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Mathematical Model of Nutrient Use in Biofloc System Vaname Shrimp to Maximize Farming Profits

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ABSTRACT

Aquaculture is one of the alternative activities in increasing fisheries production. Shrimp is the commodity with the highest number of exports, which is 239.28 million kilograms. The key to the growth of cultured biota is by feeding nutrients in order to increase company profits. The purpose of this research is to determine whether nutritional formulas may reduce feed costs for cultivation and are able to accelerate the growth of biota to be cultivated and determine the results of profit comparisons between cultivation using nutritional formulas and not using nutritional formulas. This research applies descriptive approach method by means of observation and interviews and business feasibility analysis including income, TR (Total Revenue), BEP (Break Event Point), PBP (Payback Period) and FRR (Financial Rate of Return). The results of this research indicated that the provision of nutrients in biofloc system vaname shrimp farming can maximize the benefits of cultivation, BEP and PBP are also much faster and FRR > Bank interest rates.

Keywords: *Aquaculture, Biofloc System, Mathematical Model, Nutrition, Vaname Shrimp*

INTRODUCTION

Aquaculture is one of the alternative activities in increasing fisheries production (Hikmayani et al., 2012; Karuppasamy et al., 2013). The requirements for the implementation of cultivation activities are the existence of cultivated organisms, living media for organisms, and containers or places of cultivation. Aquaculture is an activity that is familiar to the community, because this cultivation has a high level of profit and a high percentage of success. According to the Indonesian Ministry of Marine Affairs and Fisheries (www.kkp.go.id, accessed on April 20, 2023), Indonesia is the 3rd highest country exporting fisheries in the world with a capacity of 1.26 billion kilograms. Shrimp is the commodity with the highest number of exports at 239.28 million kilograms. The key to the growth of cultivated biota is by feeding that is able to meet the nutritional needs of the biota to be cultivated.

Table 1. Profit and Cost of Vaname Shrimp Farming

Budidaya	Stock	Breed Yield	Feed	Feed Yield	Supplies	Yield	Selling Price	Total	Sales Results	Net Profit
Vaname Shrimp	80.000	50	2 ton	Rp.16.000	Rp.5.000.000	1,3 ton	Rp.60.000	Rp.410.000.000	Rp.72.000.000	Rp.31.000.000
Milkfish	500	1.000	50 kg	Rp.11.000	-	150 kg	Rp.15.000	Rp.1.050.000	Rp.2.250.000	Rp.1.200.000
Tilapia	3.000	800	750 kg	Rp.13.000	Rp.2.500.000	750 kg	Rp.25.000	Rp.15.450.000	Rp.18.750.000	Rp.3.300.000
Catfish	10.000	400	1,5 ton	Rp.11.000	Rp.2.000.000	1,5 ton	Rp.20.000	Rp.22.000.000	Rp.30.000.000	Rp.8.000.000

Source: Processed Data by Researchers

From Table 1, it can be seen from some of the cultivation that has been done, it can be seen that the biggest cost incurred by farmers is feed and the biggest profit from cultivation is vaname shrimp cultivation. Cultivators must take into account the costs that will be incurred with the benefits that will be obtained from the cultivation, if the cultivator does not streamline the feed to be used then the level of profit that will be obtained will not be maximized. The use of plant and animal nutrients is a way to reduce costs incurred. In a mathematical calculation of feed that uses nutrients costs Rp.18,200,000, while feed that does not use nutrients costs Rp.26,704,000, so it is more efficient with nutrients of Rp.8,504,000 or Rp.3,000 / kg and also accelerates the growth of vaname shrimp and the safety of shrimp reaching SR (percentage of life) 90% until harvest time.

This formula needs to be researched and tested because, if the cost of feed used by farmers is very high, it can cause losses and not maximize profits. The reason for considering research and testing this formula is whether using this nutritional formula can help farmers to reduce feed costs and increase the growth efficiency of the biota to be cultivated.

