Aquaponics: Affordable, Sustainable Solution in Arizona

Context

What is Aquaponics

Aquaponics is a food production system that involves raising aquatic animals in a symbiotic relationship with plants.

Animals excrete their waste into the water and this waste is broken down into nitrates and the plants use the nitrates in return as food for growth.

Introduction

In the research paper, “Food Production and Water Conservation in a Recirculating Aquaponics System in Saudi Arabia at Different Ratios” which was published in August of 2008, researchers S. Youseef and others discovered that a large sized aquaponics system in Saudi Arabia was more cost effective than traditional farming, because of it’s crop yield, which was more than that of traditional farming and it’s high reactant recyclability rate (the system recycled over 98% of it’s water input and did not lose much to evaporation).

Hypothesis

I predicted that the researcher’s conclusions could be generalized to the state of Arizona, because Arizona has a similar desert climate to that of Saudi Arabia as well as little freshwater; as a result of this, the two tanks will be similar in efficiency.

Materials

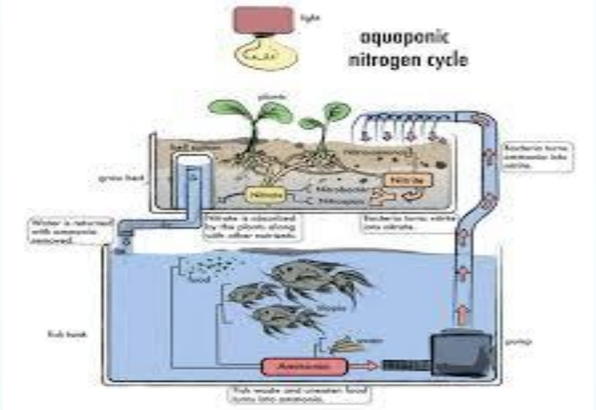
•1 Tape Ruler
•1 Standard 10 gallon fish tank
•Paper
•Pencil
•Calculator
•Values that the researchers in Saudi Arabia found which are 40g/fish produced per 6 months and 30 heads of lettuce produced per 4 weeks per m^2 of grow space.

Results

•I found the volume of the tank to be 0.043608 m^3 and the grow area of the tank to be 0.071854695 m^2.
•Using the ratio explained in step 3, I set up the equation: 213 m^2/30m^3=0.071854695m^2/x, with x being equal to 3.37345 X 10^- 4
•I then multiplied this x value by my tank volume to yield the value 1.47109837 X 10^-5 to be equally efficient to the tank in the research paper.
•I multiplied my efficiency value by 80kg fish/year, to get that, my standard tank would yield 0.00118kg fish/year.

Methods

•\Step 1: I designated an area in my house to set up an aquaponics system, which in my case was a standard 12.5 X 20.5 X 10.5 inch 10 gallon fish tank with a grow area of 20.5 inches by 10.5 inches.
•Step 2: I calculated the initial volume of the tank by multiplying the length of the tank by the width of the tank by the height of the tank.
•Step 3: Using the original data from the research paper, I found that the volume required for the tank to be efficient by setting up a ratio between the grow area over the volume of the tank in the research paper (which was 213m^2/30m^3) equal to my grow area over x.
•Step 4: I multiplied this new variable x by the tank volume to see how efficient my fish tank needed to be in order to be equally efficient to the tank in the research paper.



Results Continued

Finally I multiplied the efficiency value by the researcher’s value of 390 heads of lettuce/year to find that my standard sized tank would produce 0.00574 heads of lettuce/year per 1 meter squared.

Conclusion

From the data gathered, I concluded that the household aquaponics system was inefficient in comparison to traditional farming because this tank would only yield 0.844th of a head of lettuce. Although my hypothesis was incorrect, I believe that the small size of the tank ultimately resulted in the lower crop yield and with a larger tank and more growing space, one could yield more crops.

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References

Al-Hafedh, Y.S., Aftab, A., and Beltagi, M.S., 2008, Food Production and Water Conservation in a Recirculating Aquaphonic System in Saudi Arabia at Different Ratios of Fish Feed to Plants, Journal of the World Aquaculture Society, v. 39, No. 4, pps. 510-519.

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