Assessing the Effect of Flow Rate on The Growth of Lettuce in Three Aquaponics Systems

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INTRODUCTION

Traditional agricultural practices pose an incredible threat to the world’s natural resources through their extensive land, water, and fossil fuel usage in order to meet the food demands of the growing population.

Aquaponics is a sustainable practice that allows for minimal effects on the environment by growing plants and raising fish at the same time, either indoors or outdoors. However, aquaponic systems can be constructed differently, so the most efficient system for production has yet to be determined. Because the demand for food will only increase, efficient and sustainable food production is vital moving forward.

It was hypothesized that an increased flow rate will allow for more readily available nutrients to the plant roots and allow for the largest yield in lettuce.

METHODS - STUDY PARAMETERS

- 60 Black Convict Cichlids per system
- 10 Black Seeded Simpson Lettuce Plants per system
- Plants housed in plastic growing cup with Hydrocorn media
- pH, Ammonia, Nitrite, and Nitrate monitored weekly
- Plant harvest measured plant volume, plant length, leaf surface area, root to shoot mass ratio, and total number of leaves

METHODS - STUDY PARAMETERS

RESULTS

Average Change in Lettuce Volume (mL)

Figure 1. The average change in plant volume (mL) was found from averaging the change in plant volume (mL) from growing cups A-J in each of the three aquaponics systems measured using a graduated cylinder.

Average Change in Lettuce Length (inches)

Figure 2. The average change in plant length (inch) was found by averaging the change in length (inch) from growing cups A-J in each of the three aquaponics systems. The plant length refers to just the plant shoot.

Average Lettuce Leaf Surface Area (cm²)

Figure 3. The average surface area (cm²) was found for the largest leaf of each plant from growing cups A-J for each aquaponics system by scanning the leaves on a portable scanner and using the program FIJI.

CONCLUSION

The data does not support the hypothesis that plant growth would increase as the flow rate of the system increases due to the availability of more nutrients.

The lettuce plants had a fine fibrous root system allowing them to be vulnerable to large amounts of activity, such as a high flow of water, possibly explaining the more productivity within the slower flow rate systems.

It is possible that the rate at which nutrients are taken up by the plants occurs too fast for the nutrients to have a very significant impact on the productivity of a system.

Finally, aquaponics has the opportunity to grow more financially feasible as a sustainable agriculture resource when it is applied on a small scale if productivity can be maximized. By placing crops within the aquaponics system that maintains their preferred flow rate, food can be grown more efficiently and sustainably moving forward.

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Bibliography