

HOW TO BUILD A SMALL TOP DRIP SYSTEM USING BATO BUCKETS



This system is by far the most ambitious of the 5 "mini-farms" we present in this series. You must follow the assembly directions carefully and pay attention to details. Why go to the trouble? We have found that our top drip systems have produced the most lush and prolific plant growth of all. Also, once it's built, it's pretty low-maintenance.

We have designed here a small unit that supports 3 large growpots (Dutch Bato Buckets). We love Bato buckets because they are inexpensive and have a built-in safety feature. A small reserve of nutrient solution is always held in the bottom of each pot. In the event of a power failure, the plants will not die, but can live off the reserve for a couple days.

Top drip Batos form a great, dependable hydroponic unit. This garden cost about \$135 in early 2009 (not including a lamp and food). Most of the materials are available from Home Depot or Walmart. A few items must come from a hydroponics supplier (but we give you a good cheap source).

SUPPLY LIST:

- ◆ Rubbermaid Black Storage Tote Bin with lid- 18 gallon [Walmart] (Or similar sturdy tote bin of 16-20 gallon volume)
- ◆ 3 Bato dutch buckets [try www.bghydro.com]
- ◆ Small submersible pond pump- 120 gph [heres one cheap: <http://www.hydroponics-simplified.com/cheap-hydroponics-supplies.html#ebb>]
- ◆ Timer, mechanical garden; 15 minute increments [Walmart]
- ◆ Aquarium air pump, 6 feet of airline tubing, "T" connector & 5" airstone [Walmart]
- ◆ PVC pieces: **1 1/2" schedule 40 pvc pipe**: Two 10 foot pcs of pipe; 8 elbows; 1 "t" piece; Tip: (buy 2 extra elbows and 1 extra T-piece in case of gluing mistakes [Home Depot])
- ◆ One 4 oz. Can of PVC cement (gold label)[Home Depot] **Don't get blue glue.**
- ◆ Small tube **aquarium grade** silicone sealant [Pet shop]
- ◆ Black irrigation tubing, 1/2 " I.D. (inner diameter) about 6 feet long [Home Depot]
- ◆ 1/4" irrigation "spaghetti" tubing, 10 feet (for drip lines)[Home Depot]
- ◆ Six 1/4" irrigation barb connectors (smallest bag)[Home Depot]
- ◆ Small bag of perlite [Home Depot]
- ◆ One brick of coco coir & small bag of LECA (Hydroton or clay balls). More on this and ordering info later in the Tips 'N Techniques section.



TOOLS NEEDED:

- ◆ Power drill; 1-3/4" or 1-7/8" & 2-1/4" hole saw drills & 7/8" and 1" spade drill bits (Borrow a hole saw kit or buy one, you will definitely use it again).
- ◆ Hacksaw, pvc pipe cutter or power saw to cut the PVC pipe.

The heart of the Bato bucket is the built in safety "reservoir" for nutrient solution which rests at the bottom of the pot. The bucket has a "cutout", allowing it to sit on 1-1/2" PVC pipe, into which you drill some drainage holes. A special port which comes with the bucket allows excess drainage to leave the pot via these drainage pipes. (This will all make more sense to you during assembly of the unit.)

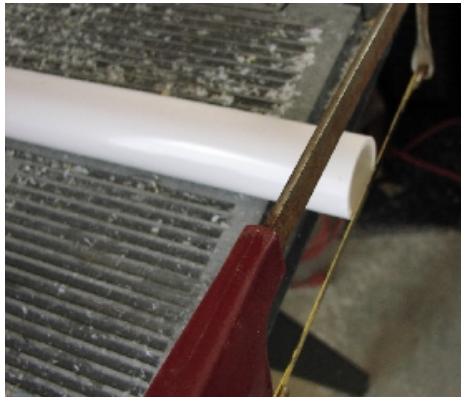


Here's how to build the system:

First cut and assemble the PVC stand. Please follow instructions carefully in the order suggested.

