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Aquaponics How To

By Sylvia Bernstein and Dr. Wilson Lennard

Many aquaponic gardeners have pointed out that we need some basic "Aquaponic Gardening Rules of Thumb" for DIY aquaponics. Why? Because the beginners among us could use some help with "Aquaponics How-To" without spending weeks researching what to do. I've had the distinct honor of collaborating with Dr. Wilson Lennard from Australia on just such a set of guidelines.

In 2006 Dr. Lennard earned one of the few PhDs in aquaponics in the world. After that he designed, constructed, and managed Minnamurra Aquaponics, Australia's first truly commercial-scale aquaponic system. Dr. Lennard writes extensively on aquaponic how-to for both scientific and trade journals, and currently consults worldwide through his company, Aquaponic Solutions.

Nothing we say in the Aquaponic Gardening Rules of Thumb is set in stone and there are exceptions to almost every one of the listed rules-of-thumb

given certain conditions. However, they do offer a set of generally accepted "Aquaponics How-To" that, if adhered to, will put you on the path towards successful aquaponic gardening.

Let's get started with aquaponics how-to tips...

Aquaponics System Type

Media bed is recommended for new, hobby growers. Why not NFT or Deep Water Culture (AKA raft or DWC)?

A media bed performs three (3) filtering functions:

> mechanical (solids removal)
> mineralization (solids breakdown and return to the water)
> bio-filtration

Because the media bed also acts as the place for plant growth, it basically does everything all in one component making it all simple.

> Media also provides better plant support and is more closely related to traditional soil gardening because there is a media to plant into.
> The cost of building the system is lower because there are fewer components.
> It is easier to understand and learn.

AQUAPONICS GROW BEDS

> The industry standard is to be at least 12″ (30 cm) deep to allow for growing the widest variety of plants and to provide complete filtration.
> Must be made of food safe materials and should not alter the pH of your system (again, beware of concrete).

Aquaponics Fish Tanks

> If you have flexibility here, 250 gallon (1000 liters) or larger seems to create the most stable aquaponics system. Larger volumes are better

for beginners because they allow more room for error; things happen more slowly at larger volumes.
Must be made of food safe materials and should not alter the pH of your system (beware of concrete, for example).

Stocking Density

1 fish per 5 – 10 gallons of fish tank water (.5 kg per 20-26 liters)

Steps for Planning Your System

Determine the total grow bed area in sq ft (or sq m)
From grow bed area, determine the fish weight required (pounds or kg) using the ratio rule 1 lb (.5 kg) of fish for every 1 sq ft (.1 sq m)of grow bed surface area, assuming the beds are at least 12″ (30 cm) deep.
Determine fish tank volume from the stocking density rule above (1 pound fish per 5 – 10 gallons of fish tank volume or .5 kg per 20-26 liters). When your fish are young and small, reduce the number of plants in proportion to the size of the fish and their corresponding feed rate / waste production.

For example, if you plan to have two 2'x4' grow beds, then you will have 16 sq ft of growing area. Plan to stock so you have a mature weight of 16 pounds of fish which require an 80 – 112 gallon fish tank.

Aquaponics Grow Media

Must be inert, i.e won't decompose or alter the pH of the system.
LECA (Lightweight Expanded Clay Aggregate, AKA Hydroton), Lava Rock, and Gravel are the most widely used media types. If you choose gravel, understand it's source and avoid limestone and marble as they could affect your pH.

Water Flow

You should flood, then drain your grow beds. The draining action

achieve a reliable flood drain system is using a timer. While more complex, bell siphons are also excellent options for aquaponics.
If you are operating your system with a timer you should run it for 15 minutes on, and 45 minutes off.
You want to flow the entire volume of your fish tank through your grow beds every hour if possible. Therefore, if you are running your pump for 15 minutes every hour (see above), and you have a 100 gallon tank, you need at least a 400 gallon per hour (gph) pump. Now consider the "lift" or how far against gravity you need to move that water and use the sliding scale that is on the pump packaging to see how much more power you need beyond the 400 gph.

Starting Your System or "Cycling"

Fishless Cycling is recommended because it will develop a robust bacteria base and allow you to fully stock your fish tank in a couple of weeks vs. the traditional method of using fish which takes over a month and is very stressful for the fish.
For instructions see our FAQs section on Cycling.

