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ANALYSIS OF AQUAPONIC LETTUCE AND TILEFISH WITH NUTRIENT FILM TECHNIQUE (NFT) SYSTEM AT PT. TANIKOTA

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ABSTRACT

Organic vegetables produced by aquaponic cultivation are exclusive vegetables with many benefits, so don't be surprised if they are more expensive than ordinary vegetables. PT. Tani Kota is one of the companies engaged in agribusiness with aquaponic cultivation techniques with the Nutrient Film Technique (NFT) system. PT. Tanikota has not carried out farming calculations using precise and detailed accounting technology; currently, in calculating costs and income, it is still conventional, not using the software, so it is not known whether farming is efficient. This study aimed to analyze the level of income and the break-even point (BEP) of lettuce and tilapia farming aquaponics with the Nutrient Film Technique (NFT) system. The research method used is a case study at PT. Tanikota. The analysis used in this research is the analysis of farm income and Break-Even Point (BEP). This study indicates that the income from lettuce farming is Rp. 14,958,510,81 and tilapia, which is Rp. 2,752,360.81 per one aquaponic growing season. The break-even point analysis (BEP) results showed that the BEP of lettuce production volume was 85,463 kg and tilapia was 109,230 kg. BEP sales of lettuce are Rp. 4,358,579,630 and tilapia is Rp. 5,734,620.56. This means that the production and sales pass the break-even point, which means that aquaponic lettuce and tilapia farming is profitable or feasible

Keywords: *aquaponics, nutrient film technique, income, break-even point*

BACKGROUND

Based on data from Ministry of Agriculture Republic of Indonesia (2020), the value of the Gross Domestic Product (GDP) of the horticulture sub-sector has increased every year from 2016 to 2020. Changes influence this increase in the lifestyle of the Indonesian people, who are now more concerned with health during the COVID-19 pandemic, which previously consumed non-organic vegetables to switch to organic vegetables. This causes the market demand for organic products to increase.

The increase in market demand for vegetables is not directly proportional to the production land area, which is an obstacle to vegetable productivity. Based on data from Central Bureau of Statistics (2020), the vegetable land area has decreased every year from 2017 (315,995 ha) to 2019 (282,621 ha). Aquaponic cultivation techniques are the solution for farming in increasing production and overcoming the lack of agricultural land and declining soil quality. This aquaponics uses the basic principles of the Integrated Verticulture Aquaponic City Farming (IVACF) model, which is a combination of fish cultivation (aquaculture) and hydroponics, plant growth, and fertilization in one integrated system. It can create a symbiosis between the three fields (Hadi, 2016). Organic vegetables produced by aquaponic cultivation are exclusive vegetables with many benefits, so don't be surprised if they are more expensive than ordinary vegetables (Mas'ud, 2009).

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Lettuce is one of the horticultural commodities containing phosphorus, iron, fiber, vitamin A, minerals, and many other ingredients that are good for the health of the human body and increasing public awareness of health and nutritional needs; this results in high demand for lettuce (Evelyn et al., 2018). Aquaponic lettuce cultivation is carried out because lettuce plants have commercial value and bright prospects and agricultural products that people need daily in various food menus.
Lettuce farming with aquaponics cultivation techniques is one of the farming activities carried out by PT. Tanikota. PT. Tanikota is the first company to produce and is one of the pioneers in developing aquaponic vegetables in Bandung. PT. Tanikota, in aquaponic farming activities, applies the Nutrient Film Technique (NFT) system. SuperiorityNutrient Film Technique (NFT) systems are reliable for large-scale crop production. They do not require special maintenance because water and plant nutrients do not circulate but utilize a recirculation system (Herdhiyanto, 2018).

PT. Tanikota in the practice of aquaponic lettuce cultivation using the Nutrient Film Technique (NFT) system using tilapia as aquaponic system cultivation. PT. Tanikota chose tilapia because it is easy to maintain, stronger and famous in the market (Siantara et al., 2017). This is reinforced according to Nawawi et al., (2018), Tilapia is a type of freshwater fish that is very popular in aquaponic system cultivation and has superior characteristics in aquaculture, namely easy to breed, eats all feed, fast growth, can reach harvest size quickly, and high tolerance to various environmental conditions. The production of lettuce and aquaponic tilapia with the Nutrient Film Technique (NFT) system was carried out in a 200m2 greenhouse with 2,457 planting holes.

