

The 'coldFusion' Trial

Hydro-Organics Made Simple

By Laurie Lamberth



Christopher transplants store-bought 'Patio Tomatoes' into the coir-perlite potting mix.

If someone told you hydro-organic gardening was easy, would you believe them?

I didn't. Organic hydroponic nutrients were a big hassle, in my experience. They were smelly, their pH didn't stabilize, and they needed to be mixed and bubbled for at least a day before they could be fed to the garden. Automated watering was problematic since the pH had to be adjusted before every feeding, and I worried that the relatively thick, gooey solution would clog my pump or feed lines.

Hydro-organics had made me a slave to my garden, and I wasn't anxious to return to that drudgery.

Then I tried out a new line of hydro-organic nutrients that changed my mind. These new nutrients, called "Nature's Nectar," first captured my interest because they are OMRI-certified, which means they have been approved for organic food production by the Organic Materials Review Institute (OMRI). But it was the manufacturer's "Organic Gardening Tips for Hydroponics" that riveted my attention:

- Please do not adjust pH. Greenhouse trials have proved that this step is not necessary.
- Do not inject air into reservoir (i.e. air stones, air pumps, etc.).
- Please note that mixing instructions are the same for both vegetative and flowering cycles.

"No way," I thought. These instructions flew in the face of everything I thought I knew about hydroponic gardening. Without injecting air into the nutrient reservoir, how could the solution deliver enough oxygen to the root zone? How would the growth of smelly anaerobic bacteria and their bioslime be controlled? No N-P-K shift between veg and bloom? As for not adjusting the pH, that made no sense, unless the nutrients stabilized at an appropriate pH – something that did not happen with organic nutrients in my experience.

If Nature's Nectar worked as advertised, those hassles were gone. Hydro-organics could be easy for anyone.

I needed to be convinced. My partner, Christopher Sloper, and I looked again at the announcement, which was in the 2007 National Garden Wholesale catalog and included photos of a Nature's Nectar trial at NGW's eastern distribution center. I looked more closely at the photo.

Kneeling next to those great-looking toma-

atoes was our friend Bill Harpole, NGW's Southeast Region sales manager, who had conducted the NGW trial. In an instant my partner and I knew what to do: we were going to re-create Bill's trial in our shop.

We dubbed the trial "Cold Fusion" after the attempts by scientists to generate energy from nuclear reactions at low temperatures and pressure. Such a discovery has proven illusory in physics. To us it represented a Holy Grail – just as physicists sought an easy, inexpensive and nearly inexhaustible power supply, so we were seeking a simple, clean way to grow organic produce hydroponically. Hence the name, "Cold Fusion."

Beginning the Trial

We started the Cold Fusion trial on April 24, 2007. We followed Bill's lead and selected another brand-new product for our growing system: the "Easy2Grow" pots. These are passive hydroponic systems, which mean that they use gravity instead of pumps to move the nutrient solution from the reservoir to the garden. They do not need either electricity or a timer. Easy2Grow systems feature a clever two-float controller that creates a moist zone about an inch deep at the bottom of each pot. The nutrient solution is distributed throughout the growing media by capillary action, also known as "wicking." We used a potting mix made of 75 percent shredded coco coir and 25 percent chunky perlite, both known to provide good capillary action.

Hydrodynamics International donated one-pot and two-pot Easy2Grow systems for the trial and National Garden Wholesale provided the nutrients. The pots sit on a base that serves as a shallow reservoir, the depth of which is maintained by an Easy2Grow controller.

We transplanted a Roma tomato plant from our shop stock into the single-pot system, and two young "Patio Tomatoes" from the hardware store into the two-pot system. We set the Easy2Grow systems on a bench in a 4-foot square HomeBox growing enclosure, illuminated with a 400-watt Metal Halide light in a horizontal reflector.

We hand watered the plants for a few days to allow their root systems to develop, then connected both systems to a five-gal-



Close-up of our first tomato.

lon reservoir and started the gravity feed. We supplemented the gravity feed with top watering for a few more days until the plants were well established. Or so we thought.

The First Wilting

When we opened the store on May 3rd, we found the leaves on the Roma curling in on themselves, as though dried out or suffering from salt damage. In contrast, the Patio Tomatoes looked great and had started to flower.

We consulted our friends at Hydrodynamics and NGW, sent photos and swapped e-mails, and agreed that the Roma probably was drying out – a side effect, we surmised, from not wetting the potting mix thoroughly enough prior to transplant. This could have caused poor wicking action, which made sense, since the problem had appeared when we stopped top-watering.

We flushed the Roma, fed it, and then set it a bit farther away from the light to give it time to recover. The plant bounced back in no time, so we moved it back into the light after four days. We also leveled the systems.

