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A Study of The Treatment of Larvae Vannamei Shrimp (*Litopenaeus vannamei*) In Banyuwangi

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Abstract

Vannamei shrimp (*Litopenaeus vannamei*) is a brackish water commodity that is currently in great demand and is a leading producer of the aquaculture sector in Indonesia. This is because some of the advantages possessed by the vannamei shrimp, among others, can be maintained with a high stocking density, rapid growth, has a high resistance to disease and environmental changes. The mating process occurs through four stages, namely approach, pursuit, pride, and mating. This process can be known by looking at the behavior of the male parent who swims to follow the female parent. They both looked like a chase. Then the male parent swims parallel to the female and turns her body towards the female shrimp's belly. After that, the male grabs the female and releases sperm that attach to the thellycum. In the maintenance of larvae that must be considered is the management of water quality and feed management. This is because water is a living medium for aquatic organisms, so it determines the survival of larvae.
During the period of high maintenance and market, demand continues to increase where the shrimp farming process includes the hatchery stage to enlargement. Vannamei shrimp hatchery activities are inseparable from the availability of quality fry.

Keywords: Vannamei shrimp, aquatic organisms, water quality

INTRODUCTION

Indonesia is the largest archipelago in the world with an area of sea that can be managed. Indonesia has a very large diversity of marine and fishery resources and the potential for results to continue to increase. Indonesia is a Marine country that is rich in marine resources and is one of the largest exporters of Fisheries and marine products in the world. Fisheries' contribution to gross domestic income (GDP) continues to increase. In terms of production, fishery production in Indonesia continues to increase every year (Purwono et al., 2012).

Vannamei shrimp is one of the leading commodities owned by Indonesia in addition to seaweed. This type of shrimp ranks second after seaweed. In addition to the expensive price, shrimp enthusiasts are also quite high and even become a world export commodity and Indonesia ranks second after China. This type of shrimp is widely developed throughout the region of Indonesia. This is because Indonesia is a tropical country that gets sunlight all year round. The Vannamei shrimp cultivation process requires full sun or sunlight (Saputra et al., 2021). Vannamei shrimp (*Litopanaeus vannamei*) is an introduced species that is currently widespread and widely cultivated in Indonesia. White shrimp known to the public by the name of Vannamei is a shrimp native to Latin American waters that belong to the family Penaidae. This shrimp is considered to be able to replace tiger prawns which decreased production in 1992 due to natural factors in the form of environmental changes. The decline in tiger shrimp production is inversely proportional to the demands of the need for shrimp both in local and international markets as a food ingredient that continues to increase. To meet this demand, in 2001 Indonesia as one of the shrimp-producing countries began to cultivate Vannamei shrimp (Anam et al., 2016).

To achieve the target and increase production in shrimp Vannamei (*Litopanaeus vannamei*) farming there are several technologies used to make reference to the achievement of production targets so that production can increase every year. The technology that can increase the productivity of Vannamei shrimp is traditional, semi-intensive, intensive, and super-intensive. The difference between the four technologies is the use of feed, technology, and dense stocking used on land (Nasution & Yanti, 2015).

PT Ndaru Laut company is a company engaged in the field of Fry seeding, which is addressed at jalan raya situbondo km 13 Banyuwangi. The company began its construction at the end of 1986. Until 1988, with an initial production run in August 1988. Vannamei shrimp hatchery business at PT. Ndaru Laut has a very large value and opportunity to be developed optimally in the market because in Banyuwangi Regency has high water resources so it is suitable for the sustainability of the Vannamei shrimp hatchery business. Seeing the potential and opportunities of it, the author wants to know the financial analysis at PT. Ndaru Laut, Banyuwangi, East Java. Therefore, based on the background of the authors carry out research at PT. Ndaru Laut, Banyuwangi, East Java.

