Algae Growth Lab

By: Thayer Thomas

Collaborators: Noah Nelson, Parker Savage, Devin Stafford

Introduction/Problem:

"A rough calculation of current rates of soil degradation suggests we have about 60 years of topsoil left. Some 40% of soil used for agriculture around the world is classed as either degraded or seriously degraded." (Crawford) Many countries around the world face the same problem of having clean water and fertile land to feed its growing populations with agriculture. Solutions have been brought about throughout the world to try to find ways for people in these struggling areas to get fed daily. The solution that my group and I have made is called an aquaponic system. The system allows fecal matter of fish to be present in fresh water, this water circulate in a pump to another area with flowing water, plants and gravel. The fecal matter helps the plants grow by its nutrients but is filtered when drained back out into the main tank. This process creates plants that are accessible without soil. This is a huge solution for countries that lack fertile land such as countries in Africa. Through this lab the main problem being answered is : "How does an aquaponics system affect the cleanliness of water contaminated with aquaculture waste and the effectiveness of the irrigation of plants?" This lab hopes to set a guideline for future generations when growing agriculture.

Hypothesis:

With the introduction of an aquaponic plant bed, the level of algae in the fish pond at Heritage High School will decrease steadily removing most of the growth from the water system through plants and flowing water.

Variables and Problems:

After long hours of work, the aquaponic system finally functioned correctly with lots of flowing water with growing plants and gravel at the base of the tubs. This action quickly decreased algae growth by sight and the water started to clear up essentially just from the flow through the beds and pipes. Through constructing the system I learned a lot of different ways to function a successful aquaponics system. In our example, gravity plays a key role in the downward flow of the water, allowing the water to flow into the next bed and empty out back into the tank. This shows how important the balance of boards and gravity plays in the proper function of this system. A problem that occurred while constructing the project was that the beds were at a slope, allowing the water to sit in a position rather than flow down hill. This allowed their to be more standing water, creating more algae adding to the problem. Action was taken and blocks

were added at the beginning of the bed so that it created a downward plain. This clearly fixed the problem of standing water in no time. Another key component to the way the system works is the drain. Without a functional drain, the water doesn't get from one place to the other. For us the water kept leaking under the drain into the base of the wooden bed, then causing leakage into the ground. It was fixed by adding more clamps and also by making sure there were no openings between the liner and drain. This allowed the water to drain without any major leaking.

Parts of the Experiment:

- The independent variable is the use of aquaponic plants in the ecosystem.
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- The dependent variables are nitrogen, phosphate, and dissolved oxygen levels.
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- The control group is the polluted water before the aquaponics system was made.
- The experimental group is the water after the aquaponics system is made.
- The controlled variables are the type of fish used, the source of water, and the position of the pond.

Materials:

- Wood
- Drill
- Saw
- Nails
- Cement
- Cinderblocks
- Shovel
- Plastic liner
- PVC pipe
- PVC glue
- Drains
- Box cutter
- Water
- Fish

Method:

1. Construct one wooden box that is large enough to sufficiently hold a few dozen small fish.
2. Line the box made in step one with plastic liner and place water and fish in that box.

3. Construct two identical wooden boxes that are large enough to hold a large amount of water and are similar in size to the box made in step one.
4. Line the boxes made in step three with plastic liner and place water in both of them.
5. Place one of the boxes made in step three on top of the box made in step one, but slightly raised on one side by cemented in cinderblocks.
6. Place the other box made in step three on top of the box that was placed on top of the box made in step one, but slightly raised on one side by cemented in cinderblocks(the slight raise in the boxes will help to keep water circulating throughout the aquaponics system).
7. Once all the boxes are in place, drill holes in the two boxes that were made in step three at the lower end of the boxes. Then place drains in the holes.
8. Place gravel in the wooden box directly above the box made in step one, and put plants in both of the boxes created in step three.
9. Place one end of a water pump in the box constructed in step one, then place the other side of the pump in the highest stacked box.

Data/pics:

1 2 3

4

Data Table:

Dissolved Oxygen	Nitrates	Phosphates
0	40	4
2	30	4
4	40	5

Analysis of Pics and Table:

The pictures above shows how the aquaponic system was created. The process was long but reassuring and was worth the work put into it. Pictures 2-4 show how the beds were formed, with what materials, and the point of each part. Each bed above was formed by cut sections of three pieces of treated wood. One being the base and the other two were sides that were drilled into the base. This allowed for the structure to maintain shape without giving away. After the wood was drilled, plastic liner was over extender over each bed so that there was extra plastic at each end just to make sure we had enough on the ends and sides. The plastic liner is to keep the water and rocks from getting into the wood and leaking on to the ground. It helps the water maintain its flow without any disruptions. The concrete blocks held each bed and creates downward flow and is very important for the aquaponic system. As seen in pictures 2 and 3, drains were put in each bed in order for the water to flow back into the main tank. The PVC pipe is for the adding of water through a pump to the top of the first bed. This allows the water to go from the tank to the first bed without manually putting that water their. The first picture shows

the hard work and dedication that the students had to work on a project to help save lives in Africa outside of school hours.

The table above was taken from the main tank gradually from before the start of the system to after a day from its start. (3 days) It shows how before the system was implanted, DO levels were low, Nitrates and Phosphates levels were high. This shows that the algae growth and standing water created unhealthy contaminated water. As time went on through the flowing of the water through plants, pipes, and rocks, those numbers went in opposite directions for dissolved oxygen levels. It went from 0-4 in the matter of two days. This is good because there were less algae consuming O2 out of the water. This shows that the system is creating water quality that is right for plant growth and may be the future of agriculture for areas with low fertile land.

Conclusion:

After finally completing the construction of the aquaponic system and started it, I can say that the system was a complete success. Even though we had limited time and spent most of the time constructing the system, the little time that the system worked, we saw improvement in water quality and decreasing algae growth. This a great sign for the future of the this project and help me learn about alternative ways of growing healthy food other than growing them in the ground. This system could be a model for the future of agriculture. Fertile land is a lot more limited than flowing water. This system is perfect for third world countries with little fertile land for agriculture. They just need some flowing water and they can create their own aquaponic system.

All though this lab was a success, my group and I faced some key problems while constructing the system. The first problem was that the water was leaking through the clamps and liner and into the wood and out on the ground. This caused massive puddles around the project and over time could lead to serious wood damage. To fix the problem we updated our drains so that no space between the drain and liner was accessible. We also added more clamps to reassure the closed space. These actions helped our group proceed further into the project. The other main problem was that the group connected the water pumping from the greenhouse to fertilized water instead of regular water. This may have skewed our data with algae growth because fertilized water is high in Nitrates and Phosphates. By switching the water source I thought helped clean the algae out gradually and helped the DO to go up.

Ways that the project relates to Environmental Science is that this project was created to make food for humans and create a standard to follow for humans. For example, project wisdom is going to Ghana to bring all of the food that is grown from our project to feed the hungry people present there. This will help starving people in the present and future. Not only are we bringing the grown food, we are also going to teach the people how to make and run an

aquaponics system for their own use. This will allow people in third world countries have food as the world's fertile land gradually decreases. Aquaponics is to save lives through education and process.

Works Cited

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