DIY NUTRIENT FILM TECHNIQUE (NFT) AQUAPONIC SYSTEM

Nur Aziemah Jasni[1], Rozlianah Fitri Said[1], Jasmira Jabridin[1], Forney Felix Marcus[1] & Mohammad Haiqal Hassan[1]

[1]*Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA Sabah Branch, Malaysia*

Corresponding author e-mail: aziemah856@uitm.edu.my

ABSTRACT

Malaysia's total population in the year 2021 was 33.45 million, and the need for food production is elevated to feed the nation's mouth. However, Malaysia is currently faced with land scarcity for the agricultural sector and food insecurity. Malaysian agriculture sector competes with other sectors for land, such as industrialization and housing projects. This situation might affect food production for human consumption and contribute to an undernourished issue. Malaysia's land scarcity issues lead to low food production, creating food insecurity and undernourishment. In addition, the COVID-19 pandemic left a tremendous impact on the lower-income group, especially in their food bills. Therefore, aquaponics' soil-less culture technology is a right-thinking way to mitigate listed issues. Plants and fish grow together in one system without soil and less water, limited use of space, source of side income, and produce fresh food from the farm to your table. This study focuses on soil-less agriculture, which is the aquaponic system. This project aims to set up a DIY NFT Aquaponic system and identify the growth of fish and vegetables in different aquaponic treatments. The project was conducted at Unit Ladang, UiTM Sabah Branch, from 10 December 2021 until 28 January 2022. This project uses Tilapia fish and mustard to complete one unit of an aquaponic system. The results show treatments 2 and 3 have decent plant growth and fish development compared to treatment 1. In conclusion, aquaponics can alleviate land scarcity, food insecurity and poverty as it can produce fresh food plus generate income.

Keywords: land, scarcity, food, insecurity, aquaponic.

1. INTRODUCTION

The total world population in the year 2021 was 7,874,965,732 [1] and expected to reach over 9 billion by 2050. Malaysia's total population in the year 2021 was 33.45 million, and the need for food production is elevated to feed the nation's mouth. However, Malaysia is currently faced with land scarcity for the agricultural sector and food insecurity. With the advent of civilization, open field/soil

Based agriculture faces some major challenges; most importantly decreasing per capita land availability and threatening the food production under conventional soil-based agriculture [2]. Thus, the Malaysian agriculture sector competes with other sectors for land, such as industrialization and housing projects. This situation might affect food production for human consumption and contribute to an undernourished issue. According to [3], hunger is rising, with almost 770 million people undernourished in 2020, close to 160 million more than 2014, and 118 million more than 2019. The undernourished issue has increased rapidly in 2019 and 2020 due to COVID-19 pandemic. Hence, modern farming can mitigate agricultural land scarcity and food insecurity issues. Modern farming uses modern technologies, techniques, and science to increase farm production. There are four categories of modern farming: soil-less agriculture, hi-tech mechanization in agriculture, precision agriculture, and Big Data application.

Malaysia's land scarcity issues lead to low food production, creating food insecurity and undernourishment. In addition, the COVID-19 pandemic left a tremendous impact on the lower-income group, especially in their food bills. Therefore, aquaponics' soil-less culture technology is a right thinking to mitigate listed issues. Plants and fish grow together in one system without soil and less

water, limited use of space, source of side income, and produce fresh food from the farm to your table. This study focuses on soil-less agriculture, which is the aquaponic system. The concept of aquaponics is the combination of hydroponic and aquaculture systems. It combines fish and plant farming in a land-based soil-less system. The fish and plants work together to produce efficient, profitable, and sustainable food. Aquaponic is a self-supporting food production system that combines recirculating aquaculture with plant culture without soil (hydroponics). High-volume fish production results in nutrient-rich water that can be used to provide nutrients for plant cultivation [4].

There are three primary growing methods in aquaponic: Nutrient Film Technique (NFT), Ebb and flow, and Raft or Deep Water Culture (DWC) [5]. NFT is the simplest and most straightforward technique used in hydroponics and adaptable to aquaponic. This system exposed plant roots to access water, oxygen, and nutrients. In NFT aquaponics systems, nutrient-rich water is pumped as a very thin film down small enclosed gutters [6]. Plants are placed in a small plastic cup to allow their roots to access the water and absorb the nutrients produced by fish waste. This system is also known as a recirculating system as water is circulated from the fish tank to the plant's cup and returned to the fish tank. The study aims to set up a DIY Nutrient Film Technique Aquaponic system and identify the growth of fish and vegetables in different aquaponic treatments.

2. MATERIAL AND METHOD

This project uses Tilapia fingerling fish and mustard to complete one unit of an aquaponic system. Each aquarium consists of 10 tilapia fish densities and six mustard plants. There are three types of treatment used in this project, as shown in Table 2. Fish were fed two times per day and fertilizer foliar spraying every three days. The fish weight and plant height are collected every week. The project was conducted at Unit Ladang, UiTM Sabah Branch, and the date started on 10 December 2021 until 28 January 2022.

Table 1: Aquaponic Treatment

Treatment 1	Fish without an aquaponic system
Treatment 2	Fish with an aquaponic system, no fertilizer added
Treatment 3	Fish with an aquaponic system, with fertilizer added

3. RESULTS AND DISCUSSION

Data collection for fish weight and plant height started on 20 December 2021 until 17 January 2022. The fish weight and plant height were measured and recorded every week.

