How to Build A State-of-the-Art, High Yielding Aeroponic Growing System

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Introduction:

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Aeroponics is a technique for growing plants without soil or hydroponic media. The plants are held above a system that constantly mists the roots with nutrient-laden water.

Using this technique correctly can generate growth rates of up to two times that of an ebb and flow hydroponic system. Currently this growing technique is the worlds most efficient and fastest way to grow many vegetables, fruits, and flowers. Also, with faster growth rates gardeners are able to generate up to 4 harvests per year. The rate of growth and flexibility of this system are not the only reasons that aeroponics is the best way to grow many plants.

Aeroponics is much neater than hydroponics. There is less mess to clean up after harvest due to the minimal amount of growing media. The only mess there is to pick up is the roots and dead plant waste.

This catalogue/instructions will help guide you through the processes of:

1. Getting the parts and tools to make your own versatile aeroponics system
2. Assembling the parts
3. Using the system, setting cycles, and maintaining the system

Lets Get Started!

What You Will Need and Where To Get It:

Getting the Parts:

This chart show the items you will need to complete the system as well as where to get the items. Most of these items are available online. The reservoir can be made from a wide variety of storage bins so go to the local hardware store and find one that fits your growing area and water reserve needs.

Online Items:

Item	Quantity	Cost	Location	Picture
Reservoir	1	10.00	Lowes	
2.5" Drill Bit	1	14.99	Lowes	
1/2" PVC Tubing	4	4.16	Lowes	
3/4" PVC Tubing	3	3.18	Lowes	
Nylon Drain & Overflow Pipe Kit	4	1.36	AcmeHardware.com	
1/2" Elbows	5	0.82	Lowes	
1/2" Tees (One w/ threads in Bottom)	4	.20	Lowes	

1/2” PVC to 1/2” Adaptor	1	.49	Lowes	No Picture
1 ft. 1/2” Tubing	1	2.95	Home Depot	
3/4” Elbows	12	.20	Lowes	
3/4” Tees	4	.20	Lowes	
1/2" Valve	1	2.00	Lowes	
1/2" Cap	4	0.72	Lowes	
Fence Caps	8	15.92	Lowes	
6’ Fence Posts w/ No Holes	4	48.64	Lowes	
Pump - ViaAqua 3600	1	54.94	www.drsfostersmith.com	
3” Grow Cups	32	11.20	Futuregarden.com	
Rockwool	32	16.00	Hydroharrys.com	
Nutrients – Grow, Micro & Bloom	1	18.00	Futuregarden.com	

Micro Spray Jets	28	28.00	Home Depot	
Rocks	32	3.20	www.easyhydrokit.com	
Timer	1	19.95	Home Depot	
PVC Glue	1	2.95	Home Depot	
Silicone Caulk	1	3.89	Home Depot	
TOTAL		264.00		

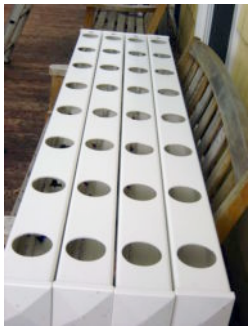
Household Items:

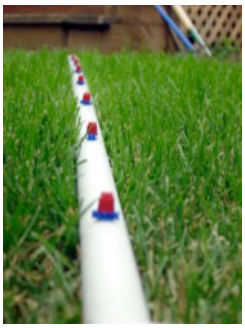
Drill				
3/8” Drill Bit				

Putting it all Together:

After you have purchased all the required items listed above you are ready to start assembling the system. Start with the Grow Chambers and Misting Lines and then move on to the Reservoir, Distributor Line, and Elevator Stands.

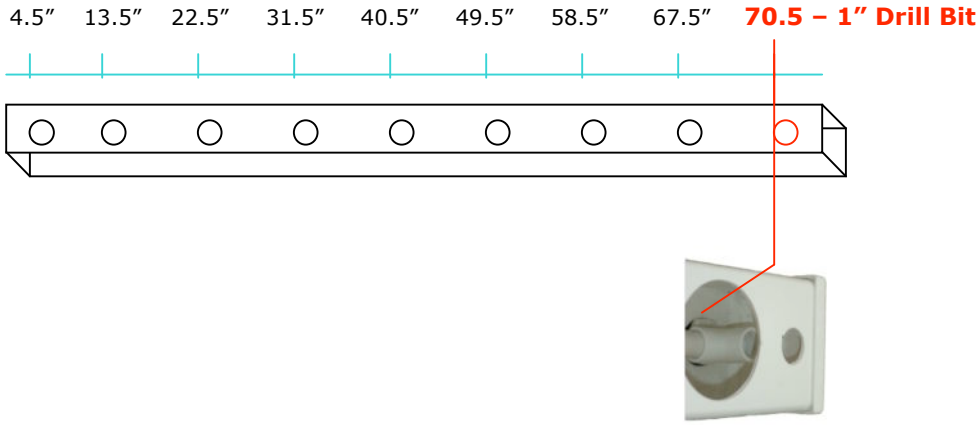
Making the Grow Chambers and Misting Lines:



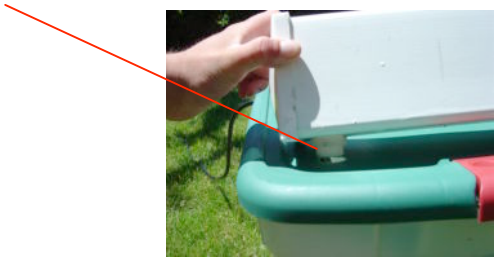


Step One: You will need – Fence Posts, Nylon Drain, 4 Fence Caps, Silicone Caulk, 3" Drill Bit, 3/8" Drill Bit, Drill

- Lay the four fence posts side by side and make each of these markings and then drill them out with the 3" drill bit, except for the hole at 70.5", making sure you are in the center of the fence post (like in the picture above).



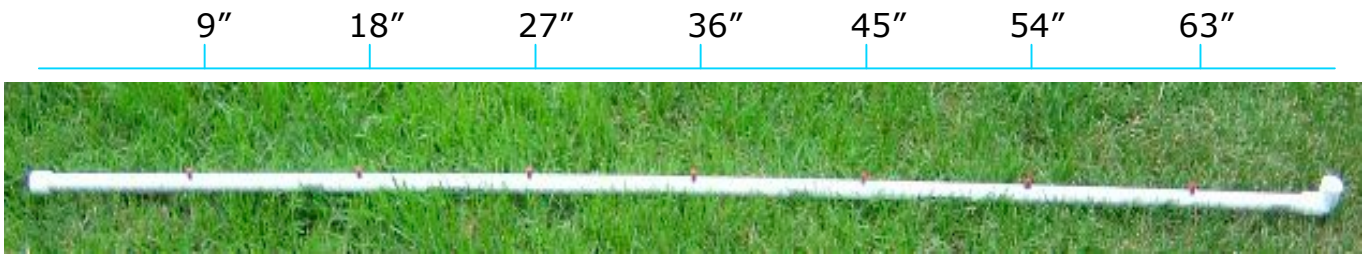
- The hole located at 70.5" should be drilled *straight* through the opposite side. This hole is for the returned nutrient solution. After drilling the 1" hole through both sides of the fence install the Nylon Drain in the hole on the backside of the grow chamber.



- The measurements above are for a 32-site system; more holes can be drilled depending on what you plan on growing and how far apart the plants need to be. For ease of instruction these directions will continue with the 32-site system.
- After you have finished Drilling all the holes in each of the four fence posts and installing the Nylon Drain you are ready to glue on the Fence Post Caps.
- Caulk around the inside edges of each of the four Fence Caps and insert the end of the Fence Post with the Nylon Drain into each of the 4 Fence Caps. It is very important to add enough caulk to make sure there will be *no leaks*. This end of the grow chamber is for returned nutrient and water will be circulating by these end caps for the life of the system. Do not attach the other Fence Cap to the other end of the Fence Post; this is where you will insert the Misting Lines. After the misting lines are inside the Grow Chambers is when you will glue the other End Cap on.

Step Two: You will need – 1/2" PVC Tubing, 1/2" Caps, 4 1/2" Elbows, Micro Spray Jets, 4 Fence Caps, PVC Glue, Drill, 3/8" Drill Bit.

- First, cut the 1/2" PVC Tubing to 69" so that it will fit inside the Grow Chambers. Save the Scraps, they will be used for making the Misting Line.
- Next use the 3/8" Drill Bit to drill holes at:



