III. System Startup, Operation and Maintenance

(BTW, this Startup info is a chunk right out of our current Commercial Aquaponics Manual; giving away this accurate and useful information is obviously a shameless plug for our DIY Commercial package and our Aquaponics Technology Training. You're getting it for FREE!)

III-A. System Startup

III-A-1. Verify Water Quality And Fill Up

- If you are using anything but chlorinated potable water to fill your system up, there is the possibility that something nasty will come in with it. To avoid that possibility, if you are using anything else but potable water for a fill, you can chlorinate it with a quart of Chlorox per 600 gallons of system water. Fill the system with whatever nasty water you have, calculate how much Chlorox is needed to get that quart per 600 gallons, and dump it in. Turn on your pump and your blower, and run the system like that for three or four days, with the RAFTS OFF THE TROUGHS. Every living thing in the system should be dead at the end of the first hour or two, and you don't want to be downwind from this, or you will regret it. The next two or three days will blow off and burn off the chlorine in the system, until you can test it with chlorine test strips and find none. Now it is safe to start the next step.

  Check your pH before filling up. If you are filling up with water that is slightly acidic, you can balance it until it has a pH of 7 with the addition we use, calcium carbonate. If your water is very basic, i.e. over 8, you need to add something to bring the pH down to acceptable levels, we would guess (but this is ONLY a guess!) acetic acid (vinegar) would be allowed by OMRI (Organic Materials Review Institute). The best thing to do to get pH down is to get FISH in the system; they breathe out carbon dioxide, which turns to carbonic acid, which acidifies the water.

- There is one more consideration here: you filled your system with clean water, or cleaned it after filling it. If you ever add water to the system in the future, you need to follow the same procedures. If you are going to chlorinate it, you need to chlorinate it OUTSIDE the system, otherwise you will kill everything again. You need to get a makeup water tank separate from the system, fill it up, chlorinate it, and then pump or siphon that water into your aquaponics system when the chlorine measures zero. We use a makeup water tank and let our County potable water sit for a couple days to burn off the chlorine whenever we add any significant amount of water to our systems (more than 50 gallons per day per system addition).

III-A-2. Get Fish: You Need The Fertilizer

It's a lot cheaper to buy little fish and put them in the system than it is to buy bigger fish, right? Our song used to be: "Little fish excrete little solids which turn into little nutrients for little vegetables". With what we've learned this last year about things growing well even if we have nutrients so low as to be unmeasurable, we are currently doubting this wisdom. We just saw a 1,024 square foot aquaponics system one of our students built, with only 20 fish in it (maybe 30 pounds at the most, in a system we thought should have 300!), no measurable ammonia or other nutrients, an acidic pH of 4.56, and the most amazing crops of vegetables we ever saw growing in it. However, if you have a monthly payment to make, you might want to hedge your bets by getting the largest and most fish you can afford. Weigh this one out and make an intelligent decision. Production a month (or six) sooner could be worth a lot to your operation. This is the same reason we inoculate with nitrifying bacteria instead of just waiting for them to show up. The current "safe" amount we're recommending is 0.3 pounds of fish per square foot of raft area in your system.

- You don't need all tilapia at first, even if that's what you're planning to grow. For instance, you can put in a mixed bunch of koi, catfish, bass, sunfish, and tilapia, as long as the smallest ones you put in are not so small that they get eaten by the biggest ones you put in. The vegetables are 92% of the system production anyway, you just need fish to make fertilizer in your system at first. Sort them out later with a net and have a barbecue.

- Tilapia are legal in Hawaii and commercially valuable almost everywhere. If you're not in Hawaii, check with your local University or Ag extension office, or anyone who grows fish for a living (hatcheries, trout farms,

bass farms). They will let you know what kinds of fish are legal to grow in your state, what other people are growing locally, and will be able to direct you to a source of baby fish to stock your system with. If you are in a cold climate, they will also steer you to cold-water fish that should be able to handle aquaponic water quality, so you are not fighting so hard to get your fish water warm as you will be with tilapia.

