The Productivity of Aquaponic Growth in *Lactuca sativa* as a Means to Reduce Commercial Runoff

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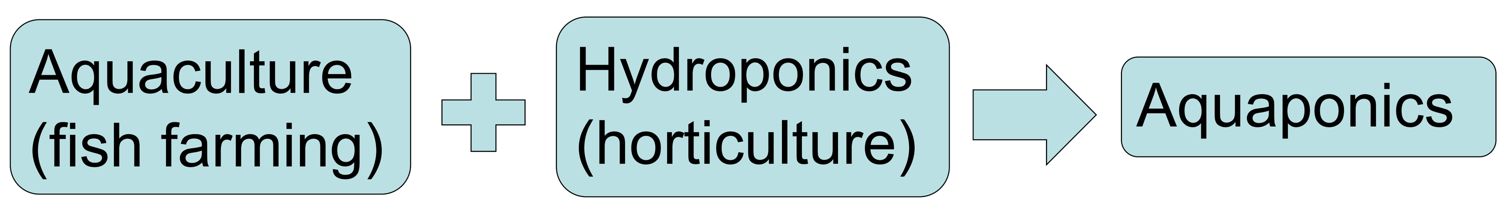
Introduction:



1. Fish are fed with waste animal and vegetable matter.
2. The feces and excreted ammonia from the fish are then broken down into plant soluble nutrients by the bacteria in the bio-filter.
3. The plants up take these nutrients through their roots. The water is now considered "clean".
4. The "clean" water is then returned to the fish tanks, and the cycle is repeated continuously.

Methods:

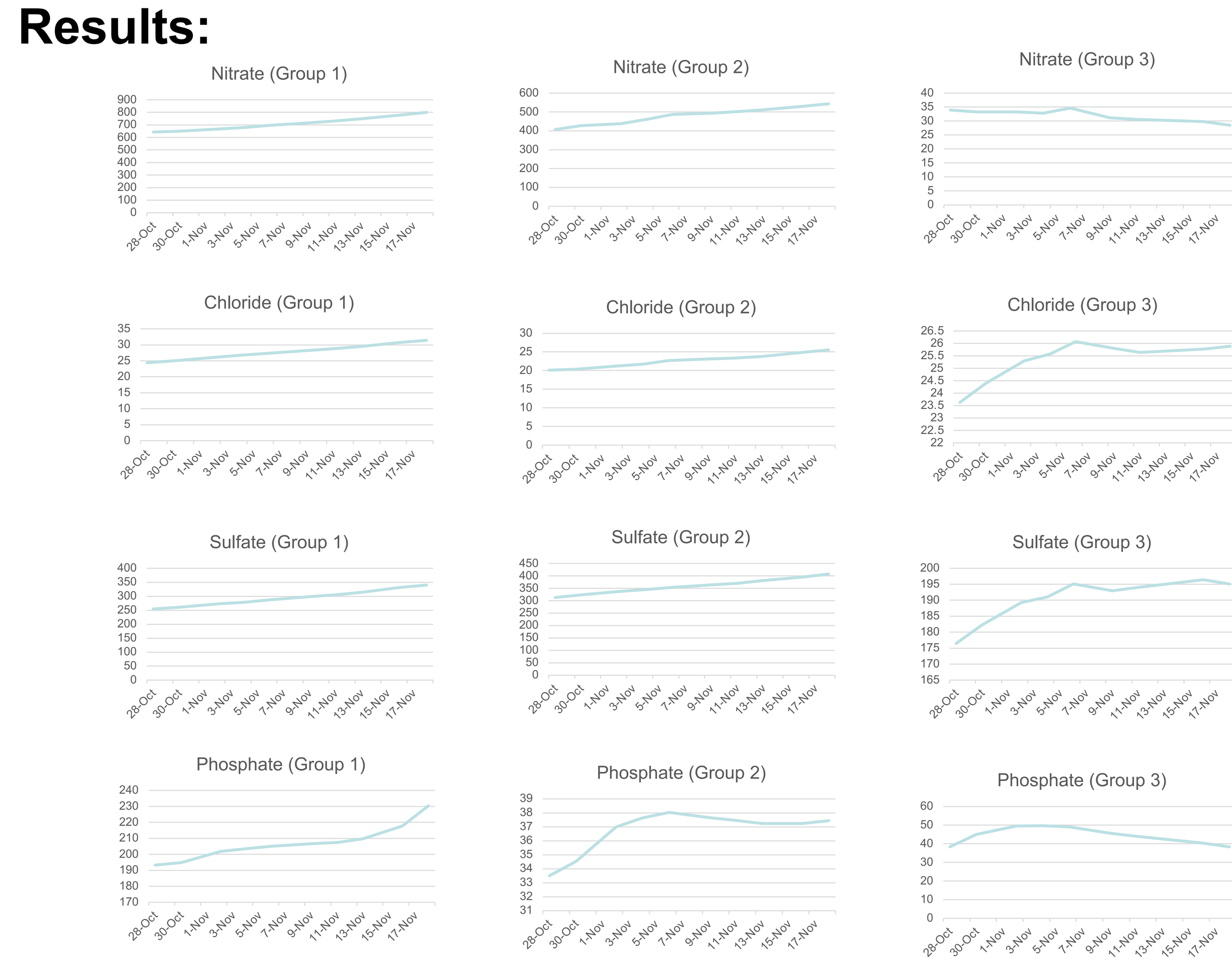
Three test groups:
1. Water mixed with a store-bought hydroponic solution (control)
2. Fish wastewater mixed with some added nutrients (Magnesium Sulfate and Calcium Nitrate) that were found in the hydroponic solution.
3. Only fish wastewater