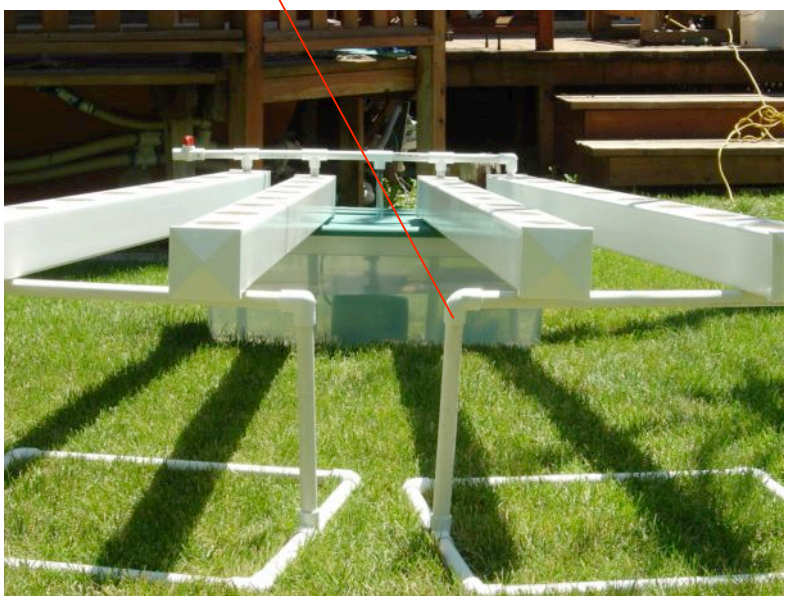
- Glue the 1/2” Caps and the 1/2” Elbows on to the Misting Lines.
- Screw the Micro Spray Jets into each of the 28 holes. The holes are very tight and screwing the jets into each of the holes requires a lot of work. Boring the holes out just ever so slightly can aid in this process.
- Insert the Misting Lines into the Crow Chambers with the elbow toward the end with the 1” hole in it.
- Glue the 4 Fence Caps onto the ends of the Grow Chambers with minimal glue. Minimal glue is used because this end does not support any water. The water will be flowing in the opposite direction. If anything goes wrong with the Misting Line it will be easier to access if the glue is kept to a minimum around the bottom edge.

Now that the Grow Chambers and Misting Lines are Complete it is time to build the Reservoir and the Distributor Line.

<u>Making the Reservoir, Elevator Stands and Distributor Line:</u>

Reservoir:

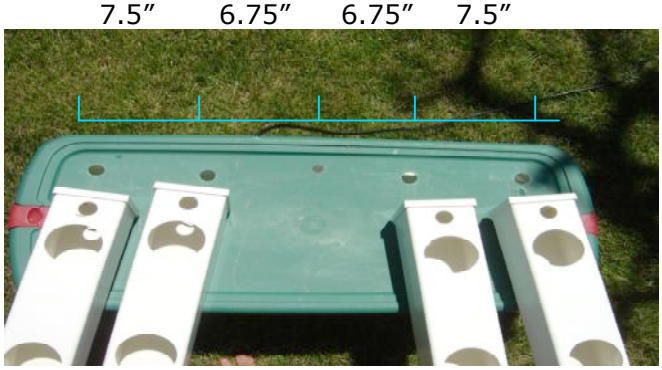
Elevator Stands:



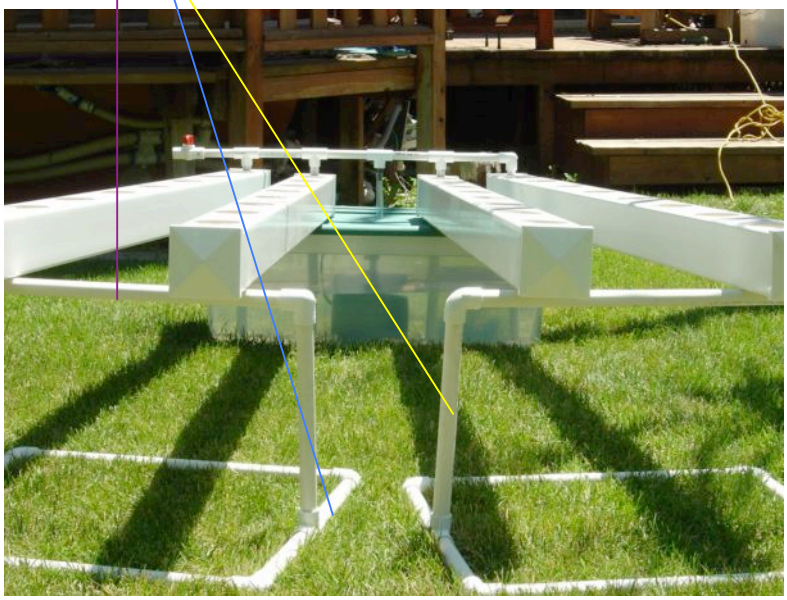
Step1: You will need: Reservoir, 3/4” Tubing, 3/4” Tees, 3/4” Elbows, Drill, 1” Drill Bit.