RESEARCH METHODOLOGY

This research uses a descriptive approach method. The process in conducting this research is by means of observation and interviews. The data analysis method used is business feasibility analysis including income, TR (Total Revenue), BEP (Break Event Point), PBP (Payback Period) and FRR (Financial Rate of Return). The formulas used are:

1. Revenue

$$\pi = TC - TR$$

Notes:

π = Total revenue/profit
TC = Total Cost
TR = Total Revenue

2. BEP

There are two BEP calculations, namely unit and rupiah BEP. The unit BEP formula is as follows:

$$\text{Breakeven} = \frac{Fixed\ Cost}{`Selling\ Price\ per\ Unit - Variable\ Cost\ per\ Unit}$$

The BEP rupiah is as follows:

$$\text{Breakeven} = \frac{Fixed\ Cost}{1 - \frac{Variable\ Cost\ per\ Unit}{Selling\ price\ per\ Unit}}$$

3. PBP

$$\text{PBP} = \frac{Investment\ value}{Net\ Cash\ Inflow}\ x\ 1\ year$$

4. FRR

$$\text{FRR} = \frac{\pi}{TI}\ x\ 100\ \%$$

Description:
π : Profit (Harvest/Rp)
TI : Total Investment (Harvest/Rp)

This analysis will use decision criteria, namely:

1. If the FRR value> Bank interest rate then, investment in this cultivation business is much better
2. If the FRR value < Bank interest rate then, investment in this cultivation business should not be done.

The bank interest rate used is based on the value from Bank Indonesia as of May 2023 where, the bank interest rate in May 2023 was 5.00% (www.bi.go.id., accessed on May 27, 2023).

RESULT AND DISCUSSION

In this study analyzed using 2 cycles and the difference in shrimp farming with nutritional feed and not. This study will find capital and production costs, income, and analysis of the feasibility of vaname shrimp farming.

Capital and Production Costs

Shrimp farming is a field of business that is in great demand by farmers throughout Indonesia, there are also preparations that must be prepared for vaname shrimp farming, or it can be called the capital that must be spent on making ponds and purchasing the necessary machinery in shrimp farming in the first cycle. While production costs are related to the total cost of making the product both direct costs, indirect costs and profits (Murnawan, H., 2016).

For the amount of capital spent can be seen in Table 2.

Table 2. Vaname Shrimp Farming Capital

Pool Equipment	Item Price
2 units of Super Charge	30.000.000
Genset	48.000.000
2 Units D-15m and 1 Unit D-6m	100.000.000
Water content measuring instrument	10.000.000
120 units diffuser	9.600.000
4-unit wheel	12.000.000
Drill Well 2 units	20.000.000
Sipon Machine	5.000.000
Scales	1.000.000
Pipe for Super Charge	8.000.000
Well Pump 3 Units	5.000.000
Total Initial Capital	285.000.000
Venue Rental Fee	20.000.000/year

Source: Processed Data by Researchers

With the initial capital that has been described, vaname shrimp farming research from cycle 1 to 2, nutritious and non-nutritious get different yields and production costs of feed use. For production costs and yields generated from 2 cycles both nutritious and non-nutritious can be seen in Table 3.

Table 3. Comparison of Yields and Production Costs

Cycle	With Nutrition		Without Nutrition	
	Harvest Yield	Production Cost	Harvest Yield	Production Cost
1	1.381 kg	Rp.36.800.000	1.152 kg	Rp.44.100.000
2	1.097 kg	Rp.37.927.000	930 kg	Rp.42.298.000

Source: Processed Data by Researchers

From Table 3 it can be seen that the results of research conducted in vaname shrimp farming there is a difference in harvest income and production costs with a difference in yield of 229 kg and production costs of 7,300,000.

Revenue

Revenue is a source of income for a person to meet daily needs and is very important for the survival and livelihood of a person directly or indirectly (Suroto, 2000). To see a comparison of the results of vaname shrimp farming income can be seen in Table 4.