1. Cut pieces of the 1-½" schedule 40 PVC pipe to the following lengths. Lightly file or sand the cut edges to remove burrs:

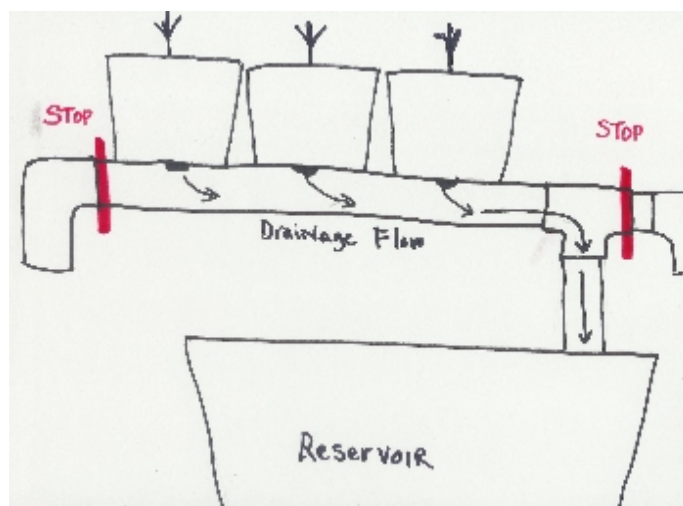
- ◆ 1 pc 31" long
- ◆ 1 pc 35-¼" long
- ◆ 1 pc 18" long
- ◆ 1 pc 17-½" long
- ◆ 1 pc 16-½" long
- ◆ 1 pc 16" long
- ◆ **2 pcs.** 5" long
- ◆ 1 pc. 6" long
- ◆ 1 pc 2" long



2. Next, a word about PVC cement. You will apply a nice coat of glue to each PVC piece before pushing them together. *Once you attach them together, you have all of **5 seconds** to get it seated properly before a permanent and unbreakable bond is set.* If you screw it up, throw in the trash and start over. (Hence the advice to buy a couple extra elbows and t-piece).

You are going to assemble and glue up the back drain pipe first. This is by far the trickiest part of the whole operation. Listen carefully to avoid a trip back to Home Depot.

To form the back drain rail, you will need the 31" pipe, the 2" pipe, and the "T" piece. This pipe is what will collect the drainage from your pots, and so it needs to be sealed off on both ends so the fluids won't run down into the legs of your stand. (This will also make more sense to you once you start putting things together). First study the drawing below. See how you need to block off the inside of the tube at the elbow and "t" piece (at the RED STOPS) so there is only one small restricted chamber for fluid drainage?



So you will need to insert a waterproof "block" at the elbow on the left and the outside port of the "T" piece. You can use whatever inert (plastic) material you can find and seal it off with **aquarium grade** silicone sealant. (Do not use household silicone, it has chemicals you don't want to feed your plants). We blocked ours off with 2" wide styrofoam circles cut from building insulation. You could cut 2" circles from an old Styrofoam ice chest, or whatever works! See photos below.



3. Next, push one styro block into one elbow piece and do the same for one end of the "T" piece. Push in far enough so you leave enough room for the straight pipe to fit in there later. Apply a thick coat of silicone sealant on top of the block, and around the sides of it. Allow it to set up, then apply a second coat. The idea is, you want it totally blocked off so no moisture can get through. *Tip: do not use PVC cement for this. It melts the styrofoam. Trust me.*



4. Okay, time to glue up the back rail. For this, use the 3/4" & 2" pieces of straight pipe, and the "T" piece with the "block" glued in one side. Do not put the elbows on at this time. Make sure you put the T-piece on with the "block side" towards the outside, the 2" piece. This is how it should be assembled:



How to use PVC glue: apply to both pieces, then push them together, all the way in. Hold jammed all the way together for about 5 seconds to set the glue. It is now permanently bonded.

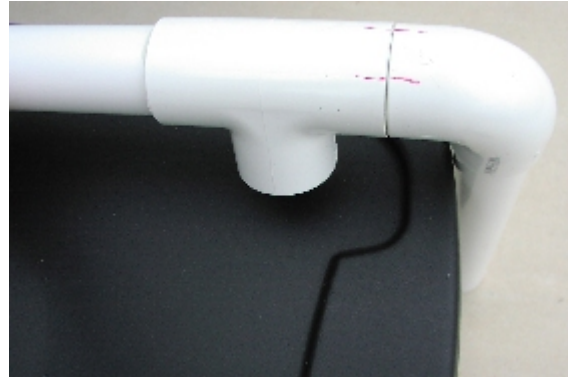
5. Next glue the elbow with the "block" glued in it to the 18" cut piece, **glue the leg into the end without the block.** Glue 3 other elbows to the other leg pieces (17-1/2" , 16-1/2" & 16" cut pieces). This is how it should look:



