Home Hydro Systems

Easy to Build Hydroponic Drip System

Because prices change from place to place, your exact cost is going to be determined by what you can get in your local area. But you should be able to acquire all the materials needed for under $100. I built this system myself for between $60 and $80. You may even already have some of the needed materials around the house.

Even though this system is designed to grow 4 plants in 5 gallon buckets, you can easily adapt it to grow more or less plants as you wish, as well as in larger or smaller containers/buckets.

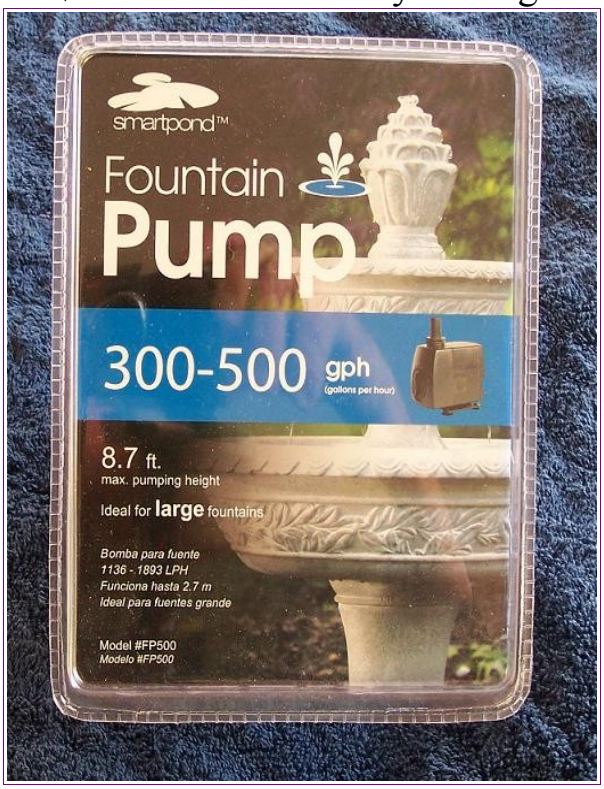
System Parts List

- 4 Five Gallon Buckets (for plants)
- 4 Through Holes (also called bulkhead fittings)
- Black Vinyl Tubing (for both fill and drain lines), also blue Vinyl tubing from a hydroponic supply shop will work fine as well.
- 1 Submersible Fountain Pump (found in most nursery's)
- 18 to 30 Gallon Storage Tote for reservoir (larger is better in the long run)
- Inexpensive Lamp Timer (with lots of on/off cycles to turn pump on and off with)
- Hydroponic Growing Medium (to support plants and hold moisture for the roots)
- One Inexpensive furnace Filter (to keep growing medium from getting in the tubing)
- A Few “T” Connectors that Fit the Vinyl tubing your using (how many depends on your final configuration)
- Two Cans of Inexpensive Black Spray Paint, and Two Cans of Inexpensive White Spray Paint (in order to light proof the buckets and reservoir)
- (Optional) A small amount of PVC tubing and connectors (for return line ends)

Additional Items You'll Need to Grow the Plants

- Hydroponic Nutrients (any type, as long as there designed for hydroponic plants)
- pH test kit (to test pH of the nutrient solution) pH drops by General Hydroponics works best and is the cheapest way to go.
- pH Adjusters (pH up, and pH down) That's to adjust the pH if needed once you have tested it.

Except for the hydroponic nutrients, pH testing kit, pH adjusters and growing medium, you should be able to get the rest of the materials needed at local stores like Home Depot, Lowe's, Wal-Mart, Target, Big lots, Kmart etc. I got the five gallon buckets at Home Depot for about $2.50 each, and the 18 gallon storage tote at Wal-Mart for $3.50. The black vinyl tubing and "T" connectors, I got at Lowe's.



The fountain pump was from Lowe's as well. That was the most expensive part of the whole system. The pump was about $40, but for this system you don't need a pump as large to do the job, but it does allow you to expand on the system in the future. Just make sure any pump you use has a removable filter, If not you will want to create one to keep debris out of it.

