

Aquaponics: Can I Produce My Own Food?

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Aquaponic production is a way to grow food using different living things that help each other by sharing nutrients. In this system, fish, beneficial bacteria, and plants work together. You might have heard words like **aquaculture**, **hydroponics**, **sustainability**, and **circular economy**, which can all relate to aquaponics.

BACKGROUND

An aquaponic system has a fish tank and a plant-growing area connected by bacteria. The system works by feeding the fish. The fish produce waste, which also becomes food for the bacteria. The bacteria change the waste into important nutrients that help the plants grow, including phosphorus and nitrogen. The solid waste can be turned into organic fertilizer. The water, now cleaned of harmful nitrogen compounds like ammonia and nitrites, goes back to the fish in a closed loop. This system needs electricity to keep the water moving between the fish and plant areas.

Aquaponic systems can be located either outdoors or indoors. They can grow different types of fish, vegetables, fruits, and herbs.



Words in **bold** are highlighted in the glossary at the end of this Idea Starter

PLAN YOUR PROJECT

Use this idea starter AND publication 4-H 365 *Self-Determined Project Guide* as the starting place for your 4-H self-determined project. The *Self-Determined Project Guide* is available from your county OSU Extension office or on the Web at **ohio4h.org/selfdetermined**. You may choose to do a little or a lot depending on your level of interest. Be sure to register your project with your county OSU Extension office.



Here are some reasons why aquaponic systems are appealing:

- Water use is very efficient. Aquaponics uses 90% less water than standard vegetable crop methods and 97% less water than typical aquaculture methods.
- They can be adapted to any space, including urban settings.
- There is a lower impact on the environment than standard crop and aquaculture methods.
- They typically do not use artificial fertilizers, **pesticides**, or **herbicides**.



Photo courtesy of Michael McGraw, The Ohio State University

Fish filter units

Types of Fish

You can raise warmwater fish, such as tilapia, or coldwater fish, such as koi or goldfish. The cost of raising warmwater fish is higher because you must keep the water warm.

Fish Food

The fish in your aquaponics system must be fed. Any uneaten food produces ammonia which is toxic to fish. The ammonia flows through a biological filter in your system where bacteria will convert the ammonia to nitrite. A second bacteria converts the nitrite to nitrate. Nitrate is harmless to fish and fertilizes your plants. Then, the clean water will then flow back into the fish tank.

Plant Production

Raising plants increases the potential profit of the system. The waste from fish offers a consistent

supply of nutrients for your plants. You can raise all types of plants in your system, including leafy vegetables, fruits, herbs, flowers, and aquatic plants.

Choosing which plants to grow in your aquaponics system will be determined by your own interests. Do you want to provide healthy food for your family, establish a steady source of income, or both?

Carefully consider the relationship among your plants, the number of fish, and the type of food being fed to the fish. The number of fish determines the amount of nutrients in the wastewater produced by the fish. The quality of the fish food also affects the nutrient level of the wastewater. The nutrient level in the wastewater helps to determine which types of plants will best grow in your system.



Photos courtesy of Michael McGraw, The Ohio State University

Beds of lettuce being raised in an aquaponic system.

Designing Your System

Aquaponic systems consist of three main parts—fish tank, filters, and plants. The two types of filters are mechanical and biological. The mechanical filter removes solids, and the biological filter assists in the nitrification process by bacteria. There are three different types of plant production—**media-filled beds**, floating rafts also known as **deepwater culture** (DWC), and **nutrient film** technique (NFT). Each of these methods have advantages and disadvantages and can be adapted to specific needs.

To be successful, you need to develop skills related to fish culture, plant culture, water quality, mechanics, plumbing, food safety, planning, marketing, and economics. Activities in this project will help you to understand what you need to succeed as an aquaponic entrepreneur.

AREAS OF INTEREST AND THINGS TO DO

Every self-determined 4-H project can be broken down into areas of interest. These are the specific things members want to address during their project adventures. Using 4-H 365 *Self-Determined Project Guide*, identify at least three areas of interest with at least three activities per area to explore. Take your ideas from the list below or make up your own.

Learning About Aquaponics

- Research the history of aquaponics and write a brief summary.
- Make a poster showing an aquaponic system and how it works.
- Research the advantages and disadvantages of an aquaponic system. Write a short summary of what you learned.
- Visit a commercial aquaponic facility. Find out what type of fish they raise and what kinds of plants they grow. Ask where they sell their plants and vegetables and how often they sell their products. Share what you learned with your club or group.

Making Your Own Aquaponic System

- Explore the different types of systems. Write a brief summary of each.

- Make a list of the equipment and supplies needed to set up your own system. Decide whether you will make your own system or buy an aquaponic kit that is ready to assemble. Include the cost of making your own system versus buying a kit.
- Draw a poster illustrating the design you have chosen for your system.

Plants in Aquaponic Systems

- Research the best plants to grow in aquaponic systems. Create a poster showing examples.
- Explore what you need to consider when planning the growing space for your plants. Explain why these considerations are important.
- Make a list of the plant(s) you will grow. Include why you chose the plant(s) and the cost of each.
- Explain why pesticides should not be used in your system.
- Describe non-chemical ways to control insects and diseases in your system. Share what you learned.



Photo courtesy of Michael McGraw, The Ohio State University

Plants grow in a media bed culture.

Fish in Aquaponic Systems

- Research the factors you need to consider when selecting fish for your system.
- Make a list of two warmwater fish and two cold water fish you could grow. Create a poster which shows the pros and cons of raising each type of fish.
- Decide how many fish you will need. Make a chart showing how much they will cost, how big they will be when you buy them, and how big they will be when you sell them.

- Research the type of feed you will need for your fish. Estimate how much feed you will need and how much it will cost. Write a summary of what you learned.
- Explain why **therapeutants** should not be used in your system.



Photo courtesy of Michael McGraw, The Ohio State University

Plants grow in a media bed culture.

GLOSSARY

aquaculture. The farming of aquatic organisms in a controlled environment.

aquaponic. A system that consists of fish production and plant production, connected by a bacterial water treatment system.

circular economy. A system that involves sharing, reusing, and recycling existing materials and products as long as possible.

deepwater culture. Suspending plant roots in a solution of nutrient-rich oxygenated water.

herbicide. A substance that is toxic to plants used to destroy unwanted weeds or unwanted vegetation.

hydroponics. A type of agriculture where plants are grown without soil. Nutrients are added to water and delivered to the root zone of the plants in a process called fertigation. Common growing media used in hydroponics include rockwool, coconut coir, peat moss, and perlite.

media-filled beds. Containers filled with gravel or expanded clay to support the roots of plants.

nitrification process. A microbial process where reduced nitrogen compounds, primarily ammonia, are oxidized first to nitrite and then to nitrate.

nutrient-film. A hydroponic system that uses pumps to circulate a thin film of nutrient solution through shallow channels, where plant roots can receive nutrients.

pesticide. A product that claims to kill, prevent, reduce, destroy, or repel a pest.

sustainability. The ability to be maintained for long periods of time at a certain rate or level.

therapeutants. Chemicals used for treating fish diseases and parasites.

RELATED RESOURCES

Evergreen Canada, 2015. Aquaponics – How to build your own. youtu.be/k-Lc6HefrkM

Go Green Aquaponics. “The Ultimate Aquaponics Beginner’s Guide.” gogreenaquaponics.com/blogs/news/ultimate-aquaponics-beginners-guide

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