There are many species of fish that are cultured commercially, grow quickly, and can easily handle the water quality of aquaponics systems. Species that would work well are bluegill, Chinese catfish, crappie, trout, striped, largemouth and smallmouth bass, and possibly sturgeon, although sturgeon have a long growth cycle. For a cold-water fish in North America you can't beat yellow perch (also known as Erie perch or Great Lakes perch, a valuable wild species that was near fished to extinction). If you're in Australia or elsewhere in the world, there are fish with exotic-sounding names we barely know about that would work just fine. Basically, as long as they excrete ammonia, any fish will work.

- There is one more consideration here: you either filled your system with clean water in the last step, or cleaned it after filling it. If you bring in diseased fish, you've got a diseased system that could be difficult to clean up. Getting healthy fish from a known source will give you peace of mind and eliminate costly problems to resolve during startup. This is a good reason to check with your local State fish vet or animal quarantine branch to see what to beware of before buying fish from a local producer.

- **CRITICAL WARNING! Make sure you put all the rafts on the troughs and the shade cover over the fish tank as soon as your water has dechlorinated!** We have had several students mistakenly try to start their systems with the rafts off the troughs. If you do this, your system will immediately start growing algae, you will have a problem created by the algae dying and decaying into ammonia, and this will delay system startup indefinitely until you dilute the ammonia down to less than 3 ppm. Put covers and rafts on before introducing any fish to the system.

  IMPORTANT- How to kill fish with bad hauling techniques! Even if you already have fish in a pond or lake on your property, you still need to haul them to get them into your aquaponic system. Hauling fish stresses them and even on the best and most careful fish hauls we've done (and we have a GREAT haul tank with lots of aeration that has good oxygen levels even with 300 lbs of fish in it), we still lose about half a percent of them. If you have a bad haul that stresses your fish, OR your fish supplier stresses them without your knowledge before you pick them up, you can lose up to 20% OR MORE! Here's what this looks like: your supplier, not caring much about how long the fish survive after he's been paid, has pumped the fish tank down so there's only about 10 inches of water in it. The problem is, he didn't do this when you arrived, he did it last night, and the fish have been stressing in this too-shallow water for 12 hours now.

  When the fish are transferred to your haul tank, they are already stressed, have lost a lot of their slime coats (this affects fish in the same way that losing skin affects a person), and some of them are already dying. It just won't become obvious for another day or two. You have to get them out of the haul tank with a net when you get home, which stresses them further. Then they're introduced to completely different water than they came from, which may stress them further. Unless you're really observant (and know to look for this), and check the BOTTOM of the fish tank two or three times a day, the first time you may notice a problem is a couple of days after the haul, when the first dead fish floats to the top of the fish tank, and you remove it.

  The problem is that this fish has been dead for a day or two before it floats to the top, and has been pouring ammonia (a product of decomposition of decaying organic material) into the tank the whole time. If you had a bad haul with fish that were stressed before you even loaded them, and lose 20%, this can show up as fish dying for the next two weeks or so, with an attendant HUGE ammonia problem (more about that in just a bit). For now, how you reduce or eliminate this problem BEFORE you ever transport your fish is do as many of the following as you can:

  A. Make sure your fish supplier handles the fish gently and professionally before they are loaded into your haul tank, and load them with as little and as gentle handling as possible. Hard handling will stress the fish and increase your loss.

  B. Haul with a tank that is filled TO THE TOP with water and has a solid cover battened down on top of the water. This will ensure that the tank water doesn't SLOSH, as it will in a partially-full haul tank or one with NO TOP! Sloshing inside the tank will stress the fish and increase your loss.