The Through holes/Bulkhead fittings come in all sizes and shapes. They are used in all sorts of industry's, but most home improvement stores carry them somewhere in the store, and very likely to have them in more than one place. I got these in the electrical department at Home Depot for $1.97 ea, right next to the electrical conduit.

You will need to make sure the end of the through hole that the vinyl tubing will go on (end without the threads and nut), will fit the

size tubing you are using. The ones in the pictures above will fit 5/8 inch inside diameter tubing. If not you can use two sizes of tubing and/or using a hose clamp to tighten it up. Or by cutting a short piece of tubing (the size that fits the through hole), and slipping it on the through hole, then slipping the smaller tube inside the larger one. If so you may want to use a small amount of waterproof glue between the two different sizes, and/or a hose clamp to make sure there's a water tight fit. Also you may find that a old garden hose will fit just fine, and can be substituted for the vinyl tubing for the return (drain) lines.

First step is to trace the side of the through hole with the thread and nut, on the bottom of all 4 five gallon buckets. You'll want it to be close to the edge of the bucket, but not so close you wont be able the thread the nut on in order to install it (about an inch). That's so you will be able to set it upright on a table or bench, and most of the buckets weight will still be supported, and it wont tip over.

It's important that you don't make the holes too big, or it may leak. It should be just big enough to stick the threaded side of the through hole in without a noticeable gap.

I use a rotary tool to make the holes myself, like the one pictured on the right. If You don't have one you can make the holes any way you want, even a hot metal coat hanger will be able to melt the plastic nicely, then just scrape any burs off with a razor blade to make the edge smooth.

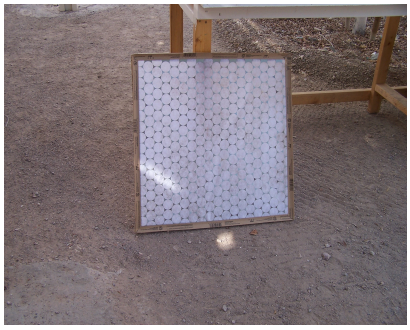
Now that you have the whole cut, insert the through hole and tighten it up. Just make sure you have the rubber gasket on the right side, in most cases (depending on the particular through holes your using) it will most likely be on the outside of the bucket, and only the nut on the inside.

In order to keep algae growth down you will need to light proof the buckets. Algae needs two things to grow, food and light. The nutrients will provide plenty of food, so you need to block the light.

Turn the buckets upside down, and put tape all around the through hole (so you don't get paint on, or in it). Give the buckets a couple of coats of black spray paint, or as many as needed to block all the light. Then because the color black absorbs heat, give the buckets a couple of coats of white spray paint. This will reflect light and help keep the root zone temperatures from getting hot. Make sure you only paint the outside, you don't want paint to come in contact with the roots or nutrient solution.

Getting the buckets ready to put the plants in is also quite simple, but just a few steeps. First cut the filter part out of the furnace Filter, then cut a piece off to place over the through holes. This will keep the growing medium out of the tubing, but still allow the water to flow easily out the bottom.

Furnace Filter



Now that you have the filter in place, place some rocks on top of that. I would fill about the bottom third with rocks. This holds the filter in place, as well as helps water drainage from the buckets. Also the rocks adds weight to the buckets keeping them firmly in place. Even strong winds won't be able move them.

Note: be sure to clean and sanitize the rocks first by rinsing them off and soaking them in bleach water for about an hour, then rinsing again. This reduces the chances of any root diseases from soil born pathogens getting into the system.

Growing Medium

On top of the rocks place the hydroponic growing medium. You can use many materials as a growing medium like Grow Rock (Hydrocorn), Perlite, Vermiculite etc.. Any inert (without nutrients) material can be used. I especially like, and used coco chips in this system. Coco chips and coco fiber are Basically the same thing, but coco chips are just in a larger partial size. The larger partial size allows more air/oxygen to get to the root system.