Table 4. Revenue Comparison Results

Cycle	Revenue (With Nutrition)	Revenue (Without Nutrition)
1	Rp.52.367.000	Rp.26.218.000
2	Rp.27.067.000	Rp.9.162.000

Source: Processed Data by Researchers

From Table 4 it can be seen that the benefits obtained from shrimp farming using nutrition and not using nutrition have a difference, when comparing the income of shrimp farming using nutrition with shrimp farming not using nutrition, the income obtained is greater, namely vaname shrimp farming using nutrition with cycle 1 acceleration of 52,367,000 while for vaname shrimp farming that does not use nutrition of 26,218,000. Cycle 2 there is a decrease in income in shrimp farming using nutrients amounting to 27,067,000 while not using nutrients amounting to 9,162,000.

Break Event Point (BEP)

Break Event Point determines the maximum profit when producing the specified amount with the production capacity owned, so that farmers will later know the minimum limit sold and the maximum profit obtained when using nutrients in full (Nugroho & Mas'ud, 2021). To find out the results of BEP in vaname shrimp farming can be seen in Table 5.

Table 5. BEP Results of Vaname Shrimp Farming Without Nutrition and With Nutrition

Cycle	BEP (With Nutrition)		BEP (Without Nutrition)	
	Unit	Rupiah	Unit	Rupiah
1	541 kg	Rp.36.191.625	681 kg	Rp. 43.588.969
2	579 kg	Rp. 36.366.859	706 kg	Rp. 41.633.943

Source: Processed Data by Researchers

From Table 5, it can be seen that BEP units and rupiah in vaname shrimp farming using nutrition is much faster than without nutrition where, has a difference of 140 kg units in cycle 1 and 127 units in cycle 2, then Rp.7,397,344 in cycle 1 and Rp.5,267,084 in cycle 2.

Pay Back Period (PBP)

PBP (Payback Period) is an analysis of the payback period of the capital that has been spent. If the payback period (PP) has a shorter period than the maximum payback period, the proposed amount of capital is acceptable (Suryana, 2009). In this study, PBP mathematical calculations will be carried out using 3 schemes. To find out the scheme used, it can be seen in Table 6.

Table 6. PBP Calculation Scheme

Scheme	Percentage	Farmers	Return of Capital
1	50% : 50%	50%	50%
2	70% : 30%	70%	30%
3	75% : 25%	75%	25%

Source: Processed Data by Researchers

From Table 6, it can be seen that there are 3 schemes used by the author to distribute profits to farmers and return the capital that has been used in vaname shrimp farming. So that it will produce PBP values in 3 schemes that can be seen in Table 7.

Table 7. PBP Results of Vaname Shrimp Farming

	Scheme	Constant revenue of 2 ponds for 2 cycles/6 months	Income for farmers	Income for return of capital	PBP
With Nutrition	**Scheme 1 50% : 50%**	Rp.149.946.000	Rp.74.973.000	Rp.74.973.000	1 year 11 months
	Scheme 2 70% : 30%	Rp.149.946.000	Rp.104.962.200	Rp.44.983.800	3 years 9 months
	Scheme 3 75% : 25%	Rp.149.946.000	Rp.112.453.500	Rp.37.486.500	3 years 10 months
Without Nutrition	**Scheme 1 50% : 50%**	Rp.63.610.000	Rp.31.805.000	Rp.31.805.000	4 years 6 months
	Scheme 2 70% : 30%	Rp.63.610.000	Rp.44.527.000	Rp.19.083.000	7 years 6 months
	Scheme 3 75% : 25%	Rp.63.610.000	Rp.47.707.500	Rp.15.902.500	9 years

Source: Processed Data by Researchers

From Table 7 it can be seen that the payback period required to return capital in vaname shrimp farming using nutrients and without using nutrients. The fastest scheme for the return of capital in the cultivation of vaname shrimp is the first scheme with a percentage of 50%: 50% with the time needed to return the capital of nutritious vaname shrimp farming for 1 year 11 months while for non-nutritious shrimp farming for 4 years 6 months. Thus, the use of nutrients in vaname shrimp farming has a PBP that is quite fast compared to no nutrition.