- Drill 4 Holes in the top of the reservoir in a *straight* line and at these 5 positions: (Next Page)

7.5” 6.75” 6.75” 7.5”



- After the holes are drilled the Elevator Stands must be assembled before the Grow Chambers can be attached to the Reservoir.
- Cut the 3/4” Tubing in these pieces:
  - 8 – 9” Segments - Footings
  - 6 – 24” Segments – Footings and Top
  - 4 Segments 1” taller than your Reservoir so the opposite end of the Reservoir is elevated and the Nutrient will return to the Reservoir.



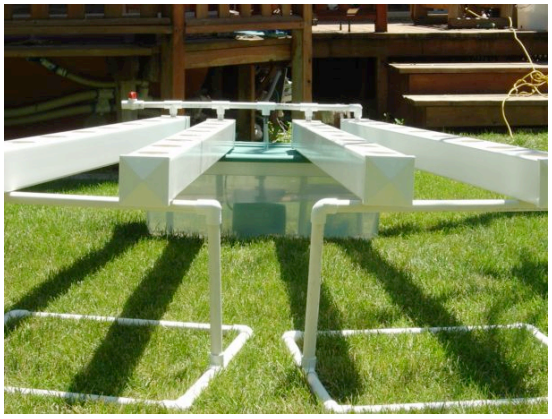
- Assemble the pieces of 3/4” Tubing with the 3/4” Tees and Elbows.
- After you have two Elevator Stands built do the following:
  - Assemble the pump
  - Fill the Reservoir halfway up with water, submerse the Pump in the Reservoir and put the lid on.

- Now attach the Grow Chambers. Unscrew the Nylon Nut from the Nylon Drain on each Grow Chamber. Insert the Nylon Drains through each of the 4 holes in the lid of the Reservoir.
- After the Nylon Drains are through the lid of the Reservoir replace the Nylon Drain Nuts on each of the 4 Grow Chambers, sandwiching the lid of the Reservoir between the Grow Chamber and the Nylon Drain Nut. Tighten the Nylon Nut all the way to prevent leakage.

- The system is almost complete. The next step is building the Distributor Line.
- You must have the system assembled up to this point in order to build the Distributor Line correctly.

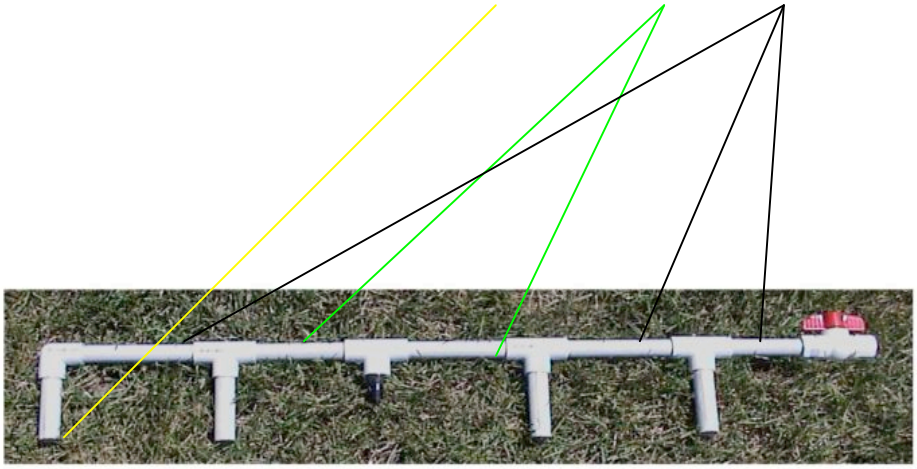
Step 2: You will need: 1/2" PVC Tubing (Leftover Pieces), 3 – 1/2" Tees, 1 – 1/2" Tee w/ Threads in the Bottom Hole, 1 – 1/2" Elbow, 1/2" Valve, 1/2" Tubing and PVC Glue.

- Now that the system is assembled it should look like this (Without the Distributor Line):



Distributor Line: From the 1/2” PVC Tubing Cut 4 – 4” long pieces 3 – 6.75” and 2 – 7.5” long pieces.

- Assemble the pieces to look like the picture below. Using the Tee with the threading as the middle piece. 4” 7.5” 6.75”



- Insert the Distributor Line into the Grow Chambers through the 1” hole that you drilled and connect all 4 Misting Lines to the Distributor Line. Keep in mind the side on which you want the Purge Valve to be i.e. the closest to the drain or irrigation.
- After you have made sure the Distributor Line fits the system glue the pieces together.
- Cut a piece of 1/2” Tubing to connect the middle Tee to the pump feeding the tubing through the middle hole of the Reservoir Lid and then into the Pump.
- Your system is now ready to use. It should look like this:

Now that you have finished the project of building your own Aeroponics System the next section will explain how to use the system and certain things you should consider while using it.

