in a spray of nutrient solution. Using off-the-shelf materials, the user will take plants from seed to sprouts to vegetative growth without soil or natural light. This example will outline the basic aeroponic setup, including the use of synthetic grow cubes, the operation of air and fluid pumps, how to prepare nutrient solutions, and ways to monitor plant growth. This example emphasizes a general procedure on how to promote the vegetative growth of leafy green plants, and many other species may be substituted for the flax plants used in this example, with minor modifications to this procedure. This simple setup may be used and scaled up for the growth of many types of plants, beyond leafy greens, in locations where natural light, soil, or other environmental conditions may not be favorable.

**Materials**

1. Please clean all solid parts of the system with a dilute bleach solution, ~1/4 c bleach/gallon of water.

2. Black plastic sprouting trays (21”x11”x2”), with and without drain holes

3. Growing tray lid with closeable vent

4. Four bulb fluorescent shop lights on timer:
   - Note: To promote vegetative growth, select the bluest bulbs, e.g., 600K-6500K, available from a local hardware store

5. Place one 98 sample sheet of rockwool cubes, ~1.5” square/sample, in the sprout tray.
Hydroponics Set-up Example 1: Basic Home-Built Aeroponics Plan and Procedure

6. Place a seedling heat mat, with temperature probe control, under sprouting trays [Optional]

7. Place one seed, e.g., flax seeds (or substitute other seeds), in each rock wool hole.

8. Gently tamp down seeds in holes with a wood rod, new pencil or toothpick.

9. Add the juice of one lemon, or an equivalent amount of vinegar, to ~1gal of tap water and gently add this solution to the seeded trays, without dislodging the seeds.

10. Let the seeds sprout and grow until roots extend from the rock wool.

11. Procure a nutrient solution, such as General Hydroponics FloraSeries® Grow, Bloom, Micro (or similar nutrient mix), and follow instructions for early vegetative growth.

12. Grow chambers:
   Examples: 4 gal Square plastic bucket or a plastic file box from an office supply store
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13. Chamber lids: Drill a grid of holes, to hold the seedlings in the rock wool plugs, in the bucket lid or 1/8” plexiglass sheet, cut to fit the plastic file box, with a corner cut out for the pump cord.

14. pH Test strips or pH Meter
15. pH Up/Down solutions, or food grade phosphoric acid and potassium hydroxide
16. Eye dropper or transfer pipette.
17. Mix the nutrient solution in sufficient amounts to fill the growth bucket or chamber with enough solution to cover the pump and spray nozzles and add enough pH up or pH down to bring the pH (test strips) to a pH between ~5.5 and ~6.5. The key point is to make sure the pH, or the acidity, of the solution is just below a neutral pH of 7.0.

18. Construct the growth chamber: The following list are representative examples and are not meant to advocate any specific product.
   - ½” CPVC piping and fittings
   - ½” high-purity plastic piping/fittings such as SDR11 HDPE with 360° micro sprayers
   - Ecoplus® ECO185 submersible pump with timer
   - Ecoplus® Eco Air 4 adjustable air pump with ¼” inert tubing and 4” oxygen stone
   - Ruler or tape measure; Utility knife; Fan for air circulation

Note: Most items can be substituted for alternatives and some are optional. Always use materials that are considered food grade or safe for gardening.
Hydroponics Set-up Example 1: Basic Home-Built Aeroponics Plan and Procedure

Dr. Daniel Herr, djherr@uncg.edu, February 7, 2019
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Additional Set-up Images:

- Various sizes of CPVC pipe and spray nozzles
- CPVC pipe connectors
- Submersible water pump, air stones and tubing, timers for lights
- The water pump is attached to the water circulation system

- Plexiglass with cut holes to hold the starter plugs and cut to fit in the top of the hydroponic system box
- Hydroponics nutrient solutions

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Hydroponics Set-up Example 1: Basic Home-Built Aeroponics Plan and Procedure

Instead of starter plugs, we can use starter mats

Growth: nutrients
Photosynthesis

Example of a Home Built Hydroponic System

Construction materials costs range from <$20-$45
Greens Growth Procedure

1. Seeding
   a. With mild detergent, wash plastic growing trays.
   b. Nest 1 tray with drain holes inside 1 solid growing tray.
   c. Fill tray with cubed Rockwool® and prescore along top with utility knife for easy breakage later.
   d. Place 1 seed in the center of each hole and tamp down gently with wood rod

2. Prepare Nutrient Mix
   a. Follow Flora® mix feed charts to prepare seedling mix.
   b. To 1 gallon of water separately add 2.5mL Gro, Micro, and Bloom while mixing.
   c. Add pH Down while mixing to adjust nutrient solution to pH 6, checking with pH meter or strips.
   d. Gently pour solution over rockwool, taking care to saturate all cubes while not flushing seeds from holes.

3. Placement and sprouts
   a. (optional) Place tray on seedling mat with temperature control probe near center and set to 80°F.
   b. Ensure tray is directly under grow lights approximately 2’ away.
   c. Close dome lid vents and place over tray. Open vents once the sprouts appear.
   d. Set lights for 24hr operation, ~16 hrs on and ~8 hrs off.
   e. Monitor regularly and wait for 2-3” tall sprouts (7-10 days)
   f. 80% viability expected from flax seeds

4. Preparing hydroponics and early growth
   a. With mild detergent, wash bucket, lid, and piping. Multiple buckets may be used.
   b. Lid should have holes with diameter approximately equal to width of Rockwool® cubes. An extra smaller hole for pump cables and air tubing is recommended.
   c. Assemble ½” pipe and sprayers to configuration appropriate for bucket size/shape with equidistant sprayers all pointed up and attach to top of pump. Place assembly in bucket.
   d. Connect Air pump, tubing, and oxygen stone. Place oxygen stone in bucket.
   e. Prepare Flora “early growth” nutrient mix with 10ml Gro, 7.5ml Micro, and 2.5mL Bloom and pH to 6, add ~1.7gal to bucket or until it touches bottom of horizontal piping.
   f. Fit bucket lid and carefully route air tubing and pump cable through appropriate hole.
   g. Select healthiest sprouts, break off cubes, then press into holes of bucket lid. Use excess rockwool to help fill any gaps.
   h. Turn on pumps, the oxygen stone should run 24hr cycle, the nutrient pump should operate 15min on, 15min off. Lights should now be 16hr on, 8hr off.
   i. (optional) Mild air turbulence helps plants like flax strengthen and stand tall. A fan for circulation may be used.
Hydroponics Set-up Example 1: Basic Home-Built Aeroponics Plan and Procedure

5. Growth phase
   a. Observe changes and measure growth every few days.
   b. Nutrient solution should be changed weekly and modified according to Flora® mix chart
   c. When plants mature, most greens can be harvested multiple times.

Some other examples of aeroponically grown greens:

Note: The author wishes to thank Mr. Steven Crawford, who received training in hydroponics technology, and kindly provided significant portions of the text and images for this example.