

Aquaponics System

Abstract

We started out wanting to create an aquaponics system that looked good and was sustainable for the schools use. We tried to do this last year but there wasn't enough support so when we had the opportunity this year we jumped on it. Plant in soil relies on the nitrogen in the soil for there nutrition and constant watering to stay healthy. The advantage of an aquaponics setting the fish excrement gives the plant the ammonia that they need to be healthy and the plants help oxygenate the tank so this creates a symbiotic relationship with the fish. This is more efficient and overall costs less because u use less water.

Background

The majority of plants that we have in our houses and gardens are in the soil. One thing that soil has in it that plants need to survive are nitrogen compounds.⁶ These nitrogen compounds are dissolved into the water and absorbed by the roots of the plant. Soil also helps plants to get some of the other nutrients to survive.

An aquaponics system is when you combine aquaculture and hydroponics.² In an aquaponics system, you have a tank of fish, these fish produce waste that is natural and organic food for the plants. The waste contains ammonia, too much of which can be toxic to fish which is how the plants create a symbiotic relationship. As well as a variety of nutrients like phosphorus and potassium.⁵ There are also microbes in the water that get rid of all ammonia that the waste produces and turns produces into nitrates.

Significance

Aquaponics is a new revolutionary way to grow plants. The system uses a natural symbiotic relationship, between fish and plants. This system saves large amounts of water, is a very sustainable way to grow plants, and show a sustainable relationship between fish and plants. Although the system is more expensive than a traditional system, it is much easier to take care of on a small scale. In a large-scale sense aquaponics can be extremely pricey compared to basic soil-based farming, but in the long run, you will save lots of money because you reuse most of the water in your system. ⁷A large-scale high-quality aquaponics system (one that could replicate a farm) costs about \$80,000. The system needs minimal care once up and running, so it would be very functional in a school or work environment. Plants also grow slightly faster because it is easier for the plants to absorb their nutrients when they are submerged in the water. Overall aquaponics is a great sustainable way to grow plants in a fast-paced environment if you are willing to put in the money.

There are a lot of benefits to aquaponics. The biggest one is water. Aquaponics takes less water than traditional farming. Aquaponics is more efficient than traditional farming. Plants that are grown in an aquaponics system grow up to four times faster than a traditional grow-bed. Also in an experiment conducted by Dr. Nick Savidov in Canada showed, that plants that are grown in aquaponics have twice as many sprouts as plants that are grown in traditional grow beds.

Question

Null Hypothesis: The cat grass grown in each system will grow at the same rate.

Alternative Hypothesis 1: The cat grass in the aquaponics system will reach the desired height of 13 to 19 cm faster than the lemongrass in the soil.

Alternative Hypothesis 2: The cat grass in the soil will grow faster than the cat grass in the aquaponics system

Methods

Our plan is to make a mini aquaponic system that we will use to grow some fruit or vegetables. We have most likely a 20-gallon tank that has the fish in it. We will also have another tank of water that is wider but not as deep and connecting the two things we will have pipes that transfer the water from the fish tank to the plant tank where the plants will clean the water and transfer the clean water back.

Control Group: Our fish will be held in a 20-gallon tank and the plants will be grown in another tank or bin. The plants will help up by some sort of thing that has small spots for the roots to be in the water but

Plant type: Iceberg Lettuce/Lemon Grass

Fish type: Trout or Koi

Other:

Planting Conditions

Plants: 20 cat grass

Planters: We will build planters out of plastic that will hold individual plants apart

Placement: Unknown

Water Schedule: It waters itself

Amount of water: Approximately 30 gallons

Lighting Times: Just natural light

Temperature: Natural Temperatures

Data Collection

Leaf Size: Every five days we will measure and see how much our grass has grown

Recording Table:

	Height on day 5	Height on day 10	Height on day 15
A1	15 cm	18 cm	21 cm
A2	13 cm	17 cm	19 cm
---- A20	14 cm average	17.5 cm average	20 cm average
S1	13 cm	15 cm	18 cm
S2	11 cm	13 cm	16 cm
--- S20	12 cm average	14 cm average	17 cm average

Analysis Table:

	Aquaponics	Soil	Total
Height greater than 15 cm	5	3	8
Height less than 15 cm	1	3	4
Total	6	6	12

- Materials & Budget:

A tank for the fish	20 gallon, glass or plastic container	\$20-\$80
Gravel	2.5 lbs. of gravel for every 5 gallons of water in the fish tank	\$2 – \$5

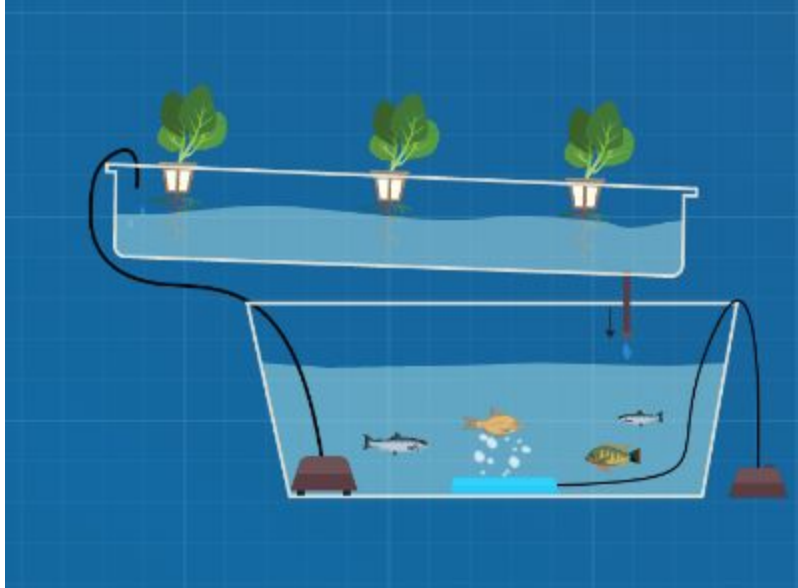
Water pump	3-4 watt pump capable of lifting 18" – 54" at 30 – 100/gal/hour (small circulation or fountain pump is ideal)	\$19 – \$ 40IO
3 ft. of plastic tubing	Must fit the air pump outlet	\$1 – \$2
Aquarium air pump	Sized for the number of gallons in your fish tank	\$8 – \$16
Air stone	1"-3"	\$1 – \$2
Grow Bed:	must sit on top of the fish tank and be 3" – 8" deep	\$5 – \$20 But we will probably make
Growing Medium	enough pea gravel, perlite, coconut coir, expanded clay pebbles or peat moss to fill the grow bed	\$2 – \$5
pH test kit	depending on the pH of your water, pH down or pH up	\$5 – \$15
Fish	Goldfish	free-?

Max: \$126

Recording Table

Analysis Table

	Aquaponics	Soil	Total
# of plants over 5inch	11	9	20
# of plants under 5inch	9	11	20
Total	20	20	40



Sources:

1. <https://aquaponics.com/>
2. <https://www.theaquaponicsource.com/what-is-aquaponics/>
3. <https://www.greenandvibrant.com/aquaponic-gardening>
4. <https://aquaponics.com/build-a-mini-aquaponic-system/>
5. https://www.sciencebuddies.org/science-fair-projects/project-ideas/EnvEng_p032/environmental-engineering/aquaponics
6. <http://theseedsite.co.uk/soil.html>
7. <https://www.friendlyaquaponics.com/commercial-system/>

Approval

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Date: _____

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