C. Make sure your haul tank has plenty of airstones and enough air pump capacity to drive them. You can get cheap air pumps (Aquatic EcoSystems catalog number DW9622) which only use 8 watts; you can run up to 6 of these off a $15 AC inverter that plugs into your cigarette lighter. One of these air pumps will keep about 30 lbs of fish alive for a two- to three-hour haul. If you don't have a haul tank with a tight lid, putting the fish in those sturdy grey 42-gallon garbage cans and lashing the lids down with bungee cords works just fine, and will keep 30 pounds of fish alive. You can drill a hole in the middle of the lid and run the airstone tubing right down through this hole, then put the airstone at the bottom of the garbage can. FILL IT TO THE TOP SO IT DOESN'T SLOSH!

D. Handle the fish as little as necessary and as gently as possible when you transfer them from the haul tank to the fish tank at home.

E. Check the bottom of the fish tank with a big net the next morning and about two to three times daily for the first few days to get dead fish out of the tank before they add a lot of ammonia to your system and cause a problem. If you have dead fish, get them out of the tank as soon as possible after they die. If you see a fish swimming or acting strangely at the surface, get it out of the tank. It WON'T recover, and you might as well get it out before it adds ammonia to the tank.

F. DON'T feed the fish until they stop dying; even if you have a good haul and no mortalities, don't feed the fish for the first few days to a week. They won't LIKE it, but it won't hurt them, and it will ensure that your ammonia levels stay low.

Now you've got your fish home, they've been in the tank for about a week, your ammonia level is nice and low (under 2 ppm), the fish are accepting food, and your mortalities have ceased. Another week goes by, and you notice a couple of dead fish one morning. What's this? Well, you will see two separate periods of mortality coming from a bad haul. The first one is usually over in the first three or four days after the haul; and consists of the fish that were so badly damaged in the haul that they died relatively soon from their injuries and trauma.

This second batch of mortalities that sometimes occurs from ten days to two weeks after the haul are (we believe) fish that were lightly damaged during the haul, not enough to kill them outright, but enough to compromise their immune systems. These fish basically caught colds and died from them because they were so weak. We've never been able to identify a true "fish disease" incident in either the first or second batch of post-haul mortalities. Get the dead fish out of the system as fast as possible to avoid adding unnecessary ammonia.

III-A-3. Do Nothing: The Three-Month Startup

- Nitrifying bacteria occur naturally throughout our world. If you put fish in your system and just wait, the bacteria show up in two to three months. This is what the university aquaponics establishment told us to do; we did it on our first system and it works. It just loses you three productive months during which you may have to make loan payments and eat.

III-A-4. Inoculate: The Five-Day Startup

- We started our second system with a non-refrigerated ProLine nitrifying bacteria concentrate in the one-gallon size for $42 (catalog #239211) from Aquatic EcoSystems, then put fish in. On this system startup, we had nitrites in the system in three days and nitrates showing in five days. We didn't know how to avoid a hard nitrite spike at that time, and so our fish went through a 10-day nitrite spike of over 10 ppm, with no mortality. We were lucky that time! This is the easiest and best way to start a system, if you know how to help your fish survive the nitrite spike.

  On our third system we used one of the Aquatic EcoSystems' $317 gallons of bacteria (plus $180 UPS overnight shipping in a styrofoam cooler), waited three weeks and nothing happened. Then we pumped over 400 gallons of water from another system and had nitrites within a couple of days. We have other reports of these bacteria AND the $42/gallon bacteria not working and think AES just had a bad batch or two.

III-A-5. Helping Your Fish Survive The Nitrite Spike

IMPORTANT! First, don't add the inoculant until and unless your ammonia is lower than 3 ppm, preferably 1 ppm. Here's why: nitrifying bacteria are inhibited by ammonia levels of 3 ppm or higher, and if you have higher ammonia, you WON'T get system startup. Make sure you have less than 3 ppm ammonia in your system before wasting inoculating bacteria on it. If you're higher, dilute your water, pump for 12 hours to mix, measure again, THEN, when your ammonia is down to 1-2 ppm, add your innoculant bacteria.

