INTERNSHIP REPORT

TERI (The Energy and Resources Institute)

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Class: MSc Part II

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TO WHOMSOEVER IT MAY CONCERN

The following student from Biotechnology Discipline of the School of Biological Sciences & Biotechnology, Goa University, Mr. Viraj Govekar has successfully completed one month internship during 1st December 2022 to 3rd January 2023 on the topic of aquafeed preparation and Aquaponics under the guidance of Dr. Elroy Pereira.

Sincerely,

(Dr. Fraddry D'Souza)
Area Convenor

ACKNOWLEDGEMENT

It was a great pleasure working at TERI (The Energy and Resources Institute).

First of all, I would like to express my gratitude to the Dean of the School of Biological Sciences and Biotechnology Dr. Savita Kerkar, and the Programme Director of Marine Biotechnology Dr. Sanjeev Ghadi for providing me an opportunity to take part in an internship. Furthermore, I am thankful for the assistance given by Dr. Samantha Fernandes D'Mello in the selection of the internship for my institute.

I appreciate the guidance provided by Dr. Fraddry D Souza and Dr. Elroy (TERI, Goa) in the internship project which allowed me to complete my tasks in an efficient way. I acknowledge the support of the Department of Biotechnology (DBT), India in the program.

Finally, I am grateful to all my colleagues and staff members at TERI whose help was essential in the completion of my internship.

INTRODUCTION

TERI (The Energy and Resources Institute) is an autonomous, multidisciplinary organization with knowledge of research, policy, management, and administration. For over four decades, TERI has primarily focused on areas such as a change in the energy, environment, climate change, and sustainability spheres.

The organization has the notion that now the key to innovative, sustainable, and accessible progress resides in waste management and resource efficiency. The work done by TERI in many domains is concentrated on:

- Promoting efficient use of resources.
- Increasing access and uptake of sustainable inputs and practices.
- Reducing negative impact on the environment and climate.

The TERI organization is headquartered in New Delhi and has campuses and regional centers in Gurugram, Bengaluru, Guwahati, Mumbai, Panaji, and Nainital.

The TERI office in Goa was established in 1996 to conduct policy research at the intersection of environment and development. It has developed expertise in the area of coastal and marine research, biodiversity mapping, and water resource management. It promotes sustainability by encouraging grassroots solutions, policy research, education, and awareness generation.

Aquaculture is one of the world's growing and improving fields currently. Aquaculture, often known as fish farming, fish culture, or mariculture, is the commercial, recreational, and academic production and maintenance of aquatic plants, animals, and other species. Unlike any other husbandry, the product of aquaculture (i.e., the fish) should be healthy and marketable, which in turn will be economically beneficial to the farmer, for which the diet of the fish is monitored carefully. A typical diet for aquaculture consists of a protein source, fiber source, vitamins, minerals, binders, etc.

The fish should also be checked whether they are eating the provided feed and efficiently converting it into body mass. This can be achieved by measuring the physical parameters of the fish and using calculations. This will tell us whether the fish is healthy and whether our diet is proper for the fish.

Due to the growing population, there is an unavailability of land for farming and aquaculture practices. Growing plants hydroponically means utilizing a water-based nutrition solution in place of soil, and growth mediums like vermiculite, coconut coir, or perlite can be used as an aggregate substrate. As there is a need of supplying nutrients externally to the plants in hydroponics, there is an alternative to this method which is called aquaponics. Aquaponics is a cooperation between plants and fish and the term originates from the two words aquaculture (the growing of fish in a closed environment) and hydroponics (the growing of plants usually in a soil-less environment).

OBJECTIVES

- Fish feed formulation using whole algae and de-oiled algae.
- Fish feeding experiment with the incorporation of experimental diet and commercial diet.
- Construction of small-scale aquaponics system.

I. FISH FEED PREPARATION:

Fish have different nutritional requirements depending on their feeding habits, digestive system, size, and reproductive status. A fish can be herbivorous, carnivorous, or omnivorous depending on their majority diet.