Ammonia, Nitrites, and Nitrates After Cycling

Be sure to have a test kit on hand to measure your system's levels of Ammonia, Nitrite, Nitrate and pH
Ammonia and Nitrite levels should be less than .75 ppm
If you see Ammonia levels rise suddenly, you may have a dead fish in your tank.
If you see Nitrite levels rise you may have damaged the bacteria environment in your system.
If either of the above circumstances occur, stop feeding your fish until the levels stabilize, and, in extreme cases, do a 1/3 water exchange to dilute the existing solution.
Nitrates can rise as high as 300 ppm without causing a problem, but much above that, you should consider adding another grow bed to your system.

Oxygen

Be sure there is plenty of oxygen in your fish tank. You can do this [illegible] separate [aeration device] and by diverting part of [illegible] your grow beds directly into

The only way you can have too much oxygen in a fish tank is if you are literally blowing your fish out of the tank.
If you don't have enough oxygen being infused into your tank your fish will be gasping for air at the water surface, but if you reach this stage you may have done permanent damage to your fish's respiratory system.

When to Add Plants

You may add plants as soon as you start cycling your system, but accept that they may not grow well for the few weeks required for cycling to occur.
If you add Maxicrop Liquid Seaweed to your tank when planting (Australians call this Seasol) at the rate of 1 quart bottle per 250 gallons (1000 liters), your plants will establish themselves much more quickly.

When to Add Fish (If You Are Using a Fishless Cycling Technique)

Add fish once nitrates are present and the ammonia and nitrite levels have peaked and declined below 1.0 ppm.

Aquaponics Fish Food

We carry both organic fish feed and high-quality, conventional aquaponics fish feed for various stages of omnivorous fish growth.
As much as your fish will eat in 5 minutes, 1 – 3 times per day. An adult fish will eat approximately 1% of its bodyweight per day. Fish fry (babies) will eat as much as 7%. Be careful not to over feed your fish.
If your fish aren't eating they are probably stressed, outside of their optimal temperature range, or they don't have enough oxygen.

Worms

Add a handful of composting red worms to each grow bed once your system is fully cycled and fish have been added.

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pH

Target a pH of about neutral, or 6.8 – 7.0, in your aquaponic system. This is a compromise between the optimal ranges of the fish, the plants, and the bacteria. For fish, this is a pH of around 6.5 to 8.0. For plants, this is a pH of around 5.0 to 7.0 and for bacteria it is a pH of 6.0 to 8.0.
Test pH at least weekly, and as frequently as 3 – 4 times per week, using your API Freshwater Master Test Kit.
During cycling pH will tend to rise.
After cycling your systems, pH will probably drop below 7.0 on a regular basis and require being buffered up. If you need to lower pH it is generally because of the water source (such as hard ground water) or because you have a base buffer in your system (egg shells, oyster shell, shell grit, incorrect media).
Best methods for raising (buffering) pH if it drops below 6.4

- Calcium hydroxide, hydrated lime or "builder's lime".
- Potassium carbonate (or bicarbonate) or potassium hydroxide (pearlash or potash)
- If possible, alternate between these two each time your system needs the pH raised. These also add calcium and potassium, which your plants will appreciate.
- You can purchase these compounds in small quantities as our AquaUp pH Raising Kits
- While they work, be cautious about using natural Calcium Carbonate products (egg shells, snail shells, sea shells). They don't do any harm, but they take a long time to dissolve and affect the pH. So, you add it, check pH two hours later and nothing has changed, so you add more. Then suddenly, the pH spikes because you have added so much.

Best methods for lowering pH, in order of preference, if it goes above 7.6

- Acids such as nitric or phosphoric as the plants can use the

Our AquaDown pH Lowering Solution is made of phosphoric acid. Other acids, such as vinegar (weak), hydrochloric (strong), and sulphuric (strong) as a last resort as directly adding these acids to your system could be stressful for your fish.

Avoid adding anything to your system containing sodium as it will build-up over time and is harmful to plants.

Do not use citric acid as this is anti-bacterial and will kill the bacteria in your bio-filter.