These are the coco chips I used in this system, they come in a compressed block. This block equaled 2 cubic feet (about 15 gallons worth) when uncompressed. To uncompressed it you just soak it in water. I would do this a couple of times to leach out some of the color. The color wont hurt the plants, but I try to get out as much color as I can first anyway. These coco chips also hold moisture very well witch is another reason I like using them. This block cost me $9.95, and was enough for all 4 five gallon buckets.

Watering and Drain lines

Now make a loop using the vinyl tubing and a connecting “T” for all 4 buckets. These will be the dripper's that will water the buckets. Once you have made them, take a paperclip and heat one end up with the flame of a candle, then poke some holes in the tubing ring with it.

Notice that I cut a notch in the side of the buckets just large enough to hold the watering line in place snugly.

The the feed line (watering) , as well as the drain line setup will depend on the configuration and positing of where you place your buckets. In the picture below you can see how I have run the lines to my buckets on the tabletop. The feed line comes up through a hole in the center of the table. Then is split into 2 lines using a “T” connector, then each of those lines is split into two lines again using the same “T” connectors. Essentially splitting one feed line into 4 separate lines (one to each bucket).

As the nutrient rich water is pumped up to the top of the plants, it then drips down through the buckets, moistening the growing medium (and roots), then freely drains back down into the reservoir through the through holes at the bottom of the buckets. Once back in the reservoir, it's able to be re-circulated through the system again. The bag of concrete is just there to help add weight to the table, we get 50+ mile an hour wind gusts from time to time, but I never had any problems with the table or buckets wanting to tip over with the weight of the rocks in the buckets as well as the concrete bag on top of the table.

The reservoir

The reservoir part is quite simple too, just paint the base and lid (outside) of the 18 to 30 gallon storage tote the same way you did the buckets. Painting it black to block light, and then white to reflect light. Once painted, cut a notch in the lid for the electrical cord and hose from the pump to go through. Then you are ready to start setting up your hydroponic system.

There are so many configurations that you can do, there is no way to explain them all. The buckets can be setup on a table, bench, wall etc.. But the one thing that you need to be sure of is that the reservoir is at least 6 inches below the buckets. Otherwise the nutrient solution wont be able to flow back into the reservoir easily.

The design is simple, the pump pumps the nutrient solution up to the top of the buckets, where it drips down through the bucket, and out the through hole at the bottom. Then the return tubing drains it back into the reservoir.

You can run the return lines different ways, but it should be a gentle slope all the way back to the reservoir. You can see that I connected the return lines from two buckets together with a "T" connecter, then back to the reservoir. The PVC at the end of the line going back into the reservoir is not necessary, although it does help keep the flow draining back more even. The tube coming out the side of the reservoir and looping back up through the center of the table is the line that pumps the nutrient solution from the pump up to water the plants from the top drip rings.

Water Cycling

I used a digital timer with this system (I already had it), but I later got another one for a different system for $5.95 at Kmart. It had plenty of settings and even a cover over the dial.

For best results with the timer, make sure it 's rated for 15 amps (usually called heavy duty). I had one that was rated for 10 amps but it burned out in just a few days. The heavy duty (15 amp) timers haven't burned out in over 2 years now.

You'll also want a timer that has pins for the on/off cycles all around the dial, not just a few (for analog timers). That's because it will need to be turned on and off many times during the day (to be explained later). Digital timers usually have many on/off cycles that can be set, though if there is a power outage it will loose their memory if it doesn't have a battery backup.

When growing outside, you will want to make sure the timer and cord connections don't get wet or they will short out. This can be done by placing them in a spot that wont get wet even if it's windy and rains hard. In my case I warped 3 plastic bags, layered one on top of the other (in case of small holes). Then tightly duct taped it to the cords. It's not as pretty as it can be, but it kept rain off the connections just fine.

There you go, you just built a drip hydroponic system. Happy Gardening!!!

