Comparing Growth Rates, Mortality Rates, and Harvest Weights of Green Grand Rapids Tropicana Lettuce (*Lactuca Sativa*) between Aquaponics Grow Beds and Bahamian Soil

Students: Kelly Duggan, Austin Frank, Alec Green, Teddy Lamont, Haley McCalpin, and Caroline Vanacore
Advisors: Ashley Akerberg and Josh Shultz

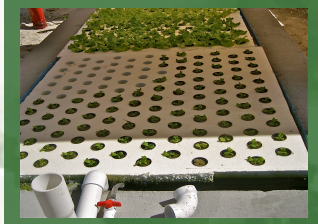
Introduction

With the world population surpassing 6 billion people, water and food are in high demand. However, many practices of growing food and fishing are unsustainable and harmful to the environment (Naylor et al., 2000). Aquaponics is a system that has the potential to meet the food and water demands in a sustainable way. Aquaponics is a single system that incorporates two methods by of artificially providing food: aquaculture, the rearing and harvesting of marine animals, and hydroponics, the process of growing plants with added nutrients in a soilless environment. The waste of one species provides the nutrients for another species. (Rakocy et al. 2006).

At the Cape Eleuthera Institute (CEI), Nile tilapia (*Oreochromis niloticus*) were used in the aquaponics system because they are extremely tolerant. Green Grand Rapids Tropicana Lettuce (*Lactuca sativa*) was grown, as it does not require varying levels of nutrients throughout different stages of growth (Jones 2009). It was debated if the in the ground would grow more productively than lettuce in the more sustainable aquaponics systems. The method by which the plants grow better has not been established nor published. The process of growing lettuce in the ground has been used for centuries, while aquaponics is relatively recent to the agricultural world (Rakocy et al. 2006). For this reason, the hypothesis was that lettuce grown in the ground will grow more quickly, will have lower mortality rates, and will have a greater harvest weight than lettuce grown in aquaponics systems.

Old Bed

New Bed



Farm Bed with Irrigation

Methods

-Conducted for 90 days at The Cape Eleuthera Institute in Eleuthera, Bahamas
-Four sheets of Rockwool, each consisting of 98 cubes, were seeded the first week with Green Grand Rapids Tropicana Lettuce and watered until germination
-One hundred cubes were planted in the new bed old bed and Farm bed
-Cubes for the aquaponics beds were placed into circular net pots and then into polystyrene sheets with circular cutouts 15.24 cm apart from each other
-Cubes for the farm were planted into beds amended with 7 cm of compost evenly spread over surface
-Each plant was placed directly in the ground and automated drip irrigation systems were set up
-Weeks two and three: an additional 50 cubes of Rockwool planted in each bed, a total of 200 cubes in each bed
-Data was collected and recorded twice a week for all three plantings consisting of: mortality, height, and leaf count of each plant
-Each replica was harvested 32 days after planting where the final height, leaf count, and weight of each plant was recorded

Results

Growth rates, mortality rates and harvest weights were compared between the lettuce in the new aquaponics bed, the old aquaponics bed, and the farm bed. Mortality rates were highest in the farm. Only 19 of 200 total plants survived the 32-day growing cycle. In the new bed, 197 plants survived and in the old bed, all 200 plants survived.

The average height of all of the plants at harvest in the farm, old bed, and new bed were 6.58 cm, 18.21 cm, and 22.51 cm respectively. (Figure 2). The average weights were 3.68 cm, 59.47 cm, and 50.04 cm. (Figure 1). The average leaf counts were 5.93 cm, 15.58 cm, and 14.35 cm. (Figure 3).

P-values were calculated for weight, height, and leaf count by bed. When comparing the farm bed to the old bed, the p-values for height, weight, and leaf count were all <0.001. For the comparison between the farm bed and new bed for height, weight, and leaf count were also all <0.001. The comparison between the new bed and the old bed for height, weight, and leaf count resulted in p-values of <0.001, 0.012, and 0.035 respectively.

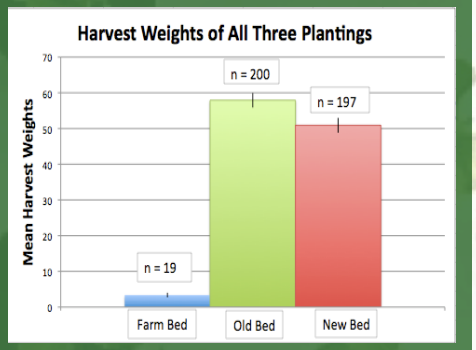


Figure 1

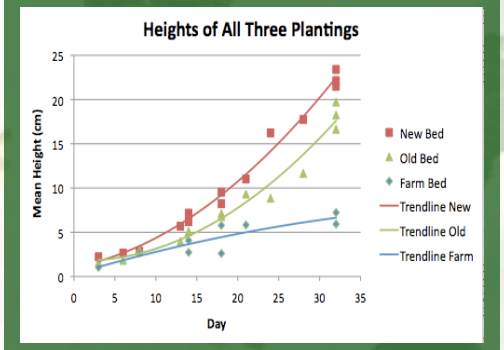


Figure 2

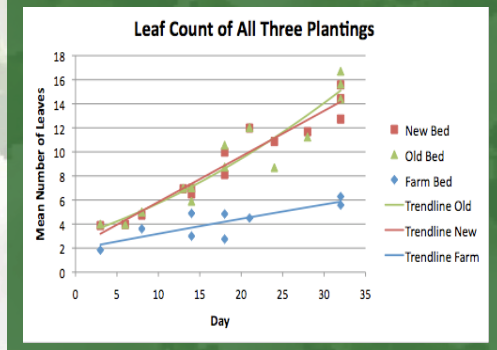


Figure 3

Discussion

The group failed to prove the hypothesis. Mortalities occurred in the farm beds because the irrigation system failed to water the plants for several days. Also, some escaped pigs trampled the plants. Due to these human errors, the majority of the plants in the farm bed was killed.

The final mean heights in the new bed were greater than in the old bed. The old bed produced more leaves per plant. However, the plantings were relatively similar to each other in growth heights.

The new bed plants had a greater mean height than the old bed plants, but a lower mean leaf count. This significant difference between the beds is shown in the p-value for new to old bed height of 0.001 and in the p-value for the new to old bed leaf count of 0.035. This could be due to the shading cover over the new bed that blocked 30% of sunlight. Because of the limited sunlight to the new bed, the plants put more energy into growing taller rather than growing new leaves. Similarly, the perimeter plants had more leaves but smaller heights than the interior plants.

The aquaponics beds were more productive than the farm beds. However, much of the farm's failure was due to human error. Ways to prevent this in future research is to make sure there is more human monitoring and supervision of the plants in the farm.

Germinated Seeds in Rockwool and Net Pots

Acknowledgements

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Literature Cited

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