3.1 Fish Weight

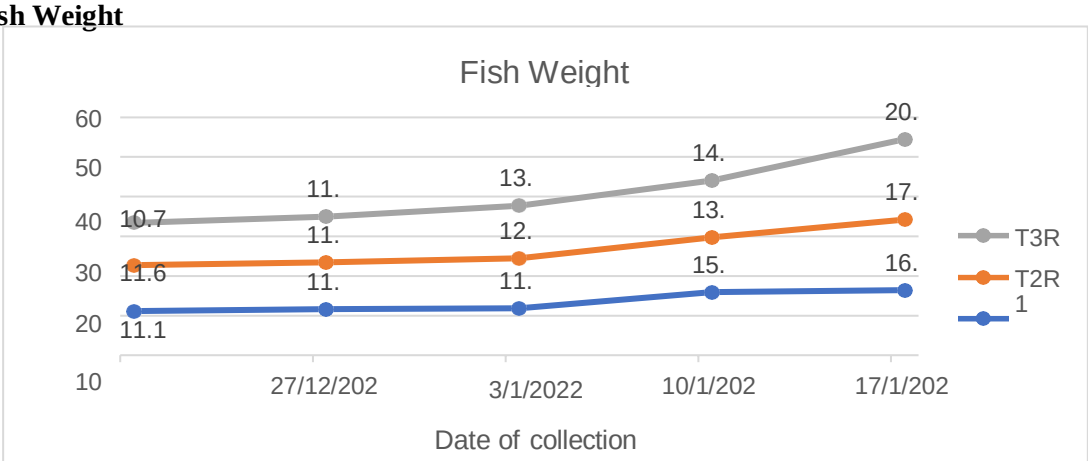

Figure 1: Fish Weight

The graph in figure 1 shows the mean fish weight. The initial mean weight fish for each treatment were 11.1g (T1R1), 11.6g (T2R1), and 10.7g (T3R1). There is gradually an increment in fish weight for each treatment. However, T3R1 shows a higher mean compared to T2R1 and T1R1. The waste urea produced by fish is an additional nutrient source for plant growth. However, there is no relationship between foliar spraying toward fish growth.

3.2 Plant Height

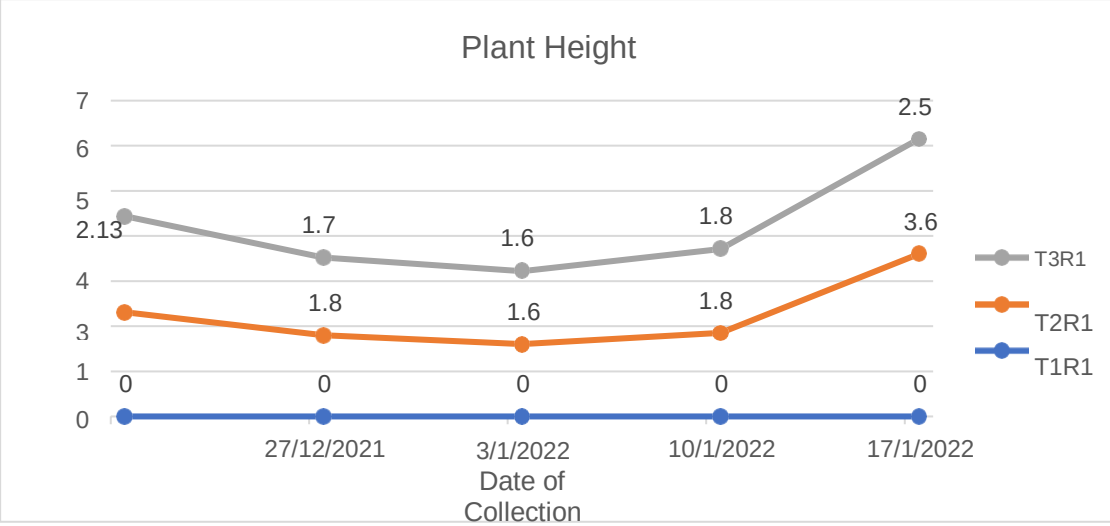

Figure 2: Plant Height

Figure 2 shows the mean plant height for 5 weeks. T1R1 is a treatment without an aquaponic system where only fish were reared in the aquarium without a plant. While T2R1 and T1R1 aquaponic systems were bred fish with a plant. Plant height mean for T3R1 is higher than T2R1 as T3R1 was sprayed with foliar fertilizer. The primary source of the nutrient for aquaponic is from fish waste urea and converted into nitrogen with the help of bacteria. In addition, nitrogen plays an essential role in forming leaf forage which is very useful in photosynthesis [8]. Moreover, T3R1 is added with additional foliar fertilizer to boost plant growth. The prominent role of nitrogen for plants is stimulating overall growth, primarily stems, branches, and leaves [7].

4. CONCLUSION

The present study was accomplished to find a feasible way to produce nutritious food without soil and chemicals. The NFT aquaponics system can have satisfactory fish weight and plant growth for home consumption. Therefore, fresh food is created from the farm to the table. Lastly, this NFT aquaponics system can generate side income for the cultivator. In conclusion, aquaponics can alleviate land scarcity, food insecurity, and poverty by producing fresh food and generating revenue.

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