



Static Hydroponic Activities

Part 1. The Soda Bottle

Materials Needed

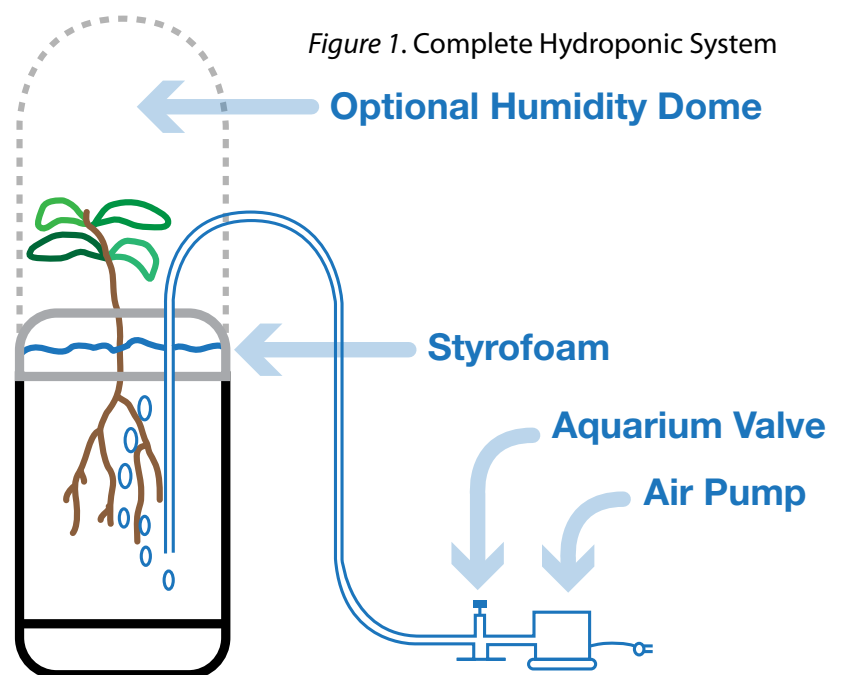
- One two-liter plastic soda bottle
- One- inch thick styrofoam
- Marking pen and labels
- Distilled water
- Electronic electrical conductivity (EC) meter
- Hydroponic nutrient solution (Hydro-Sol)
- Wisconsin Fast Plant with roots or other rooted plant start
- Calcium nitrate
- Electronic pH tester
- Aquarium air pump
- Aquarium air pump line/tubing
- Razor or utility knife
- Short blade scissors
- Cotton balls

optional

- PVC pipe, PVC cement, and PVC pipe cap

1. Obtain one plastic two-liter soda bottle.
2. Fill the bottle with hot water to soften the glue on the label. Swish the water around to soften all the glue. Remove label. You may also use a hair dryer/blower to remove the labels.
3. Mark the bottle at 23 cm from the base with a felt tip marker. Draw a line completely around the bottle.
4. Use a razor or utility knife to start the cut and short-blade scissors to complete it.
5. Place the cut soda bottle cut side down on the styrofoam block. Draw a line around the soda bottle on the styrofoam.
6. Cut around the circle drawn on the styrofoam with a sharp knife. To get an even finish on the edges of the styrofoam, rub an extra piece of styrofoam against the rough edges of the styrofoam.
7. Cut holes for the plants with scissors or poke a pencil through the styrofoam. If needed, surround the plant stems with cotton from cotton balls to help the plant stems stay in place in the holes.
8. Make a hole in the styrofoam for the aquarium tube coming from the aquarium pump. The line should be extended through the hole and into the nutrient solution.

9. Label your hydroponic system with your name, group number, and the date. Use a label and marking pen.
10. Insert the styrofoam round into the soda bottle. Another soda bottle may serve as a humidity dome if desired. See Figure 1.



Part 2. The Nutrient Solution

Your instructor will provide you with the Hydro-Sol and Calcium nitrate needed to complete this exercise. Mix one teaspoon of Hydro-Sol and ½ teaspoon of Calcium nitrate per gallon of water for the nutrient solution. Hydro-sol is a name brand product of nutrient solution for hydroponic systems. It provides the plants with the primary and secondary nutrients it will need to produce successfully. Calcium nitrate aids in the EC (electrical conductivity) count to ensure a standard for the EC meter.

Obtain the Wisconsin Fast Plant with developed roots from your instructor.

Gently insert the roots through the holes made in the styrofoam in Part 1.