Leveling is an important step in setting up ebb and flow hydroponic systems, including adaptations of this method such as the Easy2Grow pots. Water "seeks its own level," which means that it flows to the lowest point available before beginning to deepen. It's important that an ebb and flow or Easy2Grow system be level, or you could wind up with some plants soggy and overwatered on the low end, with others dry and underwatered on the high end. I rechecked the level from time to time during the trial, which is a good gardening practice that can help you avoid problems before they occur.

We added small weights to the floats of the Roma's Easy2Grow controller to slightly deepen the moisture zone at the bottom of the pot. We thought a slightly deeper moist



There's a whole lotta fruitin' goin' on as the plants begin to set fruit.

zone would help with the wicking/capillary action in this pot, which is taller than the pots in the two-pot system.

Roma Still Struggling

Even though the Roma had initially bounced back, by the end of another week it was struggling again. It was pale, as though underfed, had increasing burning and salt damage on its lower leaves, and was not thriving. Several unseasonably hot days in a row made these problems worse.

The heat also turned the reservoir and systems into a stinky, slimy mess. We should have followed the manufacturer's advice and put a filter on our feed line. While cleaning all that smelly stuff that sunny Saturday morning I resolved to change our reservoir whenever it started to get "ripe." Using this method, we found that we wound up more-or-less following the manufacturer's instruction to change the reservoir once a week or when it's down by one-third, whichever comes first.

We took a good look at our struggling Roma, comparing it to the other two healthy and vigorous plants in the trial. We suspected the Roma was damaged beyond the point where it could bounce back. It was difficult, but we decided we had to replace the Roma with a new plant.

Black and White

We picked out an interesting indeterminate tomato, called "Black Prince," at a nearby nursery. It produced plum-shaped dark purple fruit. We potted it in the single-pot Easy2Grow system in FytoCell, a new media made from biodegradable polymer foam. Moistened FytoCell looks a lot like snow, with an uneven, chunky consistency and a bright-white color. We chose FytoCell for its reportedly excellent capillary action.

We transplanted the Prince into the single-pot system, and then topped the FytoCell with

one inch of coco coir chips to prevent surface moisture loss and algae growth. The plants all looked great for a while, but then we started to notice their leaves curling under or "clawing." The curling was more pronounced in the plants in the two-pot system, though the Black Prince also exhibited it to a lesser degree.

Leaf clawing is a usually a symptom of overwatering, so we suspected that the

Easy2Grow pots were providing too much moisture to the plants. We used a moisture meter to check the wetness of all three pots, with mixed results: the meter pegged past "wet" for the plants in coir in the two-pot system, and "moist" for plant in FytoCell in the one-pot system. This was not conclusive evidence, particularly since the plants were potted in different media. All we had was a set of suspicions about what might be wrong – underwatering, overwatering, nutrients, temperatures, and so on – but nothing solid. We decided not to change anything right away but resolved to pay even closer attention to see whether we could identify the cause of the emerging problems with our plants.

First fruit!

Two tiny green tomatoes greeted us on the Patio Tomato plants after the Memorial Day break. HOORAY!!

But there was a new problem to solve: most of the flowers wilted and fell off without producing fruit, a condition known as "blossom drop." Fruit-bearing trusses had only one tomato on them, and other trusses were completely bare. The lower leaves on the Patio Tomatoes were also yellowing badly, and we couldn't decide if that was due to normal aging or something more sinister.

I looked up the causes of blossom drop online. No. 1 cause: flowers not being pollinated. Other issues can cause blossom drop, too, including excess heat, low humidity, and pretty much any other problem you can imagine. It can be

a complex issue to resolve, so we decided to focus on pollination first.

We had been using an oscillating fan in the garden, to mix and move the air and to lightly shake the flowers to encourage pollination. Clearly, that wasn't enough, so I began to pollinate the flowers by hand each day using a small paintbrush.

The leaf clawing problem was more difficult to solve. While we suspected overwatering as the cause, our friends at Hydrodynamics told us that overwatering just doesn't happen with the Easy2Grow pots. These systems are designed to provide nutrient solution to the plants in the amount that they are able to consume – not more and not less (so long as there is solution in your reservoir). If this was true, then something else had to be causing or contributing to leaf clawing.

We needed more data, and fast. Against our own general advice, we had set up our garden room without any environmental monitoring or control equipment. That sort of thing happens when you're starting a new business. Gardens always suffer when their gardener doesn't pay enough attention, and ours was no exception.

We began monitoring temperature and humidity – the bare minimum – with an inexpensive temperature and humidity gauge. Then, we hoped, we would be able to make decisions about changes to the garden with at least these few facts in hand.

Heat's the Culprit, Air Cooling Helps

Daytime temperatures inside the Home-Box turned out to be in mid- to upper 80's Fahrenheit, which was significantly hotter than the rest of the garden room even though we were using a large oscillating fan to drive



Nature's Nectar, OMRI-certified hydroponic nutrients from HigoCorp.

the heat from our light away from the plants. Our new hypothesis was that the leaf clawing was a response to excess heat. Usually, plants that are too hot or too close to the light point their leaves up to reduce their exposure. The tomatoes appeared to be clawing under for the same reason, a response that was new to us.

