Aquaponics vs. Hydroponics

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Project ID#

Q1: Research Question/Engineering Goal

Will an aquaponics system or a hydroponics system grow healthier lettuce plants?

Q3: Data Analysis & Results

The experiment results did not support my hypothesis by showing that the plants grown in the aquaponics system contained small stems, they were light green in color, and 4 out of the 6 plants fell over. Also, my data disproved my hypothesis because the nitrate levels were low and inconsistent. The level of nitrates for a healthy system is 40-80 mg/, and on average the aquaponics systems average was 20 mg/L. The pH levels needed for a healthy aquaponics system is 6.4 to 7.4, and the data showed a range in pH level of 7.5-9. The data showed inconsistent measurements which says that the system has many errors that need to be controlled for it to work properly. I have continued to collect data since the Hermosa Science Fair, and I found changes in the health of the plants in both systems. The aquaponics system plants showed a lot of change. The plants have started to gain darker green colors, broader leaves, and thicker red stems which allowed them to stand up. I believe this change occurred do to a few different reasons. The Ph decreased to 6.5, the water level was lowered due to evaporation, the Nitrates stayed at the high level of 200 mg/L. I believe that all of these factors contributed to an increased growth and overall health of the aquaponics plants. The Ph, nitrates, and plant growth within the hydroponics system remained consistent and healthy.

Q2: Methodology/Project Design

Build Aquaponics System and Hydroponics System:

1. Use a hole saw to drill fitting holes for tubing into each of the four plastic containers. Connect the two containers (one on top and one on bottom) with tubing and the water pump. Seal the tubing into the plastic containers using non-toxic silicone putty.
2. Cover tubing holes with plant root cups to prevent fish and clay pellets from being sucked into tubes.Vacuum out each plastic container to remove all plastic shavings.
3. Fill each grow bed (top containers) with equal amounts of clay growing pellets. Fill both water beds (bottom containers) with 6 gallons of distilled water.
4. Prepare 6 root cups for each system. Place 3 seeds into each of the 6 root cups filled with sphagnum moss.
5. Securely attach 1 grow light 2 feet above each grow bed of both systems.
6. Add 4 fish to the water container of the aquaponics system and turn on both systems grow lights.
7. Add 2 tablespoons of algae aquaculture nutrients to the hydroponics system water container.
8. Place both the water pump and the aerator pump into both systems. Let both systems run and pump through water for 24 hours before adding the root cups.
9. Space out each root cup 6 inches into the grow bed (top container). Bury each root cup 5 centimeters deep into the clay growing pellets.
10. Keep grow lights on for 24 hours a day.

Taking Measurements:

1. Using the directions on the API: 5 in 1 Aquarium Test Strips, test the water in both systems every 7 days. Record water testing data in charts.
2. Take photos of each plant in both systems every 7 days.

Maintaining System:

1. Keep grow lights on for 24 hours a day.
2. Feed the goldfish in the aquaponics system 2 pinches of food one time daily.
3. Check the system tubing on a daily basis to maintain consistency in water flow.

Q4: Interpretation & Conclusions

My hypothesis/goal for this project was: If romaine lettuce plants are grown in an aquaponics system and a hydroponics system, then the lettuce grown in the aquaponics system will grow healthier plants because the fish provides the needed ammonia and nitrogen for the plants to grow taller and healthier.

My hypothesis was not supported. The data shows that my hypothesis was not supported because the overall plant growth of lettuce plants grown in the aquaponics system is not as large as the overall plant growth of lettuce plants grown in a hydroponics system. When making observations based on healthy color and stem thickness, the hydroponics grown plants were far healthier. The hydroponics system lettuce plants had red colored thick stems, broad leaves, and a dark green/purple color. The aquaponics system lettuce plants had white colored, thin and weak stems which couldn't support the weight of the plant, less broad leaves, and were a light green color. Also, my data disproved my hypothesis because the nitrate levels were low and inconsistent. The level of nitrates for a healthy system is 40-80 mg/, and on average the aquaponics systems average was 20 mg/L. The pH levels needed for a healthy aquaponics system is 6.4 to 7.4, and the data showed a range in pH level of 7.5-9. The data showed in consistent measurements which says that the system has many errors that need to be controlled for it to work properly.

If I were to do this project again, I would consider studying more about how to maintain a healthy aquaponic system. I learned that in order for an aquaponics system to work properly, many components such as PH level, ammonia level, nitrates/nitrites levels have to be consistent. I tried to maintain consistency throughout my design, however I couldn't properly regulate the ammonia levels. I think that this had an effect on the lettuce growth in the aquaponics system. It is important that people know more about this topic for a few reasons. First, farming plants in an aquaponics and/or hydroponics system can help resolve future farming issues due to soil erosion of nutrient dense land and reduction. Soil is not needed for either of these plant growing methods. Second, farming plants in an aquaponic system and/or hydroponic system uses very little water, as the system is contained. Fresh water usage is, and will continue to be, a problem in many areas of the world due to increased drought levels. Lastly, an aquaponic system is a sustainable method of farming both fish (protein) and vegetables within the same system. An aquaponic system can provide both organic protein and vegetables/fruit to people in a less expensive way than purchasing them at a grocery store.