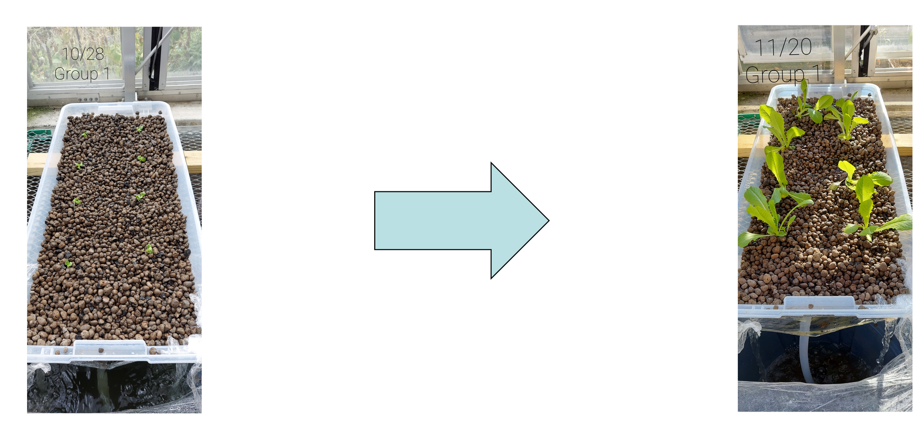
These differing groups of water were used to grow romaine lettuce hydroponically using a media-filled bed system. Each test group of water had its own shallow growing bin holding eight lettuce plants. The bins were filled with clay pellets to act as an inert substrate. Water was drawn from the 30-gallon water storage containers and pumped to the media-filled beds. The bins were set at a 10-degree angle, with the back being higher than the front. The water ran from the back of the bed to the front where it then drained back into the storage bins, creating a constant loop. The water was cycled for 30 minutes, every hour, to allow some time for the root systems to dry out and prevent an anaerobic environment being created. The ion concentrations of each group, as well as the final masses of the plants in each group were compared to measure the productivity of each growing solution.

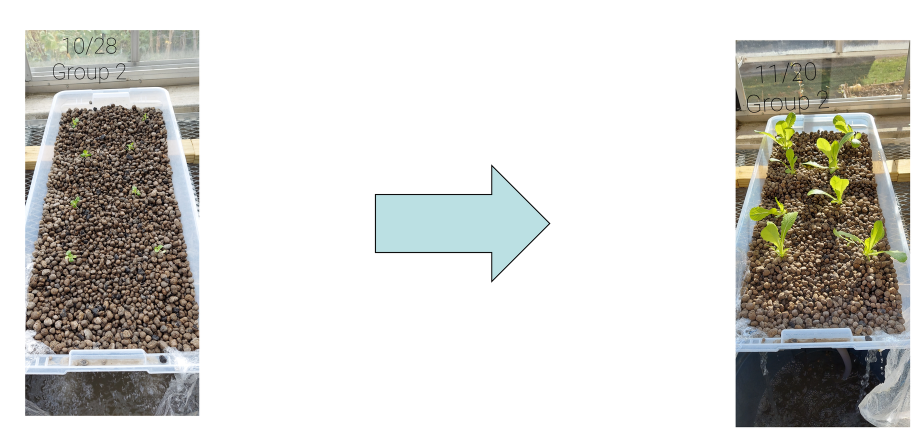
Water sampling and photographic documentation occurred every Monday, Wednesday and Friday for the duration of the study.