Financial Rate of Return (FRR)

Financial Rate of Return is an analysis to determine the percentage of profit comparison with the total investment that has been planted (Rahayu & Farid, 2018). This analysis will use decision criteria, namely:

1. If the FRR value > Bank interest rate, investment in this cultivation business is much better
2. If the FRR value < Bank interest rate, investment in this cultivation business should not be done.

The bank interest rate used is based on the value of Bank Indonesia as of May 2023 where, the bank interest rate in May 2023 is 5.00% (www.bi.go.id., accessed on May 27, 2023). To find out the results of FRR on vaname shrimp farming can be seen in Table 8.

Table 8. FRR Results of Vaname Shrimp Farming Without Nutrients and With Nutrients

Cultivation Pond	Scheme	Advantages for Farmers (Rp)	Investment (Rp)	FRR (%)
With Nutrition	50%:50%	74.973.000	285.000.000	26,30%
	70%:30%	104.962.200	285.000.000	36,82%
	75%:25%	112.453.500	285.000.000	39,45%
Without Nutrition	50%:50%	31.805.000	285.000.000	11,15%
	70%:30%	44.527.000	285.000.000	15,62%
	75%:25%	47.707.500	285.000.000	16,73%

Source: Processed Data by Researchers

From Table 8, it can be seen that both with nutrition and without nutrition have FRR values that are much greater than the bank interest rate. However, it can also be seen that the percentage value of FRR on the use of nutrients is much greater than not with nutrients. So, it can be concluded that for investment in shrimp farming with nutrition is much better done.

CONCLUSION

Based on the research that has been done, it can be seen that cultivation with the use of nutrients in vaname shrimp feed is very profitable. Based on mathematical calculations both from income to business feasibility analysis can also be said to be very good. BEP results with the use of nutrients are much faster than without nutrients where, has a difference of 140 kg units in cycle 1 and 127 units in cycle 2, then Rp.7,397,344 in cycle 1 and Rp.5,267,084 in cycle 2. PBP results with the use of the fastest nutrients is the first scheme with a percentage of 50%: 50% with the time needed to return the capital of nutritious vaname shrimp farming for 1 year and 11 months while for non-nutritious shrimp farming for 4 years and 6 months. Then for FRR also has an FRR value much greater than the bank interest rate. However, it is also seen that the percentage value of FRR on the use of nutrients is much greater than not with nutrients. So, it can be concluded that for investment in shrimp farming with nutrition is much better done.

REFERENCES

Directorate General of Strengthening the Competitiveness of Marine and Fishery Products. Available at: https://kkp.go.id/djpdspkp/artikel/33334-peringkat-indonesia-sebagai- eksportir-produk-perikanan-dunia-meningkat-di-masa-pandemi. Accessed on April 20, 2023

Hikmayani, Y., M. Yulisti, Hikmah. 2012.Evaluation of Policies to Increase Fisheries Production, Aquaculture. Journal of Marine and Fisheries Socio-Economic Policy. 2(2):85- 102

Murnawan, H. (2016). Production costs, direct costs, indirect costs and profits. International Seminar and IDEC National Conference

Nugroho, A. Y., & Mas'ud, A. A. (2021). Projection of BEP, RC Ratio and R/L Ratio on Business Feasibility (Case Study on Taoge Business in Wonoagung Village Tirtoyudo Malang Regency). Journal of Cooperatives and Management, 2(1), 27-36.

Rahayu, A. & Farid, M. (2018). Analysis of Masamo Catfish (Clarias Gariepinus) Cultivation Business in Kembangbahu District, Lamongan Regency. Grouper Journal. Vol.9, No.1, Page 8

Suroto. 2000. Development Strategy and Employment Opportunity Planning. Gajah Mada University, Yogyakarta.

Suryana, 2009, entrepreneurship practical guidelines: tips and processes to success, Jakarta: salemba four, 2009 (page 190)