

Maximizing Growth Rates of Various Lettuce Cultivars in an Aquaponics System

By

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Introduction

“Aquaponics” is the combination of aquaculture, the growth of fish, and hydroponics, the growth of crops in a soilless medium. In aquaponics, the autotrophic bacteria *Nitrosomonas* and *Nitrobacter* are required for the transformation of ammonium generated by the fish into nitrates that can be used by plants as a source of nitrogen for growth (Tyson, 2004). The fish provide this nitrogen and other important nutrients required for plant growth, while the plants filter the water and provide clean water for the fish.



Barbados is a small island nation with an area of only 430 km², and a population of approximately 284 000 people (World Bank, 2013). Archer’s Organics works to provide local healthy foods via organic practices. Organic agriculture is an alternative to conventional agriculture and is a more holistic approach to farming. Organic Agriculture aims to provide food for the need of people while using methods that can aid in preserving the environment and sustainably using the resources needed for the future needs of agricultural production.

Meet the Team



From left to right are Alexia Bertholon, Shae-Lynn Roberts, and Ananka Shah.

Important Terms

“Trough” is a large enclosed pool like space that holds the nutrient rich water for the plants to float upon and grown on. “Tray” is a floating, generally Styrofoam, platform of which various hole are drilled into to hold up the plants at the top so that they can obtain sufficient water and sunlight without allowing them to sink. “EC” is an abbreviation for electrical conductivity, which measures the degree of which a medium holds electrically conductive particles.

Objectives

Determine which growth medium promotes the best growth rate for lettuce. Determine which lettuce cultivars are the most successful in a tropical aquaponics system. Monitor nutrient levels, pH, and Electrical Conductivity (EC) in the various aquaponics troughs to understand if there is any significant difference in the

quality of the water from one trough to another.

Materials and Methods



The lettuce used for this project were 'Green Star', 'Coastal Star', 'Red Oak', 'Cherokee', 'Adriana', 'New Red Fire', 'Alkindus', 'Spretnak' and 'Outregeous'.

The methods included: planting the seeds, measuring germination rates of the seeds, measuring the seedlings in the nursery, transplanting the seedlings from the nursery into the aquaponics troughs, measuring water quality data every project day, counting leaf numbers, measuring stem height, measuring leaf height, harvesting the lettuce and measuring the lettuce mass.

Results

The most important factor to note for the different cultivars is average mass per head of lettuce and total mass of lettuce. However, the number of heads collected and total mass numbers are not totally explanatory of how the crops performed in the system. This is because there were less 'Red Oak' planted due to the fact that not enough of the seeds germinated. Another important factor, is that more of the 'Coastal Star' was planted in the system, since they had an impressive

germination rate and we thought it would be a good idea to include as many plants in the system as possible in case there were any large crop failures in different trays. The results for the number of heads remains important however because one can conclude that over the entire life cycle, from the % germination and then production of the most biomass, 'Coastal Star' was the most impressive. In the coco pod trays 'Coastal Star' was the most successful for overall mass growth. 'Red Oak' was the second most successful in the system. 'Green Star' was the least successful in the system.

In the soilless, peat medium, 'New Red Fire' was the most successful, followed by 'Coastal Star' and then 'Spretnak'. 'New Red Fire' is red coloured, while 'Coastal Star' and 'Spretnak' are green coloured. Archer's Organics sells mixed lettuce and it is good to know that two different colors of lettuce are successful in the system so that the lettuce that they sell can have colour variations and will be more aesthetically pleasing to customers.

The average mass for 'Coastal Star' in the pods was only 1-gram more than in conventional commercial peat-based medium. 'Red Oak' in the coco pods grew to an average mass that was about 10-grams greater than that of the commercial medium. 'Green Star' in the pods also grew to be around 10-grams heavier in the coco pods than in the conventional planting mixture. This shows that the coco pods may be more useful for certain cultivars and less important to use in the growth of other cultivars. This is an important conclusion that will determine the

economic viability of the use of the coco pods, since they are more expensive than the conventional potting mixture.

Looking Forward

The addition of the greenhouse over the aquaponics system will allow for greater control of the temperature in the system. Temperature is important for lettuce and other crops because it can influence growth rates and the occurrence of plant bolting. Bolting can be undesirable, as it will cause a change in the plant transforming inputs into biomass to the production of seeds for reproduction. The greenhouse will also protect the crops from the wind and intense rains during the wet season of Barbados. This is important as we observed that the plants had been growing at a slight tilt due to the constant wind from one direction. Protection from the rain will reduce the transportation of any spores of undesirable organisms onto the plants and will allow the prevention of any issues resulting from the dilution of the water in the system.

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