In the first week of the internship project fish feed preparation was carried out. Fish feed was prepared by mixing various ingredients which are beneficial for the overall fish development and also aid in the stability of the feed.

The preparation of the experiment diet consists of the following ingredients and their measurements are given below:

1. De-oiled algae.
2. Whole algae.
3. Fish meal.
4. Wheat bran.
5. Groundnut oil cake.
6. Vitamins and Minerals.
7. Binders.

Fig. Fish Feed Ingredients.

Ingredients (%)	Control	Diet 1a	Diet 1b	Diet 2
De-oiled algae		0.40	0.40	
Whole algae				0.40
Fish meal		0.1	0.25	0.1
Wheat bran		0.15	0	0.15
Groundnut oil cake		0.31	0.31	0.31
Vitamins and Minerals		0.02	0.02	0.02
Binder		0.02	0.02	0.02

The preparation of the fish feed (three diets) started with sieving and solar drying of all the ingredients. Afterward, the ingredients were finely powdered and weighed according to the chart values. The weight ingredients were then mixed with hands uniformly. After mixing the mixture was kneaded into a dough with the addition of warm water (for 1kg, 500mL of warm water).

Some of the dough was used for the preparation of pellets with the help of a pelletizer, while some of the dough was flattened in a tray. The flattened dough and pellets were kept for 2 days in sundry. After sun drying the feed was crumbled into powder which would be an appropriate size for fish fingerlings. The prepared feed was weighed as per the diet requirements of the fish.

Fig. Three diets in crumbled form and stored in vials.

II FEED OF EXPERIMENTAL AND COMMERCIAL DIET:

After the preparation of the feed, it was fed to fingerlings. 200 fingerlings of *Oreochromis niloticus* (Nile tilapia) were brought in a plastic bag. The bag was rinsed with water and placed in a half-filled water bucket so that the fingerlings can come outside on their own and get acclimatized to the surrounding environment. According to the different weight ranges, the fish were segregated into 12 different experimental tanks. There were 3 tanks prepared for each experimental diet plan with 6 fingerlings. The tanks were labeled according to the different diet plans. Each diet was fed to 18 fingerlings (3 tanks) for 14 days. There were three more tanks for controlled feed which was commercial feed. The fish was weighed and their length was measured at intervals of 0, 7, and 14 days.

III SMALL-SCALE AQUAPONICS SET-UP:

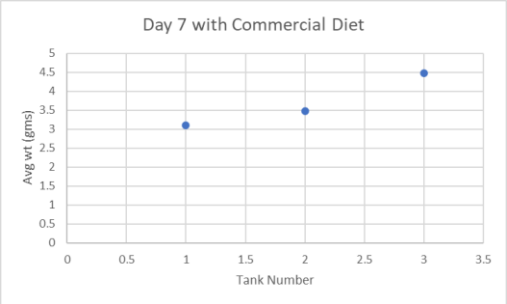
The aquaponics set-up was done in the last week of the internship. A rough plan of the set-up was laid which was approved by the guides of the project. Afterward, the requirements of the set-up were purchased.

Four PVC pipes of 1-1.5 meters were drilled with 4-5 holes of 3-4 inches equidistance from each other. Then these pipes were fixed with help of zip tags on a stand. The ends of the pipes were sealed with end caps with a hole. Through these holes, a small diameter pipe was passed so that water would flow in each pipe. An electric motor was connected so to aid in the flow of water from the fish tank to the pipe at the top. Plastic cups with holes at the bottom were placed in the holes drilled in the PVC pipes. In these cups, the plants were placed.

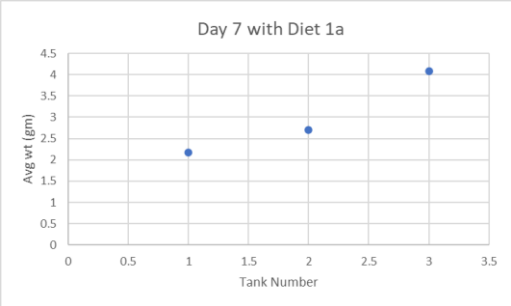
The water from the fish tank was pumped in the top pipe and through gravitational force, it was passed through each pipe and returned back to the tank.