Lettuce and tilapia farming at PT. Tanikota has not done farming calculations using precise and detailed accounting technology; currently, they do not use the software in the conventional analysis of costs and income. It is not known whether farming is efficient or not. Another reason is that the products produced by this aquaponic cultivation technique have a distinctive taste and are very healthy, and the cost of conducting aquaponics is relatively high. Based on the description above, it is necessary to analyze the costs incurred and how much income has been achieved in the aquaponic lettuce and tilapia farming with the Nutrient Film Technique (NFT) system. Point (BEP) on lettuce and aquaponic tilapia farming with Nutrient Film Technique (NFT) method at PT. Tanikota

RESEARCH METHODS

The research was conducted in July – August 2021 at PT. Tanikota is located on Jalan Cisiitu Indah VI no 1A, Dago, Coblong District, Bandung City, West Java.The location selection was made purposively. According to Tongco (2007), purposive sampling is a tool for selecting an assessment sample or expert by considering the quality possessed by the basic methodology.

The research method used is the case study method. According to Baxter & Jack (2015), a case study is a scientific approach that facilitates the exploration of phenomena in their context by using various data sources. This research was conducted in one aquaponic growing season, six months, with three harvests of lettuce and one harvest of tilapia.

The data analysis technique used to determine the aquaponic lettuce and tilapia farming can be obtained by the formula (Soekartawi, 1995). The total cost is fixed, and variable costs are incurred for farming lettuce and aquaponic tilapia at PT. Tanikota. Below is the actual cost formula:

$$TC = FC + VC$$

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The revenue is the amount of money generated by multiplying the aquaponic lettuce production with the selling price of lettuce and aquaponic tilapia received by PT. Tanikota. Below is the formula for total revenue:

$$TR = Q_y \, . \, P_y$$

Income is the amount of money generated from the total revenue minus the entire aquaponic lettuce and tilapia farming costs. Below is the income formula:

$$\pi = TR - TC$$

Revenue Cost Ratio (R/C) analysis is an analysis that compares the total revenue received by PT. Tanikota with the total production costs of lettuce and aquaponic tilapia production issued by PT. Tanikota. Below is the R/C formula:

$$R/C = \frac{TR}{TC}$$

Break-Even Point (BEP) analysis according to Cashmere (2010), namely an analysis used in financing issues at PT. Tanikota, which produces what is the minimum amount of production and minimum sales so that PT. Tanikota neither gains nor losses in aquaponic lettuce and tilapia farming. Below are the BEP volume and BEP sales:

$$\text{BEP Volume (Kg)} = \frac{FC}{(P_y - VC)}$$

$$\text{BEP Sales (Rp/kg)} = \frac{FC}{(1 - \left(\frac{VC}{P_y}\right))}$$

Information:

Q : Total Production (Kg)
Py : Sales Price (Rp)
FC : Fixed Cost (Rp/Unit)
VC : Variable Costs (Rp/Unit)
π : Farming income (Rp)
TR : Total Revenue (Rp/Kg)
TC : Total Cost (Rp/unit)
R/C : Cost Profit Ratio
BEP Volume : Break-even point volume or minimum production quantity (Kg)
BEP Sales : Break-even point of minimum sales value (Rp/Kg)

Revenue Cost Ratio (R/C) analysis aims to determine the level of efficiency of the farm. In contrast, the Break-Even Point (BEP) analysis determines the minimum product and sales so that the farm does not profit or lose (break-even point).

RESULT AND DISCUSSION

General Description of Aquaponic Farming PT. Tanikota

Tanikota is a company engaged in organic farming. This company was founded in 2016 by the company's owner, namely Mr. Danny Lukita. PT. Tanikota is located on Jalan Cisitu Indah VI no 1A, Dago, Coblong District, Bandung City, West Java. The company has an average air temperature of 18-32°C and an average humidity level of 64-83%. Cultivation of plants is very influential on

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climatic and weather factors. PT Tanikota chose vegetable crops such as kale, pakcoy, spinach, caisim, pagoda, and lettuce.

Aquaponic Lettuce and Tilapia Cultivation Facilities and Infrastructure

Production facilities for aquaponic lettuce and tilapia cultivation consist of planting greenhouse, seeding greenhouse, carrying sprayer, hand sprayer, nursery tray, pump, scissors, cluster, marker, ruler, Ph meter, and fishing net. The greenhouse is the most important means of production in aquaponic lettuce and tilapia cultivation. The aquaponic lettuce and tilapia production was conducted in a 200 m^2 greenhouse with 2,457 planting holes. The planting hole is divided into two, namely, one baby gutter and six adult gutters. Baby gutters have 351 spots, and adult gutters have 2,106 holes.

Aquaponic Lettuce and Tilapia Cultivation Process

The production process of lettuce and aquaponic tilapia at PT. Tanikota uses the Nutrient Film Technique (NFT) system. The nutrients in this system will flow through gutters where the plant roots are submerged in a nutrient solution to absorb the nutrients needed by plants—the nutrients used by PT. Tanikota is nitrates produced through the RAS (Recirculating Aquaculture System) system. The aquaponic lettuce cultivation process using the Nutrient Film Technique (NFT) system includes the nursery, planting, transplanting, maintenance, and harvesting operations.