Watering & Nutrient Solution Tips

Watering

How often and how long to water is a good question, but has so many variables like air temperature, water temp, type of growing medium used, type of plants (do they mind wet feet), how big the plants are, humidity etc. etc. etc.. That there's simply no real straight forward answer, except to say the goal is to water long enough to get the roots (and growing medium) wet, but not so long that the roots suffocate from lack of air/oxygen. Also to water often enough that they never dry out. If you see sings of wilting they are either well past dry, or to wet and suffocating.

Basically speaking, the roots just need enough moisture that they can absorb enough water to support the plants foliage. Bigger plants need more moisture (because they have a lot more foliage to support). Plants growing in dry conditions use more water than those growing in more humid conditions. Some growing medias hold moisture much better than others, thus don't need to be watered as often etc. etc. etc.. So just keep the growing media moist/damp.

Depending on the time of year (daily highs and lows), for this system I let it water for 30 minutes on, and between one and two and a half hours off. Just check the moistness of the growing medium. You will probably want to try setting the timer for different settings to find what works best for your plants, as well as your local conditions. Watering at night (during hours of darkness) is not typically necessary, because plants only suck up water during light periods. But I typically water a couple of times during the night in any system anyway, just to keep things moist.

Nutrients

There are many different commercially manufactured nutrient solutions on the market. They come in two forms, liquid and dry mixes. Most liquid types come in either a two or three part mix, and dry nutrients usually come in one or two part mixes. But just about all of them are well balanced nutrient solutions. They also come in different size containers, the larger ones cost the most but are generally the best deals in the long run (like buying in bulk). The first hydroponic nutrient I used was the "General Hydroponics Flora Series nutrients" (pictured right), it's a 3 part nutrient solution that needs all 3 parts to work properly.

But dry mixes like JRPeters (http://www.jrpeters.com/Products/Hydroponics/Buy-Hydroponics.html) Vertigro (http://vertigro.com/products/fertilizers.php), and QuickGrow (http://quickgrownutrients.com/) are generally much less expensive and just as good. So weather you choose to use liquid nutrients or dry mixes, just make sure you fallow the manufacturers directions. They should have directions for different types of plants, as well as the different stages of growth (seedlings, vegetative growth, fruiting etc.). Also I have learned you can generally mix them a little weaker than the manufactures directions and still get good results. Just make sure that you use nutrients designed for hydroponics. Nutrients designed for soil lack the essential micro nutrients that the plants need to grow healthy. Plants that are grown in the ground (soil) get these micro nutrients from the soil.

As the plants grow, they use up (absorb) the nutrient elements in the nutrient solution. Over time this dilutes the nutrient solution, so it's best to do regular nutrient change's. How often is the question, and as with most things in hydroponics has a many variables and is more a mater of experience by the grower than anything else.

Keeping an eye on the daily progress of your plants. The plants themselves can tell you a lot. But some general guidelines are, you should try to do a nutrient solution change every one to four weeks, and check pH every few days.

The biggest factor that affects how often you should change your nutrient solution is how big the plants are, compared to the size (how many gallons) of water in the reservoir. The bigger the plants, the bigger their root systems, thus absorb more water and nutrients. Another example, the plants wont deplete the nutrients in a 20 gallon reservoir as fast as they will in a 10 gallon reservoir. In other words big plants with a small reservoir should be changed more often than small plants, or with a larger reservoir.

Also you will notice that the water in the reservoir will slowly disappear, even though you don't have any leaks. The plants drink this water up, and transpire it out their leaves normally every day. The bigger they are and the hotter it is, the more they will drink up. You should mark the inside of the reservoir with a permanent marker when you first fill it (then run it until the growing medium is wet), so you know exactly how much they have used up later.

As the plants drink up this water (and nutrients) from the reservoir you will want (need) to replace it. That's where the mark from the permanent marker is important. You will want to just add fresh (plain) water back up to that mark. If you replace more water than was used, you will be diluting the nutrients in the solution, and If you don't add enough water back, the nutrients in the solution will become concentrated (to strong).