- **IMPORTANT!** When nitrifying bacteria are introduced to a system, the fastest-breeding and feeding bacteria are the ones that eat the ammonia and produce nitrites. The ones that convert the nitrites to nitrates have slower reproduction rates and are much slower to get established, resulting in what is called a "nitrite spike" where you have very high levels of nitrites for a week or two before it starts getting converted to nitrates. This is a concern because nitrite is as toxic to fish as ammonia. Theoretically, over 6 ppm of either will stress and eventually kill tilapia. However, we've had our fish in an ammonia spike of 24 ppm for a couple weeks because we didn't know what we were doing, but they lived. We also had fish in a nitrite spike of over 10 ppm for a couple weeks, and they all survived that. We recommend that you don't do this on purpose, though.

- Here's how you start your system: put the fish in your system; they will make ammonia just by swimming around (they excrete it through their gills when they breathe). If your fish are coming soon but are not available yet, you can start by putting Aquatic Ecosystem's ammonium chloride tablets (catalog #239100, $13.39) into your system water to a concentration of 1 ppm, OR about a cup and a half of household ammonia for a 1,024 square foot system, NOT BOTH! Also, DON'T put fish AND ammonia tablets or liquid ammonia in the system; if you have fish to put in, they will provide all the ammonia needed. Then you pour in the $44.68 gallon size Proline nitrifying bacteria (catalog #239211) from Aquatic EcoSystems.

  IMPORTANT! You need to have your rafts painted (Benjamin Moore AquaGlo Soft Gloss Exterior Enamel, we use their color "Brilliant White") and IN the troughs as soon as you fill the system with water (but AFTER dechlorination if you need to do this step because you used BAD water!), because the system water will grow algae if there are no rafts on the troughs to shade them. If you have already drilled holes in the rafts, fill ALL the holes with net pots to keep the light off the system water.

  Keep the water pump on 24/7, AND keep the blower(s) on 24/7 during this time because these bacteria need oxygen. Test once a day hereafter for about a week, and you should see nitrites showing within two to three days at about 2-3 ppm. If you don't do something to modulate the nitrite spike, you could end up with so much nitrites you get into the theoretically toxic range for fish of 10 ppm and over.

- **IMPORTANT!** To measure nitrites and nitrates properly, JUST DURING SYSTEM STARTUP, you need a different kind of nitrite/nitrate test strips than you use during normal system operation. Get a bottle of Pentair R444 test strips (Aquatic EcoSystems catalog #) to use during startup. This product has nitrite and nitrate ranges that can measure the higher ranges of these two that occur only during startup. During normal operation, use the Hach H27454 test strips (Aquatic EcoSystems catalog #).

  Important- How to modulate the nitrite spike! Here's how you modulate the nitrite spike to keep your fish safe (ONLY necessary if you are starting your system with fish in the system): the first day that the nitrite side of the test strip shows up as 5 ppm or over, take about half the rafts off your troughs. Keep monitoring nitrites each day, and if they continue to go up from 5 ppm, take the other half of the rafts off your troughs (leaving the cover on the fish tank). Because the nitrifying bacteria that create nitrites are sensitive to light, this measure should bring the nitrites down to about 5, where they will stay for seven to ten days or so. At the end of this phase, you will see the nitrites go down to 2-3 ppm. At this point, you can put all the rafts back on the troughs. You only have to do this startup ONCE with a system when it is new. You can plant your sprouts (which you need to have seeded into the net pots two to three weeks EARLIER than this) into the rafts as soon as NITRATES first show up on your test strips, which can be as soon as five days or as late as twenty days after inoculation, depending on water temperature. After system startup is over, (during normal operation) you will see ammonia levels from 0.25 to 1.0 ppm; nitrite levels in the same range; and nitrate levels from 1-3 ppm up to a maximum of 10-15 ppm.