Aquaponic Lettuce and Tilapia Cultivation Marketing

Marketing of lettuce and aquaponic tilapia using the Nutrient Film Technique (NFT) system at PT. Tanikota is distributed directly to end consumers and business partners, namely healthy food companies in Bandung. The selling price of aquaponic lettuce for the final consumer is Rp. 12,000/200 gr or equivalent to the price of Rp. 60,000/kg, while the selling price of salad mix for final consumers is set at Rp. 15,000/250 gr or equivalent to the price of Rp. 60,000/kg. The selling price of aquaponic lettuce for business partners is set at Rp. 8,400/200gr or equivalent to the price of Rp. 42,000/kg, while the selling price of salad mix for business partners is set at Rp. 10,500/250gr or equivalent to the price of Rp. 42,000/kg. The selling price of aquaponic tilapia for both end consumers and business partners is 50,000/kg. In comparison, the selling price of aquaponic tilapia fillets for end consumers and business partners is 55,000/kg.

Aquaponic Lettuce and Tilapia Income Analysis

Income analysis consists of cost analysis, revenue analysis, and revenue cost ratio (R/C) analysis. In this study, the calculation of lettuce and aquaponic tilapia farming was carried out for one aquaponic growing season, from seedling to lettuce harvest, and aquaponic tilapia from nursery to harvest. The detailed explanation of each sub-chapter is described as follows:

Aquaponic Lettuce and Tilapia Farming Costs

The cost of farming lettuce and aquaponic tilapia is divided into fixed and variable costs. Fixed costs are not affected by production results, such as depreciation costs for greenhouses and agricultural equipment, land rent, taxes, and electricity. The total fixed cost of this farm is Rp. 5,875,528.38. Variable costs are costs influenced by production results, such as the cost of purchasing lettuce seeds, rockwool, natural pesticides, fish seeds, fish food, production facilities, labor, and others. The total variable cost in this farm is Rp. 15,892,875, with the proportion of variable costs for

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lettuce farming of Rp. 10,771,875 and tilapia for Rp. 5,121,000. The total cost is obtained from the sum of fixed and variable costs so that the total cost for aquaponic lettuce and tilapia farming is Rp. 21,768,403.38 for one season.

Aquaponic Lettuce and Tilapia Farming Revenue

Sources of farm revenue at PT. Tanikota comes from sales to end consumers and business partners with healthy food companies in Bandung. The following total acceptance of lettuce and tilapia can be seen in Table 1.

Table 1. Revenue Analysis of Aquaponic Lettuce and Tilapia Farming

Information	Value
Lettuce	
Yield (Kg)	647.925
Total Revenue (Rp)	39,479,275
Tilapia	
Yield (Kg)	200
Total Revenue (Rp)	10,811,125

The total acceptance of lettuce is Rp. 28,668,150 and tilapia which is Rp. 10,811.125, so that the total revenue of lettuce and aquaponic tilapia is Rp. 39,479,275. The total production of lettuce is 647.925 kg, and tilapia is 200 kg in one aquaponic growing season.

Aquaponic Lettuce and Tilapia Farming Income

The analysis of lettuce and aquaponic tilapia income was obtained from the difference between total revenue and total production costs in one aquaponic growing season. Large farm income can be obtained from the large amount of revenue obtained by the company or the small costs incurred by the company. Calculation of the income of aquaponic lettuce and tilapia farming can be seen in Table 2.

Table 2. Analysis of Aquaponic Lettuce and Tilapia Farming Income

Information	Value (Rp)
Lettuce	
a. Total Revenue	28,668,150
b. Total Cost	13,709,639.19
Lettuce Income	**14,958,510.81**
Tilapia	
a. Total Revenue	10,811,125
b. Total Cost	8,058,764.19
Tilapia Income	**2,752,360.81**

The total income of aquaponic lettuce farming is Rp. 14,958,510.81 in one aquaponic growing season, with the proportion of total lettuce revenue of Rp. 28,668,150 and a total cost of Rp. 13,709,639.19. The total income of aquaponic tilapia farming is Rp. 2,752,360.81 in one aquaponic growing season, with a total proportion of tilapia revenue of Rp. 10,881,125 and a total cost of Rp. 8,058,764.19. Thus, the income of aquaponic lettuce and tilapia farming in one aquaponic growing season is Rp. 17,710,871.62.

