

# **My AquaFarm™ Aquaponics System**

Model JER 17.7,8\_16

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## **Aquaponic Basics and Operation Manual**

The purpose of this manual is not to make you an instant expert on Aquaponics but rather to give you a basic overview in layman's terms to help you succeed with this amazing food production system. Not very many people know every detail on the theory and science behind the car they drive but are able to drive it to work every day. Some will know how to do routine maintenance and some even are able to do repairs as needed. Just the same I hope to get you to be able to “drive” this system and additionally help you with the skills to know when “the engine sputters” and how to fix it. I have found that once you've made it through the critical “New Tank Syndrome” (learning to drive) stage of things, it pretty much is smooth sailing in a general way. Where all the fancy science comes in is when you want to max out every parameter much like a person involved in racing. We're not interested in racing here. Think of this system as the family sedan. Keep it simple, reliable and good looking. Maintenance must be kept to a tolerable degree and it must be efficient on fuel. With that being said. Let's “drive” in.

### **What is Aquaponics**

Most people with a bent toward gardening will know what hydroponics is. It's the growth of plants in a soil-less medium using chemical fertilizers to provide the nutrients the plants need to grow and bear fruit. Aquaponics is very similar except we use the natural bio conversion of ammonia to nitrates and mineralization of solid waste to provide those nutrients for good plant health. I know I just used some fancy terms but, using the automobile analogy let me explain.

You put fuel in your car – we feed the fish.

Good fuel is essential for good performance – Quality fish feed is essential for good performance of this system.

The fuel and air are mixed and ignited in the engine to power to turn the wheels. - The Nitrifying bacteria convert ammonia waste from the fish into nitrate (plant food). The plants use this “fuel mix” to make the structures that not only are used as food but do the conversion of CO<sub>2</sub> to O<sub>2</sub> in the process. Bacteria and other organisms complete the breakdown of solid waste into soluble components able to be absorbed by the plants.

Using the power from the engine you drive down the road to get where you need to go – We harvest the vegetables and fish to make the power in our bodies for good health.

The basics of aquaponics are really not any more complicated than that as far as basic concept goes. Where it get's more complicated is in the details, much like in your car making sure the timing is correct so the engine fires at the proper time to make power and the need for constant supply of clean quality fuel and maintenance for your engine to operate for a long time. Let's talk a little bit about the fuel.

The “fuel” for your aquaponics system is fish feed. Just like in the automobile analogy, quality fuel equates to quality performance and reliability. Since we're talking about the family sedan scenario, I'm not going to go into specific feed selection for each species. There is a lot of information on the internet and you can go as far as you want into the science of feed and how it related from many College and University extension sources. Personally, for an all around feed you want the protein content to be somewhere in the 32% - 35% range. We have found Purina Game Fish Chow to be a good choice for our tilapia, catfish, Grass carp, Goldfish, Bream and Koi in our systems.

Think of it as running your car on Regular grade fuel from a reliable good brand. Other brands may work well, this is just what we use on our farm. Organically certified fish feeds are becoming more available to the purists among us who want to ensure their system is as totally “organic” as possible. Think of this as using biofuels in your engine. They work well but are expensive though and not commonly found as easily as those you can purchase from your local farm and feed store. When it comes to feeding and feeding rates, each species may have a few differences but here's the basics. Feed twice a day, in the morning and afternoon. Feed only as much as the fish will eat in 10 minutes or so. Uneaten feed will decompose and can raise ammonia levels drastically. Adjust your feed schedule to fit your fish, don't try to force them to eat more thinking they will grow faster. They can only hold so much and the rest will go bad.

Now that we've talked about the fuel a bit let's talk about the “engine” of the system.