  Important- How to keep your system from growing green algae water (ick!) during startup, OR ANY OTHER TIME! If you have already gotten around to drilling holes in your rafts, put an empty net pot in each hole to block the light from getting to your system water. This pot will keep the light out of the system

that the algae will use to grow and turn your system water bright green, using up system nutrients in the process and giving you an ammonia problem when the algae dies. If you haven't drilled holes in the rafts yet, you don't need to do anything extra. You DO want to have painted your rafts before putting them into the system, because they will start to biodegrade FAST if they are not protected from ultraviolet light with paint (Benjamin Moore AquaGlo Soft Gloss Exterior Enamel, we use their color "Brilliant White"). There is no problem with light getting into the system during operation because the holes are all filled with pots with plants in them. A little light always leaks in around the edges of the rafts and causes a green film of algae to grow on the sides of the liner at the waterline, don't worry about this. This is not the same as the algae growing in the system water, and does not cause problems.

- We discovered how to modulate the nitrite spike during our third system startup. We remembered what we learned about nitrifiers being light-sensitive and getting killed off by too much sunlight, and we pulled the shade covers 2/3 of the way off the fish tank and half of the rafts off the troughs (this was a big commercial system). This inhibited the nitrifiers enough so that nitrites dropped to 4 to 5 ppm within two days and we didn't have the hard nitrite spike we'd had in previous system startups. We monitored it for about another week and when the spike appeared to be over and nitrites had dropped to 3 ppm, we put the covers back over the tank and the rafts back in the troughs. We planted our little vegetable sprouts into the rafts we'd left in the troughs six days after we first put in the inoculant bacteria, then added the balance of the rafts and planted them when nitrites dropped to 3 ppm. We ended up with 1 ppm nitrites and 20 ppm nitrates ten to twelve days after inoculation; perfect!. This is the easy way to control nitrite spikes during system startup yet still start the system quickly.

- **STARTUP PROBLEMS** If, during system startup, you measure low or nonexistent nitrites, low nitrates, or see low or poor plant growth, and are worrying about your system startup not being on track, read this:

  First, don't worry; these systems work. They're rock-solid and absolutely work. If you're two to four weeks into system startup and things aren't growing as well as you'd thought, you CAN'T base any conclusions on this. You're still in the startup phase, and many things could be happening. You could have done something you aren't aware of yet that's causing the problem. Even though we provide as much solid, dependable information as we can, students still try new things they think are "good new ideas", without understanding how aquaponics systems work; and guess what? They get "new results" from these "good new ideas".

  So, IF you've changed things from the "standard systems" as shown in the plans, or are starting up or operating the system differently from the way it was explained in our materials, then you are embarking on an exciting experiment in aquaponics, and we can't predict what will happen. We may not even be able to help you, you might be in such new, unexplored territory!

  Good luck with your experiment! Thank you for being willing to risk compromise or failure of your aquaponics system to advance aquaponic knowledge. Please let us know how it worked; if it was a success, we will be happy to put it in our manuals with your name as the discoverer. If it was a disaster, we will also put it in our manuals, but we will omit your name and any embarrassment you might experience as a result. Either way, the results of your experiment will be very beneficial to others! However, if you just want to grow plants and fish, we've had SO many SUCCESSFUL startups from all kinds of people who built and operated these systems EXACTLY the way they're shown and explained in the manuals, that we are absolutely sure they work. Absolutely, completely, rocks-are-solid-water-is-wet sure. However, just in case you're curious, some of the more common ways to foul up the system startup follow:

- **Important- One Way to Foul Up The System Startup!** Your system will fail to start if your ammonia level is over 6 ppm. Although the information on how to measure system ammonia before adding nitrifying bacteria inoculant is included in our Construction Manual, is included in our main manual, and is also repeated in the instructions on the bottle of ProLine bacteria concentrate, we forgot to write it in six-inch high letters so everyone would realize how important it was. So here it is:

  Nitrifying bacteria are sensitive to ammonia levels in the water above 3 ppm, which will inhibit their growth or kill them outright. When starting your system with a nitrifying bacteria inoculant such as ProLine, your system MUST have less than 3 ppm ammonia, preferably 1 ppm ammonia.

IF YOU HAVE MORE THAN 3 PPM AMMONIA IN YOUR SYSTEM, YOU WILL KILL THE BACTERIA OFF OR INHIBIT THEM, AND THERE WILL BE NO SYSTEM STARTUP.