6. Now glue the two longer legs to the back (drain) rail (the assembly with the T pc glued in). The 18" pc (with the block glued in the elbow) goes on the plain end of the rail. The 17 1/2" leg goes on the T-pc end of the rail. First you will do a dry run. The legs need to be flat (& parallel), but the t-piece will angle in, to drain into the reservoir. This is what you are attempting to do:



7. First assemble as a dry run, making sure the legs lie flat, with the top pc angled in slightly. Use a marker to show where the pieces line up before gluing them home. Push flat on the floor as you glue it together so it is perfectly FLAT.



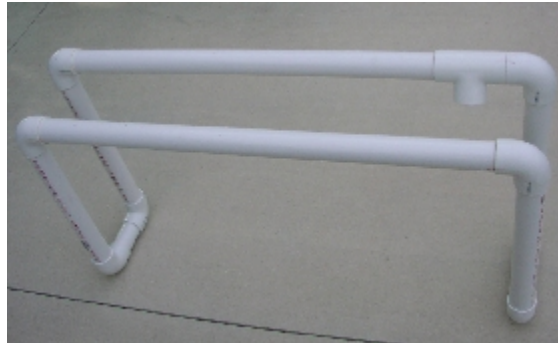
8. Next glue in the two shorter legs to the front rail, using the 35-1/4" , 16-1/2" , & 16" pieces. Do a dry run first, lay the assembly flat on the floor, and mark where the pipe goes into the elbows like below. Then glue them on. Push flat on the floor as you glue together so it is FLAT.



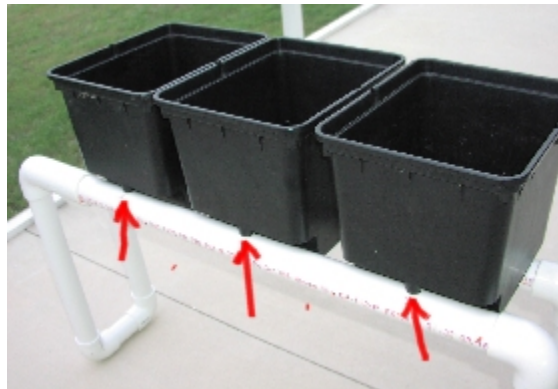
This is how the frame will sit over the reservoir:



9. Next add the two 5" pieces to the bottoms of the legs. Glue one elbow on each end of each of the 5" cut pieces, making sure to seat them all the way in for each joint. Then glue to the bottom end of the two assembled frames. The two taller legs (18" and 16-1/2") go to one "U" and the two shorter legs (17 1/2 and 16") go to the other "U". This is what it looks like all glued up:



10. Now it's time to drill the drain holes in the back drainage rail (the one with the t-piece). Set the three Bato buckets onto the frame so they line up evenly between the elbow and the T-piece and mark on the PVC pipe where the drain holes come out:



11. Using the 7/8" spade bit or a 1" hole saw bit, drill the three holes in the very top of the PVC pipe. This is where the Bato bucket drain elbows will fit into the drain pipe.



12. You're really getting there now. This is what it looks like with buckets in place:



13. The remaining 6" piece of PVC pipe is the drain pipe extension. Glue it into the down port of the T-piece. Then using the 2-1/4" hole saw, cut a hole in the reservoir lid right where the drain port extension hits the lid, so it will enter it. Cut a smaller 1" hole in the front corner as shown. This is where the hose is going to come up from the pump to the feeder lines.



14. Push one end of the 6 foot 1/2 inch irrigation tubing onto the outlet port of the pond pump. If it fits too loose, you must secure it with a zip tie so it doesn't come off during assembly and operation. First push the pump electrical plug up through the bottom of the reservoir lid, then the 1/2" irrigation tubing through the same hole. See photos below.



15. Now set the frame up where you want your garden to reside permanently. Assemble the two black elbow pieces that come with each Bato bucket so it forms a "U". Then push it forcefully over the drain hole in the bottom of the bucket, until it snaps down completely and the barbs exit the bottom hole. This takes some force. Make sure the barbs go through completely or the bucket will not drain properly. (Can't stress this point too much). Now put the buckets in place, with the drain elbows extending down into the drain holes you have drilled into the PVC pipe.