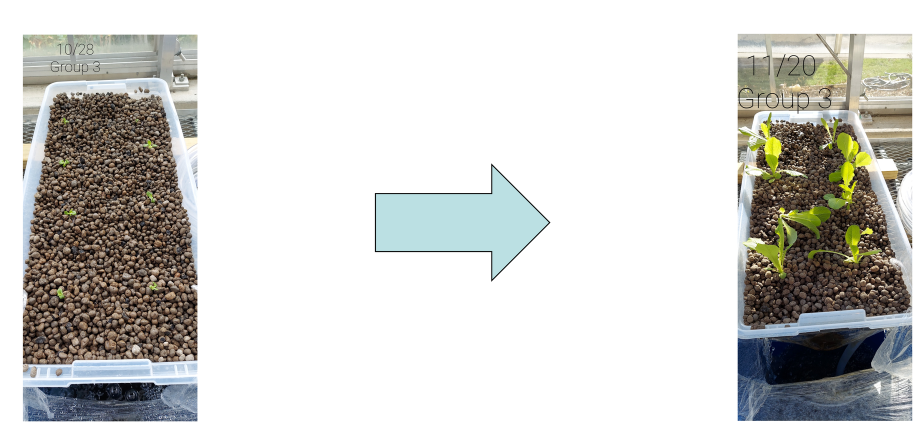
Water sampling tested for:
- Phosphate
- Nitrate
- Sulfate
- Chloride

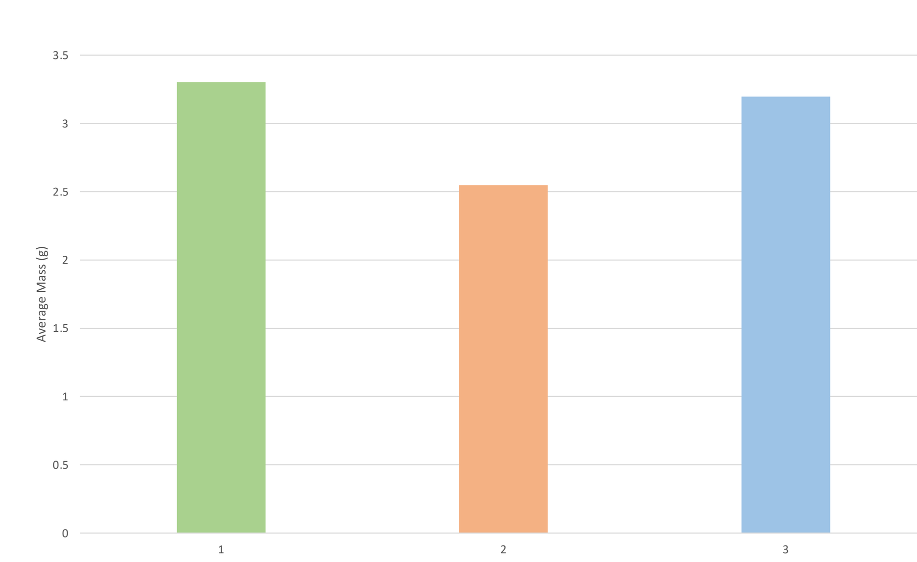
Results:











SUMMARY						
Groups	Count	Sum	Average	Variance		
Group 1 (g)	8	26.42	3.3025	1.34939286		
Group 2 (g)	8	20.38	2.5475	0.89050714		
Group 3 (g)	8	25.56	3.195	0.92025714		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2.6689	2	1.33445	1.26681991	0.30238972	3.46680011
Within Groups	22.1211	21	1.05338571			
Total	24.79	23				

Conclusion:

- The results of this study, shown by the ANOVA test, do support those of David, 1970, who found that there was no significant difference in biomass in lettuce grown with aquaponic water and nutrient supplements versus a hydroponic solution.

- The loss of water in this study was much higher than that in the study conducted by Liang and Chien.
  - Liang and Chien experienced a water loss of 3.3% in four weeks from their system.
  - There was close to a 50% water loss in a three-week period, in this study.
  - It is very important to have completely closed system for storing the water and running the water to achieve accurate results.
  - Therefore, no conclusions could be drawn based on the water ion concentration data.

The lack of statistical significance between the growth rate of any one group is a positive sign that crops can be grown effectively in any of the three mediums tested, meaning that growing crops in pure wastewater may be just as productive as using commercially made hydroponic solutions. This is a very positive sign that switching from traditional crop farming and fish farming techniques to an aquaponic method could be completely viable. If this change were to occur, we would see reduced: soil degradation, water scarcity, food insecurity and algal blooms. All of these factors would contribute to a very large net positive effect on the planet and help to make our food supply sustainable for the future.

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