The only thing you can do if you have a system with 6 ppm ammonia or higher is to dump (yes, dump out onto the ground!) about 3/4 of the system water. The easy way to do this is to turn off the water pump, cap the pipe that leads to the hydroponics troughs so that no water goes out there, put a hose (the bigger the better) into the troughs, and siphon the trough water off downhill (hopefully you have a hill to do this with, otherwise just pump it out).

Then refill the troughs with water containing NO ammonia, let it sit for 24 hours to dechlorinate if it's chlorinated tap water, then remove the cap and pump for six to twelve hours to fully circulate and mix the new water with the high-ammonia water remaining in the fish tank. This dilutes your system water ammonia levels to around 1-2 ppm (check and confirm it this time with the test strips to make sure). Now put a new gallon of ProLine bacterial inoculant in. Forty or fifty gallons of system water from an operating aquaponics system that you are absolutely CERTAIN has no diseased fish, no diseased plants, no parasites, no crawfish, and no duckweed transferred into your system at this point will work just as well as the Proline inoculant. If you purchase fish from someone with a guaranteed clean aquaponics system, put fifty gallons of their system water in your haul tank when you haul the fish to your location, and transfer it to your fish tank along with the fish.

- **Important-Another Way to Foul Up System Startup!** Another way to foul up system startup: Some of our students have left the covers off the fish tank and the rafts off the troughs for three weeks or longer while trying to inoculate their systems with nitrifying bacteria. This created TWO problems: the first was that their ammonia levels were WAY too high (over 6 ppm) for good nitrifier health, and the second was that they couldn't measure any nitrites or nitrates.

  They had nitrites and nitrates in their systems, but couldn't measure them with the insensitive test strips they had. Sensitive test strips that would work in this situation are the Hach "Aquachek" test strips which measure down to 1 ppm nitrates and 0.25 ppm nitrites (you can get these from Aquatic EcoSystems in Florida at 1-877-347-4788, their catalog number H27454). You MUST use these strips or something equivalent which can measure nitrites in the range of 0.25 to 5 ppm; and nitrates in the range of 1-20 ppm, in order to have an accurate idea of what's happening in your system.

  Their too-high ammonia level was created because they left their rafts off long enough for their systems to grow a LOT of green algae (there should be NONE or very little in your system, because you should have the rafts ON, except for a short while during system start-up if there's a nitrite spike over 5 ppm). They made a mistake assuming there were no nitrites or nitrates; there HAD to be, as the incredible green algae in the troughs and fish tank couldn't have grown without these necessary nutrients and without the troughs uncovered.

  The problem with this type of algae is that it has a very short life cycle measured in hours, and when its little carcasses sink down to the bottom of the troughs and decay, they turn into a LOT of ammonia. This ammonia inhibits and depresses the nitrifiers, which, though they ARE present, are not obviously so because their measurable levels are so low. If you've made this mistake, you will see high ammonia levels, and low or unmeasurable levels of nitrites and nitrates on your test strips, leading you to think that NO system startup has occurred.**The fix here is to dump three quarters of the green system water, refill with clean water, and COVER THE TROUGHS THIS TIME! After a while, your system will settle down and you will see normal levels of these nutrients (1-2 ppm ammonia, 0.25 to 1 ppm nitrites, and 1-20 ppm nitrates).**

  IMPORTANT- IF YOU THINK YOU HAVE NO NITRITE SPIKE! We have seen many small systems built by students start-up slowly and seemingly NEVER show a nitrite spike. However, low levels of nitrates show up within a week or two, and these systems are growing vegetables and flourishing after the second or third week, so everything is fine. So do not be alarmed if your system startup does not include a nitrite spike, even with you measuring with the "sensitive" test strips as recommended here. This is OK! The systems we've started up have all had nitrite spikes, but we think it may have something to do with the much larger mass of water in our commercial systems compared to these smaller ones.