METHOD

Location

This research was conducted on November 1, 2022 - January 31, 2023, at PT. Ndaru Laut, Banyuwangi, East Java. The tools used in this study are water pumps, feed scales, buckets, thermometers, refractometers, pH meters, DO meters, secchi disks, digital scales, microscopes, and hemocytometers. Ingredients used Vannamei broodstock, disinfectants, lime, feed supplements, artificial feed, probiotics, and vitamins.

Sampling

Data acquisition methods used during this study include primary and secondary data. Primary Data is a type of data collected directly from its primary source such as through interviews, surveys, experiments, and so on. To obtain the primary data, the observation or observation directly in the field of Vannamei shrimp hatchery techniques (*Litopenaeus vannamei*) and Vannamei shrimp hatchery business analysis. Secondary Data is data taken through intermediaries or parties who have collected the data before, in other words, the researcher does not directly take the data itself into the field. To obtain secondary data, interviews were conducted with officers, external field supervisors, the surrounding community to obtain information on the procedures for Vannamei shrimp hatchery techniques (*Litopenaeus Vannameii*).

a. Containers Preparation

Container preparation is an activity to prepare the larva tub and all facilities and equipment before the water-filling process. Maintenance container activities take place after the completion of the harvest in the tub. The stages of preparing the maintenance container include washing the tub and equipment, preparing the aeration system, and filling the water.

Before production operations, all larva facilities and equipment (such as aeration hoses, heaters, lead weights, aeration stones, and circulation filters). Artemia tanks are washed using a detergent solution, rinsed using fresh water, and then dried. Next, the tub and equipment that have been used are cleaned with a detergent solution and rinsed using fresh water. The tub is allowed to dry and in the morning installation, an aeration hose equipped with ballast Tin on the culture tub with a distance between the aeration points is 40 cm. A circulation filter is installed on the drainage channel. The filter system can be moved up and down when water circulation is carried out (the external filter is made of perforated pipe and connected with the outlet cover pipe). Furthermore, the necessary equipment such as feed dippers, buckets, thermometers and glass beakers are provided for each maintenance tub.

The aeration bubble exits through a hose that has been equipped with an aeration stone, the initial stage is made small and even, and then gradually enlarged according to the development of the larva. Preparation of the container is the activity

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of drying and cleaning the tub from all forms of dirt that sticks using densifektan disinfectant materials that serve as an exterminator of pests or bacteria that are still attached to the walls or bottom of the maintenance tub. Organic materials such as ammonia which is still left in the previous cycle, will interfere with the life of the larvae in the future. The maintenance tub to be used must be disinfected so that it is free from disease. The way, tub is dried (dried in the sun), then the base and the walls of the tub are brushed. To be more sterile use chemical substances such as chlorine at a dose of 100 ppm, KMnO4 (potassium permanganate) 10 ppm, and formalin 50 ppm. Preparation of the container is done by watering chlorine Ca (ClO)2 500 mg L-1 and then the container is washed using detergent 10g L-1, after that rinsed with clean water, then dried for 24 hours. Installation of aeration and replenishment of seawater after the drying process (Iskandar et al., 2021).

b. Larva Rearing

Water is the main medium that plays a role in the maintenance of aquatic biota. The success of Vannamei shrimp farming is determined by the good or bad quality of the seawater used. After the tub is washed then sprayed with water that has been mixed with disinfectant (sanocare PUR) to taste. Next, the tub was given 1 ml of formalin liquid and then the tub was closed using a plastic sheeting. Before the tub is filled with water rinsed using fresh water first at the time of filling water, the maintenance tub can be filled using sterile seawater. The incoming water is filtered using a bag filter in order to avoid small particles entering the maintenance tub. Tubs that have been filled with seawater were given several treatments, namely the administration of disinfectant solution (sanocare PUR) 1 ppm and then in the afternoon given a solution of EDTA 10 ppm and administration of treflan 0.05 ppm, 3-4 hours before stocking naupli and aerated. The purpose of this treatment is to prevent disease pests at the time of larval maintenance.

c. Naupli Stocking

Stadia naupli is a vulnerable stadia because naupli are still very weak to environmental changes (more easily stressed). Stadia naupli are still going with the flow and have not been able to swim against the current. Naupli comes from PT. Delta Windu Purnama. The characteristics of naupli quality are to have active movement (phototactically positive/response to light), free of contamination (ecto/endoparasite), bright body color (not dull), and all parts of the body complete (no defects). For naupli stocked in PT. Ndaru Laut a tub 2-2.5 million naupli.