Just like the engine in your car needing the interaction of several parts at the right time and place to produce power, so does the “engine” of an aquaponics system. The interaction of the fish, bacteria, plants and yourself is what produces the “power”, or in this case “produce”. I'll bet you never thought of yourself as a part of an engine before but in this case you are a vital part of it. Since everyone seems to gravitate to the fish let's start with them. Once again, I will stress I am using very basic terms here and concepts, so for the scientist's among you who are screaming “he hasn't mentioned this or that!!” stick with me, I'm just needing to get people, to drive, not develop new space age technologies. Almost everyone thinks of the waste utilized in this system as fish feces or commonly referred to as “fish poop”. The honest truth is most of a fishes waste is in the form of ammonia. You've never seen it but it's there nonetheless. It's the same stuff that takes your breath away when using it as a cleaner (hopefully in a well ventilated area). In high concentrations you can smell it if the system has an imbalance (fish are dying in this case). Think of it as the exhaust emitting smoke when the engine isn't running right. Ammonia's is one atom of Nitrogen and three atoms of Hydrogen that make up a molecule who's chemical formula is  $NH_3$ . Just as ammonia is toxic to you, it is to fish as well. This becomes a problem in a closed loop aquaculture system such as your new **My AquaFarm™ Aquaponics System**. It doesn't take long for ammonia to build up to a toxic level. If it's not converted to a less harmful and more useful form. This is why many fish die in a new fish tank when they have plenty of oxygen in the water. They simply were poisoned to death. This is what's commonly referred to in the aquarium community as “New Tank Syndrome”. Fortunately there is a natural solution to the problem.

Bacteria to the rescue!!!

Many bacteria interact in this process but for conversation sake and to try to keep this simple we

are mainly going to talk about two types in particular. The first bacteria we are going to mention are *Nitrosomonas spp.* These little guys (they really have no gender) metabolize (a fancy word meaning “convert what you can, to make what you need to live”) ammonia, CO<sub>2</sub> and the water as the components to make the cell walls and cytoplasm (the goo inside the cell walls) they need to thrive and grow and split in two (it's their way of reproduction which I would think would be somewhat painful, but I digress). As their waste they give off nitrite which has the chemical formula as NO<sub>2</sub> and excess Hydrogen (which can drive the pH down somewhat as it acidifies (makes acid) the water, more on that in “water quality”). This nitrite is unfortunately almost as toxic as ammonia to the fish in this system and causes the hemoglobin in the fishes blood to not be able to attach O<sub>2</sub> molecules to it and essentially the fish suffocate from the inside. We need another hero and there is one available and ready to get on the job. It's another bacteria named *Nitrobacter spp.* This little guy is only more than willing to gobble up the nitrite and use it as food to make it's cell walls, cytoplasm (I really like saying that word, it sounds so scientific) and reproduce. It's waste is Nitrate which has the chemical formula NO<sub>3</sub>. Nitrate is not nearly as toxic to the fish (though can be at very high levels). How do we get rid of Nitrate? I'm glad you asked. Seems this just happens to be the primary component of ..... drum roll please..... Plant food!! Yes, plants readily take up Nitrate as plant food and is why in a healthy aquaponics system one can experience (well, not you, but the plants) accelerated plant growth over conventional basic soil methods. This can be a problem though as the vegetation can get quite overgrown. This is where you come into the equation. Much like the ECM (Electronic Control Module, the computer) in your car engine that takes in information from sensors and tells the various components on your engine when and how to function, you are the primary “ECM” in this system. You determine how much to feed the fish by looking at how much they eat and how much feed is left over (after you feed them too much). You determine when the plants have grown too much and need pruning to keep good airflow through your plants. You make sure the pump is running. You monitor water quality and make changes to keep it good in need be. You pick the fruit and greens when they're ready and keep the system harvested and replanted and operating in a manner that it continues to produce for you and maintain the health of all the organisms involved. You are the manager and consumer of the goods. The system can get out of balance if not maintained and monitored properly. You are needed (now doesn't that make you feel warm and fuzzy). Oh, by the way, you just got a basic biology lesson on the Nitrification Cycle in aquatic systems!! That wasn't too painful, was it?