Fill the soda bottle with nutrient solution and record the amount of solution added to the bottle in Table 1. The nutrient solution should be high enough to cover some, but not all of the roots. This is called the “fill” level.

Part 3. Aeration - Plants Need Air

Insert the aquarium air tubing into the reservoir through one of the pre-punched holes made in the styrofoam in Part 1.

The tubing can be made rigid by slipping a plastic straw onto the tubing.

One pump can operate many individual reservoirs by using a series of 3-way aquarium valves.

Optional: To operate multiple pop bottle units from one pump, develop a manifold. Run a line from the aquarium pump into one end of a 12 inch long piece of PVC pipe. Stop the other end of the PVC pipe with a PVC cap and PVC cement to make it airtight. Bore holes into the length of the PVC pipe and run a line out the holes for each hydroponic unit. See *Figure 2*.

Adjust the aeration to a rate of 1 to 3 bubbles per second.

Manifold for Hydroponic System Using PVC Pipe

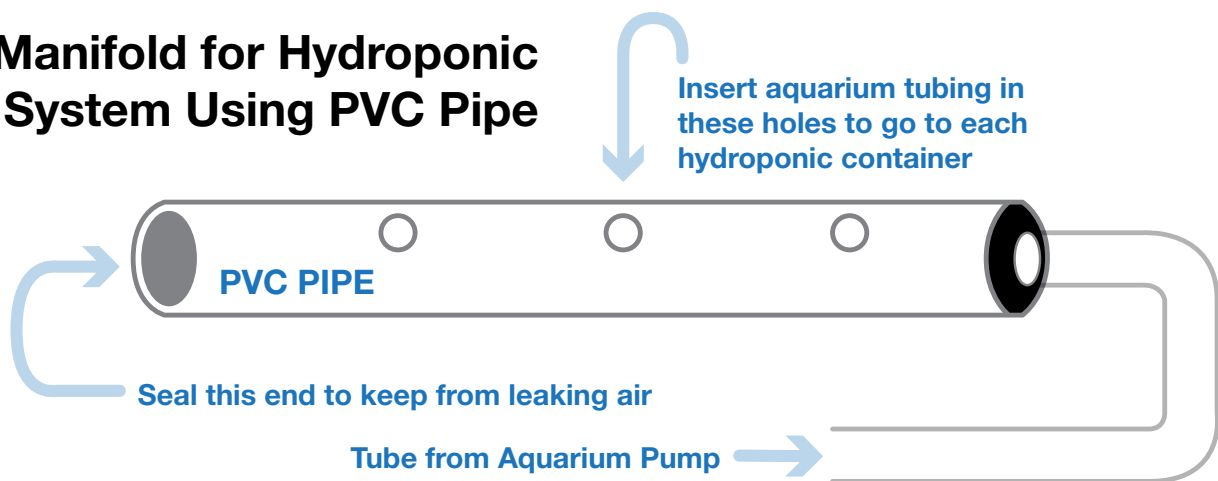


Figure 2. Manifold for hydroponic system using PVC pipe.

Part 4. Maintenance

1. Nutrient solution levels change due to transpiration and respiration. The nutrient solution level needs to be replaced every few days.
2. Develop a schedule for replacing the nutrient solution every one or two weeks. The rate of replacement depends on the rate of evaporation or water loss. Keep the nutrient solution at the "fill" level of your bottle at all times. Water daily and record how much water has been added each time the bottles are re-filled. When half of the total volume of water has been replaced, it is time to replace the entire nutrient solution with new water and nutrients. The total volume of water will vary depending on the height of the styrofoam piece and the amount of root growth. Keep a record of the total amount of water added daily by using the following watering chart. Note the day the nutrient solution was replaced and re-start the recording of total water added.
3. Use a razor or utility knife to widen the opening for plant stems as the plants grow. Be careful to not damage the plant stems when cutting.

Table 1. Water Added Daily: Hydroponic Plant Unit							
Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1							
2							
3							
4							
5							

The procedures and figures for the static hydroponic system were adapted from the following sources:

Bugbee, Bruce and Gus Koerner. *Teaching Hydroponic Science*. Hershey, David R. "Inexpensive Hydroponic Teaching Methods" (27-33).

Hershey, David R. "Solution Culture Hydroponics: History and Inexpensive Equipment." *The American Biology Teacher*, Volume 56, No. 2, Feb 94 (111-118).

Greentrees Hydroponics. 2013. Frequently Asked Questions. Retrieved from: www.hydroponics.net/learn/faq.asp#How_often_should_I_change_solution