



An AQUAPONICS

operation may be right fit
but look before jumping in

Abby Perry

Aquaponics could be a solution for those seeking to grow food for themselves, sell to others, or reduce grocery bills, but is it the right choice for Wyoming?

Aquaponics merges hydroponics (growing plants in nutrient solution rather than soil) and aquaculture (raising fish). The system is comprised of fish, fish tanks, a minimum of 150 gallons of water, and plant beds. The plant beds are soil-less and rely on nutrients from fish waste to be sustainable. Water from the tanks is pumped to plant beds, where bacteria breaks down ammonia from fish waste and converts it to nitrates that fertilize plants. The water circulates, and the cycle continues.

There are various types of aquaponic systems. Most (if not all) have a fish tank, a water pump, an aerator, and some kind of grow bed.

Consider, when choosing materials, the health of all three facets of the system: humans, fish, and plants. Media grow beds, rafts, towers, and nutrient film technique are among the more common systems.

- **Media grow beds** are good to start with because a variety of grow media is readily available, a variety of plants can be grown in them, and they are scalable.
- **Raft method**, in which plants are set in holes in a (typically) Styrofoam “raft.” Is also scalable but usually used inside a greenhouse and requires a more complex filtration system.
- **Tower or vertical system**, typically makes good use of space the fish require but can be challenging because they require a more powerful pump to move water up the tower. Dispersing light evenly over the plants is challenging.
- **The nutrient film technique**, like the media grow beds, has readily available materials, but unlike the media grow beds, the possible plants that can be grown in the system are more limited.



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Determine the type of system that best fits your goals (see page 17), and start plants from seed or find seedlings to use in the system if starting from scratch. Fill the system with chlorine- and chloramine-free water, let the water cycle for several days, and then add the plants.

At this point, fish can be added or the nitrification process can be started without fish in the system. The cycling process can be started without fish (fishless cycling) by manually adding ammonia to the water. There are several ways to add ammonia, as well as kits specifically designed for this purpose. Fishless cycling may allow the grower more control over ammonia levels, and fish may be less stressed. Fish can be added once the ammonia and nitrite levels balance.

If fish are going to jumpstart the nitrification process, start with just 20 percent of the recommended total stocking rate. Monitor the water quality and fish. Add fish in 20-percent increments every four to six weeks until the stocking rate is met. Continue to monitor water quality and fish behavior through the stocking process and after the stocking rate has been met.

The best way to have a healthy

aquaponics system is to have healthy fish, which means reducing stress.

If fish are being introduced from an outside source to a system with fish, first quarantine the new fish. Most fish species do not like direct sunlight and cannot handle extreme temperature changes. Fish also require oxygen; the system will most likely require an aerator. Having some kind of backup power source for both the pump and aerator is important. Battery based aerators are available for this.

On average, most systems over the course of several weeks lose about 10 percent water to evaporation. The water must be replaced to keep the system sustainable. Never change more than a third of the water in the system at a time. Changing more than a third of the water could mean losing good bacteria critical to a successful system.

Aquaponics are scale-able systems, which makes them more convenient to test the waters before diving into the world of fish and edible plant production, but understanding the profitability of a system may be directly linked to the scale. The system may take several years after

establishing beds and tanks to become profitable.

What Fish Species will Hook You?

When selecting a fish species, research the food type, cost, and if that food will reduce cannibalism. Growers often gravitate toward the familiar tilapia.

Consumers see tilapia at a grocery store and know they are a common fish species used in aquaponics systems. Tilapia have a high reproductive rate and are more tolerant to a variety of water conditions but prefer warm water.

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Part of the resistance to stress translates to resistance to disease, which is another constraint to be aware of. The bacteria that break down ammonia in fish waste (a very important process) can be quite sensitive to pesticides that control fish diseases. Having some kind of

non-chemical disease control method may be essential.

The local or state game and fish department office may be a resource to learn more about appropriate fish species for Wyoming climate and how to obtain them.

Just as the size of fish tanks and fish in a system can be scaled up or down, the produce you select is also scale-able. Lettuce that is fairly easy to grow and has a fast yield may be a good starting point before working up to more challenging produce. "More challenging" may mean the plant is more difficult to grow or takes longer to mature, potentially limiting profitability.

Being a successful commercial aquaponics grower in Wyoming is difficult. Producing fish and produce may be the beginning of a great venture, but also consider exploring other niche markets. Is there a market for crustaceans or cut flowers? Are people willing to pay to tour your facility or take a class where they learn about your successes and failures?

Making a business profitable often comes down to not limiting creativity.

Abby Perry's specialty as a University of Wyoming Extension educator in southeast Wyoming is range management, but a range educator can be called upon for assistance in many areas – including herding fish and corralling vegetables! She can be reached at (307) 328-2642 or ajacks12@uwyo.edu.

Is it for you?

Find out whether or not county zoning regulations and small-acreage covenants allow aquaponics systems.

Ask why you are interested:

- Do you want to create a profitable business?
- Will you utilize the edible plants and fish?
- If you plan on selling the produce and fish, to whom will you market the goods? How?

The answers will help you understand if you want to create an aquaponics system and to what scale, or if hydroponics or aquaculture will better meet your needs.

Considering the water challenges is also important:

- What is the water quality at your site?
- How will you handle the hurdle of caring for your fish in our colder northern climate? A greenhouse, heater, or combination of both may be necessary.

Answers will help determine the fish species you want to raise and harvest dates.

Fish species can be the difference between success and failure in an aquaponics system. Whichever species you chose, releasing them into the wild is NOT permissible.