1. Another phenomenon we've seen in smaller system start-ups is an apparent nitrogen deficiency. Nitrogen comes to the plants in the form of nitrates, which come, indirectly, from fish pee and fish poop. This deficiency shows up in the form of yellow leaves on plants. The whole leaf is yellow, NOT just between the veins in the leaf; and it shows up in the OLDER leaves first; they also look the worst. What you will see if there's a nitrogen deficiency is a plant whose older leaves are yellow and whose younger leaves are a nice green. This is because nitrogen is MOBILE, that means it can move from older leaves within the plant to newer leaves where it's needed. We've NEVER seen this in any of our large commercial systems, only in these smaller systems. We feel this could be occurring for several reasons:

2. The builder, being on a budget, has put in a much smaller amount of fish than is recommended for their particular system. As an example, for a Micro System 64 they might have bought from 4 pounds to 10 pounds of fish, rather than the recommended 20 pounds. This means that the plants may be receiving lower levels of nitrates (nitrogen) than they need, because the nitrates come from the fish poo and pee, which there is not as much of with fewer fish. The recommended amounts of fish are considered minimums needed to run a system adequately. In addition to there being less than the recommended amount of fish in the system, there is another factor in play: fish that have been recently moved (as all fish in new systems are) do not eat much, or sometimes not at all, for the first couple of weeks or so after the move. This means less fish pee and poo, and contributes to there being less available nitrogen, and to the nitrogen deficiency we think we're seeing here. Just wait, and your fish will start eating more and more gradually, and your vegetables will bloom and grow better by the day.

3. System startups in these small systems seem to be rather slow anyway, and IF you do not have test strips for nitrites that go down to 0.5 ppm and nitrates down to 1 ppm (as the Hach #27454 strips in the Aquatic Eco catalog do), then you won't see the nitrates when they show up, and also may miss the nitrite spike because nitrites are too low to measure with some strips that don't measure below 20 ppm nitrates. This doesn't mean they aren't there, it just means you don't have a sensitive enough test kit to measure them. Also, we have seen bad bottles of inoculant every once in a while. Basically, if you are under 3ppm ammonia and put nitrifiers in or water from another aquaponics system (that you trust to NOT have any disease in it), then you CAN'T STOP the nitrifying cycle from starting. A clear sign that you have nitrates in the system is the green algae which grows around the edges of the rafts on the liner at the waterline of the troughs.

4. Another thing to be very aware of is fish mortalities. They add ammonia to the system, which adds to the startup problem. Fish often die within 2 days to two weeks after being hauled, if they had rough treatment during the haul or are sensitive, and if they are allowed to sit on the bottom of the fish tank for awhile after dying (but before they float to the top and you see them and remove them from the tank) they will put a LOT of ammonia into the system. To fix this you have to dump water and refill to remove the excess ammonia. It is difficult to understand unless you know when the fish fatalities occurred (NOT just when they floated, as they were putting ammonia into the system as soon as they were dead), and relate this to ammonia levels happening at the time; because the two are VERY connected. Re-read the whole section on "How to kill fish with bad hauling techniques" if you want to avoid this one.

5. The last one: we have had HORRIBLE luck transplanting plants that originally developed their root systems in dirt into the aquaponics systems. They look bad then die. The biggest plants we've transferred successfully that were originally sprouted in dirt are about 2-3" tall with roots that barely come out of the net pot an inch or two, and if they're larger than that they seem to just die. This one came up because a student said "all my plants are dying in the system". Only after extensive questioning did we discover that in trying to save money this student had potted their sprouts in DIRT, rather than the coir/vermiculite potting mixture the manual recommends, and they experienced what we just described. Potting in dirt is also a VERY BAD IDEA from the standpoint of introducing soil-borne diseases into your aquaponic system, as the soil you use for potting could have all kinds of pathogens. This is also why we DON'T use peat potting mixture, even if the bag SAYS it is sterilized. People lie, you know?

6. Please, if you try something new, or do ANYTHING differently than the manual recommends doing it, please REMEMBER to tell us (the first time) when you email us and tell us your system's not working. It can take us days to figure it out otherwise, and it wastes everybody's time.