16. Now to make the "spaghetti" feeder lines. The large 1/2" tubing that comes up from the pump in the reservoir: arrange it so that it runs at the back top edge of the 3 buckets, and tape in place temporarily.



17. Cut the end of the tube off about 6 inches beyond the third bucket, roll it over 3 times and seal it off with a zip tie. This is the end of "the run", and you don't want it leaking.



18. Mark off 2 spots on this tube at each bucket. This is where the spaghetti lines will run off the larger main tube to the plants. Each bucket gets two feeder lines.

19. Now get the small 1/4" spaghetti tubing and the barbed connectors ready. Cut six 16" pieces of the tubing for the feeder lines. Take your time and work each tubing piece onto one end of a 1/4" barbed connector. It will take some time to force it down flush. And I mean all the way. Seat it properly now and it won't leak later.



20. Now you want to attach the spaghetti lines to the larger feeder tube where you marked the six spots. You must punch a **tiny** hole at each of those six spots where you marked them off. We use a hole punch made just for the job. It only costs a couple of bucks in the irrigation section at Home Depot, but we didn't see the added expense to you for just six holes. It does a nice job, though.



21. Insert the other end of the barbed connectors into each one of the six tiny holes you punched in the large tube. You might have to untape the tubing from the backside of the pots to do this, as it takes a bit of work. Take your time and carefully work them all the way in until they “pop” and the barb is now inside the larger tube. Do this right and it will not leak. Then retape the larger line to the backs of the pots and route two spaghetti lines to the top surface of each Bato pot.



22. You can just lay the tubing on top of the pot surface, or secure it in some way. We use little metal plant clips we found in the Walmart garden center.



Note: They sell dripper valves that go on the ends of the spaghetti tubing, but these always get clogged. Save yourself the money and headache and just let them be. The nutrient solution trickles out the end of tubes at the base of the plant. No problem.

23. Oops! Forgot to tell you how to fill the buckets. After **fully** installing the drain elbows in the bottom of the pots, fill them up with a 50/50 mix of Coco coir and perlite. Then place a 1" layer of LECA or clay balls on the top. The balls help keep the medium from being disturbed during the feeding cycle, and also keeps algae from growing on the top. (More details on media in the Tips 'N Techniques section at the end).

24. Plant your seedlings or baby plants (not seeds), and install the drip lines on top. This is what it looks like:



25. The reservoir: Fill the black bin (reservoir) with **10 gallons** of water. Plug in the water pump and test for operation and leaks. Seal up any leaks with the aquarium silicone sealant and allow to cure. Add a nutrient concentrate of choice. If you are using GH Flora Series (recommended), add 10 tsp. each of the Flora Grow, Flora Micro & Flora Bloom, (one at a time, in that order). [Order it in quart bottles below]. Adjust the pH of the solution with a test kit (more on all this later).

26. Plug the water pump into the timer and set to feed 3 times a day, **for only 15 minutes** each feed cycle. (6am, noon and 6pm is good). Let them rest through the night; no feeding.

27. Aeration: Place the bubbler airstone in the bottom of the reservoir, run the airline tubing up where the pump tubing is, and attach to the air pump. The bubbler stays on 24/7. This oxygenates and aerates the nutrient solution, keeping it from becoming stagnant.

Earlier we listed the cheapest supplies we could find, to help keep the cost of this setup low. However, you might want to go to a pet shop and buy an upgrade air pump for the stone. We bought this one for \$20 and it is super quiet! Also look for a circular airstone. **Important tip:** the air pump must be placed higher than the reservoir to prevent backflow of solution into the pump.



This air pump has two outlet ports. If yours does too, then buy the "T" adapter and tie in both ports to one airstone. No use wasting half those precious bubbles!

TOP DRIP SYSTEM OPERATING TIPS 'N TECHNIQUES

LIGHTING:

You can use just the light from a sunny window if all you are growing are houseplants. Anything else requires some supplemental lighting. A T5 compact fluorescent "grow light" will do fine for houseplants, herbs, and leafy green veggies like lettuce. This one is available for under \$75, including the 125 watt compact T5 bulb:



You can order this lamp and bulb here: <http://www.hydroponics-simplified.com/cheap-hydroponics-supplies.html#lighting>. You can get off much cheaper by getting a fluorescent "grow stick" at Walmart for about \$25, but you will not get the lush growth a better light setup will produce. Also, for best results, upgrade to the 200 watt bulb listed on our supplies page.

