Individual Analytical Analysis 2

To: Dr. Trevas
From: Yanchu Du
Due: 10/11/2020
Team number and name: Team Vertical Farming
Section information: ME486C-001
Re: Individual Analytical Analysis Report

Introduction:

Vertical farming is a new concept emerged since World War II. Compared with traditional agriculture, vertical farming has advantages in environmental protection and quality stability. The goal of our project is to design a vertical agricultural device that can be enjoyed by individuals who are interested in planting. The system can provide fresh and high-quality organic plants for individuals and beautify their living environment. There is no sponsor for the project, but the cost of the design is provided by the Northern Arizona University. Hunter, a member of the project, is the starter of the project because he is very interested in vertical agriculture. Because of this, we chose aquaponics as the main direction of this project.

In my personal analysis report last semester, I studied the nutrition needed by the system, the nutrient cycle, the optimal growth environment for fish, plants and microorganisms, and the potential nutrient loss of the system. In this personal analysis report, I will take a deeper analysis and mathematicise it. The nutrition source of an aquaponics system is mainly fish food. Other things and the main feed rate are calculated by the basic conditions of the equipment.

Procedures:

The steps and equations to calculate feed rate are shown below.

Step 1: Determine the total growing area

Step 2: Determine the weight of feed required per day

$$1.86 \ \frac{\frac{grams}{day}}{ft^2} * growing \ area = \text{grams of feed required by day} \qquad (1)$$

$$\text{grams of feed required by day} \div 454 \frac{\text{grams}}{\text{lb}} = \text{lbs by day of feed required} \qquad (2)$$

Step 3: Determine total lbs of fish needed to consume the total feed required based on % body weight fed at harvest size.

$$\text{lbs by day of feed required} \div 1 \% \text{ body weight fed} = \text{total lbs of fish} \qquad (3)$$

Step 4: Determine the number of fish required based on desired harvest weight:

$$total \ lbs \ of \ fish \div 1.5\text{lb harvest weight} = \text{number of fish} \qquad (4)$$

The growing area is 8 square feet which is the area of fish tank Hunter owns. Hunter have fish

farming experience and we plan to use the fish tank he used before. The grams of fish food per square feet per day is around 1.86. The body weight fed is usually 1 to 1.5 percent based on fish species and harvest weight is also based on fish species and here I use 1% body weight fed as well as 1.5lb harvest weight.

Results:

Growing area(ft^2)	8
grams of feed required/day	14.88
lbs/day of feed required	0.03277533
total lbs of fish	3.27753304
Number of fish	2.185022026

Table 1: Feed Rate and Number of Fish

Through these two personal analysis reports, I learned what nutrients are needed for a safe aquaponics system, such as nitrogen, iron, copper, etc., and the nutritional content of fish food. I also learned the growth conditions suitable for different kinds of fish, plants and microorganisms, such as pH value of water, dissolved oxygen, etc. I also learned about the potential loss of nutrients in the system. I calculated the feed rate of fish feed and the number of fish needed in the system we designed. Quantifying these conditions makes our design more likely to succeed.

Reference:

[1] "How to Determine Feeding Rate in Aquaponic Systems," *The Aquaponic Source Growing Fish and Plants Together*. [Online]. Available: https://www.theaquaponicsource.com/determine-feeding-rate-in-an-aquaponic-system/

[2] "HOW MUCH DO I FEED MY FISH?", *The Aquaponic Source Growing Fish and Plants Together*. [Online]. Available: https://www.theaquaponicsource.com/faq-items/much-feed-aquaponics-fish/

[3] Shirlie Sharpe, Fish Food Nutrition and Vitamins 101, the spruce Pets. Accessed on Jan 2020 [Online]. Available: https://www.thesprucepets.com/fish-food-nutrition-1378503

[4] "SPECIES PROFILE Amphilophus citrinellus (GÜNTHER, 1864) Midas Cichlid," *SERIOUSLY FISH*. [Online]. Available: https://www.seriouslyfish.com/species/amphilophus-citrinellus/