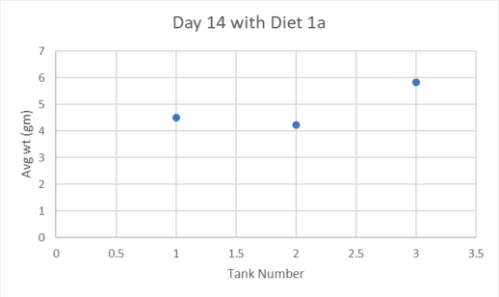
Fig. Aquaponics Set-up.

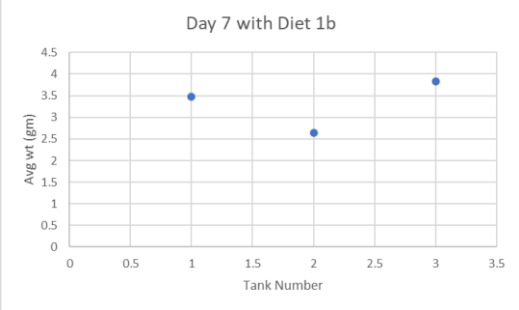
RESULT:

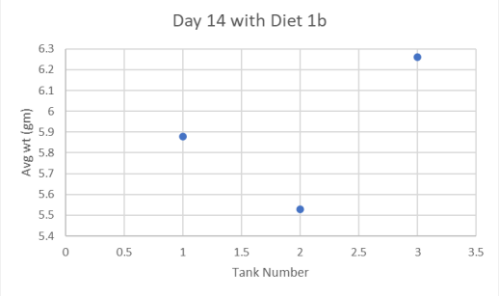

Day 7 with Commercial Diet
Avg wt (gms)
Tank Number

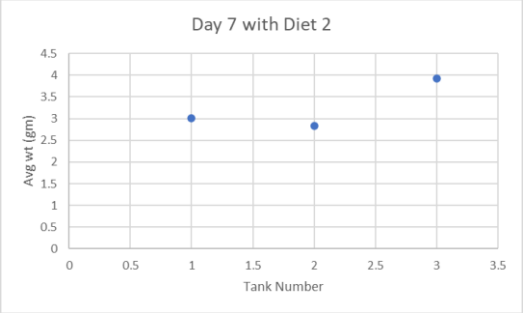

Day 14 with Commercial Diet
Avg wt (gm)
Tank Number

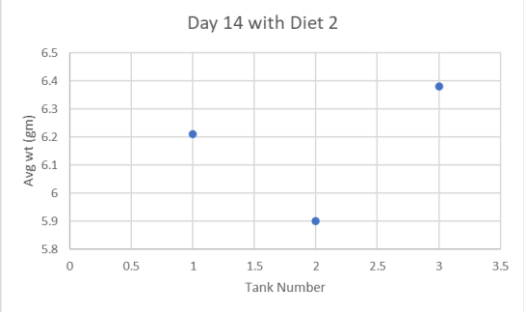

Day 7 with Diet 1a
Avg wt (gm)
Tank Number


Day 14 with Diet 1a
Avg wt (gm)
Tank Number


Day 7 with Diet 1b
Avg wt (gm)
Tank Number


Day 14 with Diet 1b
Avg wt (gm)
Tank Number


Day 7 with Diet 2
Avg wt (gm)
Tank Number


Day 14 with Diet 2
Avg wt (gm)
Tank Number

CONCLUSION:

The feed preparation for the fingerlings was carried out successfully. The feeding experiment conducted showed a good growth rate of fish with commercial feed compared to the experimental feed. The aquaponics was set up using easily available materials.

LEARNING OUTCOME:

During the period internship, we learn the following things

1. Feed preparation and assessment of the ingredients.
2. Maintenance of the tanks and fish.
3. Estimation of the fish weight and length.
4. Setting up of an aquaponics.