Two lessons learned: Garden temps can't be accurately guessed, and your plants don't always do what you expect them to.

We hung a 4-inch centrifugal fan just outside the HomeBox, ducted it to our reflector, and exhausted the heat from the light up into our attic. Temperatures in HomeBox quickly dropped into the upper 70's. The leaves started to uncurl after three days.

Just out of curiosity, we decided to check the pH of the Nature's Nectar feed solution. Three days after it was mixed it was 5.8 – perfect.

A Whole Lotta Fruitin'

The plants responded to cooler temps and manual pollination with heavy blossoming and fruit set. By late June, tomatoes were popping out everywhere. All three plants were vigorously setting flowers and fruit, even though they continued to develop salt burns on some of their lower leaves from their earlier heat problems.

On the first of July, we harvested our first vine-ripened tomato... and it was GOOD! Sweet and juicy, with a melt-in-your-mouth texture, it might have been one of the best tomatoes I'd ever eaten. My partner declared it to be as good as his grandma's. We waited with anticipation for the rest of the fruit to ripen.

Disaster Strikes!

Our air conditioning failed over the July 4th holiday, during which ambient temps in our grow room reached 88.7 F for an undetermined period – probably several hours. All three plants were badly wilted, with many of the vines bent over and damaged beyond repair.

We pruned off the most heavily damaged limbs, flushed and fed the plants, and raised the light. We wanted to keep the plants alive long enough to ripen the rest of the fruit, and we were able to keep them going another week before the fruit stopped ripening. We harvested a dozen more tasty tomatoes, all



Easy2Grow set up, note reservoir sits slightly higher than the pot bases.

just as good as the first one, before we put the plants out of their misery and concluded the trial. It was a disappointing end.

Conclusions and Lessons Learned

Even though we didn't get to harvest a bountiful crop of tomatoes like our friend Bill, and our trial came to a premature end, we still call the "Cold Fusion" trial a success. Our objective was to learn whether hydro-organic gardening could be as easy and reliable as Nature's Nectar promised. We also wanted to see the Easy2Grow pots in action, and draw the same conclusions about them.

The results? Nature's Nectar nutrients were as easy to use as we had hoped, and they produced delicious, juicy tomatoes. All we did was follow the directions on the back of the bottle and change our reservoir when needed.

A Nature's Nectar reservoir may get a little stinky and slimy at times, and a small amount of bioslime may also accumulate throughout the hydroponic system that you use with them. Next time, we'll use an in-line filter between the reservoir and the Easy2Grow systems to reduce bioslime accumulation around the controllers. But the slime didn't harm our plants or clog the systems, and it didn't smell very much as long as we changed the reservoir frequently. One tip for any hydroponic grower is to change your reservoir when it's one-third consumed or on your regular interval, whichever comes first.

The Easy2Grow pots also worked great. The damage to our plants that we thought was from overwatering turned out to be from high temperatures instead. The systems could not be easier to use, and in combination with hassle-free nutrients such as Nature's Nectar, they may be an excellent tool to attract traditional garden enthusiasts to the hydroponics side of the game.

We were also reminded the hard way that no whiz-bang growing system or nutrient can make up for a failure in basic gardening practice. Establishing and maintaining an appropriate environment is critical to the success of any garden. Temperatures that are too high or too low, out of range humidity levels, or unaddressed pest issues will take their toll on your garden, regardless of whether your garden design is simple or sophisticated.

The first line of defense against environmental problems is monitoring. Using a temperature and humidity gauge from the start would have allowed us to see the temperature-related problems coming and to make corrections before the excess temperatures damaged our plants.

Our air conditioning failure over the long, hot holiday weekend experienced wasn't something that's easy to anticipate and it would have been costly to establish a back-up for this critical system. A high-temperature shut-down controller for our garden light would have helped; not using one was another departure from our standard gardening advice and practice. The primary defense against this type of failure is more frequent garden checks. These checks can be automated by using an environmental controller with communication capabilities to alert you when your garden environment deviates from a preprogrammed set of parameters.

Even without our air conditioning outage, we would have had a smaller crop than we should have because of the high-temperature problems that had come before. In the end, the quality and yield from your garden can only be as good as the environment you provide for it. If you give your plants a great environment, feed them quality nutrients, and give them plenty of light, your garden should reward you richly. 🍅

About the Author

Laurie Lamberth is one of the founders of G & G Organics and Hydroponics, a retail gardening store in Compton, California. In addition to writing articles about hydroponic gardening, Laurie discusses hobby hydroponics on air as regular guest on the "Garden Party" call-in radio show, hosted by organic gardening guru Jeff Lowenfels, on Anchorage's KBYR 700 AM.