If you are interested in fruiting veggies like tomatoes, or serious herbs, you will have to upgrade to an HID lamp. Learn more about HID lighting and see our special combo lamp deal here: <http://www.hydroponics-simplified.com/hydroponic-lights.html>. One final note: the grow room must be kept cool. Use a fan on low in there to cool it down. HID lamps will really add some heat.

NUTRIENTS:

We highly recommend the **Flora Series** nutrient solutions put out by GH (General Hydroponics). This stuff is superior, easy to use, and reasonably priced. It consists of 3 parts (Flora Grow; Flora Micro; and Flora Bloom). If you have hard water, get the Hardwater Flora Micro instead. For this smaller garden, order a quart of each of the three solutions: <http://www.hydroponics-simplified.com/cheap-hydroponics-supplies.html#nutrients>. Stick with Flora Series, follow the label directions, and you can't go wrong!

The nutrient reservoir must be kept cool (55-70°). This is especially important for the cool-season crops like lettuce and broccoli. Learn more about hydroponics nutrient solutions here: <http://www.hydroponics-simplified.com/hydroponic-solution.html>. We also provide a nifty little mixing chart there for the Flora nutrients that you can print out and save.

As the nutrient level drops in the reservoir bin, you need to periodically add water only (not more nutrient). Keep track of how many gallons you top up with. When you have replaced 5 gallons of water, stop topping up and then let the level drop down towards the pump. When the pump starts "sucking air", drain the bin and mix up a whole new batch of nutrient solution. Each new 10 gallon batch should last 3-5 weeks by following this "50% system".

For our top drip system here, you can lift the lid off the reservoir and rotate aside slightly to allow access to the nutrient solution; for testing and refills, etc.

pH- It is a very good idea for any serious hydroponics project to keep the pH of the water in the proper range, which is 5.5 to 6.5 (6.0 is ideal). If the pH is out of range, some of the nutrients get "locked out" and the plants suffer. GH puts out a simple test kit with pH up & down solutions **cheap**. It will last you through *many* gardens: <http://www.hydroponics-simplified.com/cheap-hydroponics-supplies.html#nutrients>.



GROWING MEDIA:

You can actually use whatever growing medium you prefer in the Bato buckets. We recommend a 50/50 Coco Coir and perlite mixture for the growing area. Then add a 1" layer of LECA (Hydroton or clay balls) to the top of the pots. The LECA provides an excellent surface for the nutrient solution to trickle onto and prevents the Coco/perlite mixture from moving around during the feed cycle.

This is a brick of Coco-Coir and a handful of Hydroton clay balls:



Here is a cheap source for your media: <http://www.hydroponics-simplified.com/cheap-hydroponics-supplies.html#media>.

Perlite can be bought at any garden center. Coco Tek and Hydroton balls must be ordered from a hydroponics supplier. Learn more about hydroponic growing media here: <http://www.hydroponics-simplified.com/hydroponic-growing-medium.html>.



We hope you will try out our plans for this cool little top drip hydroponics system. You will be amazed at the scope and amount of produce you can reap from this unit. It provides a great introduction to hydroponics for adults and children alike, and it's just plain FUN.

Our guess is that once you get a taste of hydro in this way, you will go on to bigger and better things. This field of horticulture is wide open! There are many different methods for you to try, and you'll just get more knowledgeable and skilled at it as time goes on.

You might try growing heirloom tomatoes, medical herbs, or even orchids. Or you might just enjoy munching on your own healthy, homegrown salad micro-greens! No matter which way your interests take you, you are sure to enjoy this clean, healthy, prolific, earth-friendly gardening method. We just love hydroponics and know you will too.

Visit our website: <http://www.hydroponics-simplified.com> often for updates on equipment, lighting, nutrition, plants and seeds, pests, grow-closets, and plans for several other different growing systems. We provide simple information, insider secrets, and easy-to-follow instructions to get you up and growing in no time...



Enjoy!
Simon & Stella

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