The reason you want to add fresh water back instead of more nutrient solution, is plants don't absorb water and nutrients evenly. The plants only take up the nutrients they need and leave the rest. That's also one of the reasons for doing regular nutrient solution changes, over time the nutrients the plants don't use will become concentrated in the solution. But by simply doing a change you can be sure it's balanced again.

pH

pH in hydroponics is important to healthy plants, but luckily it's not to hard or expensive to take care of. Even though there are more expensive pH testing equipment available, with no meters to calibrate or give false readings the pH drops by General Hydroponics (pictured right) is probably the easiest and cheapest. Unfortunately the pH testing equipment for pools wont be able to test the right ranges needed for hydroponics, so those wont work.

Most plants fall in between a pH of 5.0 to 7.0, although almost all do well at about 6.0 right in the middle. It's not necessary to get it down to the exact number like 5.5, plants adapt well to there surroundings and have adapted for thousands of years to fluctuating environments. Including fluctuating pH. The important thing is to keep the pH within a range (not to an exact number).

Once you have tested your nutrient solution's pH level, and have determined if it's high or low. Then you will want to add some pH down if it was high, and add pH up if it was low. pH adjusters (pH up/pH down), like nutrients come in both liquid and dry forms, and the dry adjusters are generally the best value (just mix well before adding it to the nutrient solution). PH adjusters are basically just acids and bases, but you will want to use adjusters that were designed for hydroponics in order to avoid any problems. The adjusters are sold at any hydroponics shop and run about $8 to $15 depending on size and type. Also generally a little goes a long way, add a little at a time then re-test. In a short time you will be able to guess just how much to use depending on how far off the pH was to start.

Here are some plants and pH ranges for them, but you don't need to be exact.

Fruit	pH	Fruit	pH
Banana	5.5-6.5	Pineapple	5.5-6.0
Black Currant	6.0	Red Currant	6.0
Blueberry	4.0 -5.0	Rhubarb	5.0- 6.0
Melon	5.5-6.0	Strawberries	5.5-6.5
Passion fruit	6.5	Watermelon	5.8
Paw-Paw	6.5		

Vegetable	pH	Vegetable	pH
Ambra radicchio	5.5-6.5	Marrow	6.0
Artichoke	6.5-7.5	Okra	6.5
Asparagus	6.0-6.8	Onions	6.0-6.7
Bean (Common)	6.0	Pak-choi	7.0
Beans (Italian bush)	6.0-6.5	Parsnip	6.0
Beans (Lima)	6.0-6.5	Pea	6.0-7.0
Beans (Pole)	6.0-6.5	Peas (Sugar)	6.0-6.8
Beetroot	6.0-6.5	Pepino	6.0-6.5
Broad Bean	6.0-6.5	Peppers	5.8-6.3
Broccoli	6.0-6.5	Bell peppers	6.0-6.5
Brussell Sprout	6.5-7.5	Hot Peppers	6.0-6.5
Cabbage	6.5-7.0	Potato	5.0-6.0
Capsicum	6.0-6.5	Pumpkin	5.5-7.5

Carrots	6.3	Radish	6.0-7.0
Cauliflower	6.0-7.0	Spinach	5.5-6.6
Celery	6.5	Silverbeet	6.0-7.0
Collard greens	6.5-7.5	Sweet Corn	6.0
Cucumber	5.8-6.0	Sweet Potato	5.5-6.0
Eggplant	5.5-6.5	Swiss chard	6.0 6.5
Endive	5.5	Squash (Summer)	5.0-6.5
Fodder	6.0	Squash (Winter)	5.0-6.5
Garlic	6.0	Tomato	5.5-6.5
Leek	6.5-7.0	Turnip	6.0-6.5
Lettuce	5.5-6.5	Zucchini	6.0

Herbs	**pH**	**Herbs**	**pH**
Basil	5.5-6.5	Mint	5.5-6.0
Chicory	5.5-60	Mustard Cress	6.0-6.5
Chives	6.0-6.5	Parsley	5.5-6.0
Fennel	6.4-6.8	Rosemary	5.5-6.0
Lavender	6.4-6.8	Sage	5.5-6.5
Lemon Balm	5.5-6.5	Thyme	5.5-7.0
Marjoram	6.0	Watercress	6.5-6.8