Growing With Your New System:

When growing Aeroponic crops there are four main elements that affect the rate of growth. They are – Nutrients, Ph, and Carbon Dioxide Content in the garden and Watering Cycles.

Most people believe the amount of nutrients a plant receives is directly related to a plant's growth rate. This is only partially true. A plant needs nutrients but when you feed nutrients to a plant at the wrong Ph level the plant will not even be able to utilize those nutrients and the nutrients will build up in your system. These built-up, unused nutrients become salt over time and start inhibiting the plants' roots from absorbing nutrients. First and foremost the Ph Level must, at all times, be between 5.5 and 6.5 otherwise the growth rate cannot ever reach 100% due to lack of nutrient uptake. While the plants are small never let Total Dissolved Solids get over 1100 PPM; when the roots are just babies they will not be able to absorb much nutrient solution at all. Wait until the plants have been in the system for at least 1 month before letting the PPM go over 1100. Never exceed 1800 PPM unless CO2 is being added to the grow room.

Adding CO2 to a grow room can increase growth rates only if the Ph and Nutrient Solutions are at the proper levels. Only then will CO2 be able to be utilized at faster than normal rates. I recommend injecting the grow room for 3 minutes at 20 PSI on the hour, every hour while the lights are on during the bloom phase. Make sure to exhaust the CO2 after each injection to make sure there is enough ventilation for the plants. They still need a lot of fresh air. Injecting the grow room with CO2 while the lights are off will just waste the CO2 because the plants need light to use the CO2. Photosynthesis occurs in the presence of light, CO2, chlorophyll, and nutrients. Watering the plants while the lights are off also does not increase growth rates.

Watering the plants takes good timing and quality water. Most aeroponic systems have expensive timers that turn the pump on and off 6 – 8 times an hour. With the system you just built it is only necessary to set the pump to turn off for 20 minutes every other hour. The nutrient solution is aerated during circulation. If enriching your garden with CO2 it is highly recommended that you add an aerating rock to the Reservoir. This way the roots can absorb nutrients at accelerated rates. Depending on where you live tap water can vary widely in Ph levels. Most areas in the Western United States have somewhat high Ph levels ranging from 6.8 – 7.7. Do not adjust for Ph before adding nutrients to the water; some nutrients can change the Ph of the nutrient solution. The nutrients are delivered directly to the roots by the 28 misters inside the Grow Chambers aerating the water

while it is circulated. The roots are misted 360 degrees with nutrients making it easier for the plants to develop root structure. This system can also be configured in various positions to maximize square footage and overall yield of your garden.

Depending on the dimensions of your grow area the State-of-the-art Aeroponic System you built can fit your needs. Here are a couple of pictures to give you an idea:

Maintenance:

Regular Maintenance:

Regular Maintenance is mandatory. Making sure the misters are working properly and that the pump is not clogged are the two most important aspects of regular maintenance for this system.

Making sure the misters are functioning properly should be done every week. Lifting up each plant and visually inspecting the each mister is all you need to do. If some of the misters are clogged simply turn the pump on and take the red cap off of the Micro Spray Jet; the clog will be forced out of the Misting Line. Clogging does not normally occur during the first couple of weeks using the system. After the roots have filled the Grow Chambers and the plants are well sustained is when a rare clog might occur. These clogs are due to foreign debris getting through the enclosed filter in the Submersible Pump.

The Submersible Pump should be cleaned every 4 weeks. To clean the internal filter, unhook the pump from the Distribution Line and remove the pump from the Reservoir. Take the front part of the pump off and remove the filter. Rinse the filter under warm water making sure there is no debris left in the filter before replacing it. Making sure that the internal pump filter is clean and that the misters are working properly will make for faster growth rates and larger yields. The only other maintenance this system needs to operate correctly is cleaning after each harvest.

Cleaning After Each Harvest:

After each harvest the system should be purged, or drained completely and rinsed thoroughly. Follow these steps:

i. Remove all of the Grow Cups and root debris from the Grow Chambers
ii. Pump all of the water out of the system and refill it with fresh water
iii. Scrub the sides of the reservoir with a cloth making sure all of the algae is off the sides of the reservoir
iv. Use the Purge Valve on the Distributor Line to pump out all the wastewater from the Reservoir.

The system should be clean. Repeat these steps if necessary. The system should look like new before starting each new cycle.

Conclusion:

The information in this manual is a compilation of knowledge from many years of aeroponic and hydroponic gardening. This system has produced many years of gratifying harvests from fruits to vegetables. Anybody willing to put forth the effort to build a system like this one will be able to achieve similar results for many years.

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