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Analysis of Revenue Cost Ratio (R/C) Aquaponic Lettuce and Tilapia Farming

Revenue Cost Ratio (R/C) analysis is a comparison between the revenue earned and the total costs incurred for the business which aims to determine how efficient the farming is. Farming is said to be efficient and profitable if the R/C value > 1, whereas if the R/C value < 1 it can be said that farming is inefficient. Thus, if the value of the revenue cost ratio (R/C) is greater, it means that the farm is very efficient and profitable. The calculation of the Revenue Cost Ratio (R/C) for aquaponic lettuce and tilapia farming can be seen in Table 3.

Table 3. Analysis of Revenue Cost Ratio (R/C) Aquaponic Lettuce and Tilapia Farming

Information	Value (Rp)
Lettuce	
a. Total Revenue	28,668,150
b. Total Cost	13,709,639.19
Revenue Cost Ratio (R/C)	**2.09**
Tilapia	
a. Total Revenue	10,811.125
b. Total Cost	8058,764.19
Revenue Cost Ratio (R/C)	**1.34**

The Revenue Cost Ratio (R/C) value for aquaponic lettuce farming using the Nutrient Film Technique (NFT) system is 2.09 in one aquaponic growing season. The value of Revenue Cost Ratio (R/C) indicates that each cost incurred in one unit of rupiah will receive an income of Rp. 2.09 and an income of Rp. 1.09 earned by the company. The results of the Revenue Cost Ratio (R/C) analysis of lettuce and aquaponic tilapia can be concluded that the farming activities of lettuce and aquaponic tilapia are very efficient and profitable to cultivate because the Revenue Cost Ratio (R/C) value shows more than one, with a value of 2.09.

The Revenue Cost Ratio (R/C) value of aquaponic tilapia farming using the Nutrient Film Technique (NFT) system is 1.34 in one aquaponic growing season. The value of Revenue Cost Ratio (R/C) indicates that each cost incurred in one unit of rupiah will receive an income of Rp. 1.34 and an income of Rp. 0.34 obtained by the company. The results of the Revenue Cost Ratio (R/C) analysis of lettuce and aquaponic tilapia can be concluded that the farming activities of lettuce and aquaponic tilapia are very efficient and profitable to cultivate because the Revenue Cost Ratio (R/C) value shows more than one, with a value of 1.34.

Break Even Point (BEP) Analysis of Lettuce and Aquaponic Tilapia Farming

Break Even Point (BEP) analysis is an analysis where the company is not making a profit and is not experiencing a loss, which is known as the break-even point. The company is said to be feasible, if it is above the break-even point, if on the contrary the break-even point is below the company is said to be unfeasible. Break Even Point (BEP) analysis is divided into two, namely BEP volume and BEP sales.

The BEP value of lettuce farming volume was 85.463 kg and tilapia was 109.230 kg. This means that if the company can sell lettuce and tilapia at that amount, the farm is at the break-even point or not making a profit and not losing. In this study, lettuce farming was sold for 647.925 kg and tilapia for 200 kg, so that farming is above the break-even point which means that farming is profitable to run.

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The value of BEP sales of lettuce farming is Rp. 4,358,579.630 and tilapia is Rp. 5,734,620.56. This means that if the company gets the sales value of lettuce and tilapia at that amount, the farm is at the break-even point or is not making a profit and not losing. In this study, the sales value of lettuce farming was Rp. 28,668,150 and tilapia for Rp. 10,811,125, so that farming is above the break-even point, which means that farming is profitable to run.

CONCLUSION AND SUGGESTION

Based on the results of the analysis and discussion, the conclusions of this study are:

1. The income of aquaponic lettuce farming with Nutrient Film Technique (NFT) system at PT. Tanikota is Rp. 14,958,510.81 while tilapia is Rp. 2,752,360.81 in one aquaponic growing season (six months). The total revenue earned by PT. Tanikota of lettuce and tilapia in one aquaponic growing season is Rp. 17,710,871.62.
2. The results of the analysis of Break Even Point (BEP) production volume of aquaponic lettuce farming at PT. Tanikota is 85.463 kg and the value of BEP sales is Rp. 4,358,579.630. The results of BEP analysis of aquaponic tilapia production volume at PT. Tanikota is 109.230 kg and the value of BEP sales is Rp. 5,734,620.56.

Based on the conclusions that have been described, there are several suggestions related to research, namely as follows:

1. To meet the increasing consumer demand and increase the income of aquaponic lettuce and tilapia farming, it is recommended that PT. Tanikota add or expand a new aquaponic cultivation area with the Nutrient Film Technique (NFT) system so that it can increase production and company income.
2. In order for farm expenses and income to be well and systematically arranged, it is necessary to calculate the farm in a proper accounting manner using software, and others.

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