Naupli stocking is done after the process of filling seawater in the maintenance Basin has reached 15 tons. The parameters of seawater quality in the larval bath are not too different from the naupli media (pH, temperature, alkalinity, and salinity). Acclimatization is the process of adjusting the conditions of naupli media before being stocked into the cultivation tub. Acclimatization is done so that naupli can move to new media (cultivation tubs) with optimal conditions so that metabolic processes can run well and launch the molting process. Acclimatization is intended to prevent high mortality (mortality) during and after stocking (Ansori, 2015).

Before naupli arrived at the hatchery site, 500 L tanks were prepared and filled with sea water with a salinity of 30 ppt as much as 90% or about 450 L. Turn on the heater with a temperature range of 32-33ºC then clean the hose for flow throw by rinsing it with water. After naupli comes in input on the tank capacity of 50 L give aeration and adjust the water level to the limit of 40 L then drain the water on the tank 40 L using seser and ballast and then move the tank spatial acclimatization. Install the flow throw hose and let the water flow until the temperature reaches 32ºC or about 30 minutes and then put it on the maintenance tub.

Water quality measurement results show that the quality parameters of temperature, water pH, DO and salinity are still in a decent condition as shown in Table 1.

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The temperature stability of the cultivation tub is a vital parameter because it is related to the body's metabolism, and this can affect the growth rate. After stocking naupli, the temperature of the larva tub is attempted to reach 32-33ºC (if necessary assisted using a heater). Temperature stability is always maintained from stadia naupli to harvest. Acclimatization of temperature, salinity, pH, and other water quality is done to avoid the death of nauplius at the time of stocking and is carried out for 30 minutes-L to hours (Panjaitan, 2012).

Table 1. Water Quality Parameters at a time of stocking

Parameters	Range	literature
DO	>5 ppm	3 – 6 ppm (Afrianto & Muqsith, 2014)
pH	8,0 – 8,3	7 – 8,8 (Afrianto & Muqsith, 2014)
Salinity	30 ppt	(Wyban & Sweeney, 1991)
Temperature	30 – 31^{0}C	30 – 33ºC (Atikah, 2018)

d. Larva Handling

The development of Vannamei shrimp larvae includes stadia Naupli until reaching PL4, which is maintained in modules A, B, C, and D. Before and at the time of entry naupli tub maintenance is done filling sea water that has passed Ultraviolet (UV) twice and then given EDTA treatment 10 ppm 12 hours before entry naupli. When naupli entered stadia zoea 3, mysis 3, and PL1, circulation was carried out by removing 2 tons of water and adding 2 tons.

Plankton feeding is done 8-12 hours before naupli become zoea 1 in accordance with the standard. Plankton feeding the following days follow the standard program that has been set right. When the Fry has reached stadium PL4, the tub harvest will be harvested, the temperature decrease will be done the day before harvest by opening the plastic sheeting.

e. Larva Feeding

The larvae are given feed in the form of natural feed and artificial feed. The natural feed given to Vannamei shrimp larvae is algae and Artemia. The algae that are commonly given are types of Chaetoceros. Natural feed in the form of Chaetoceros entered into the maintenance tub in the morning before naupli entered as much as 2 tons or a density of 50,000 cells/mL. After naupli develop into zoea, enough plankton is available as biofeedback in the tub. The greater the stadia and shrimp growth, the higher the need for feed. The nutrient content of the feed greatly affects the survival rate of Vannamei shrimp larvae (Putri et al., 2020).

Table 2 is the standard of plankton feeding on various larval stages, but before giving plankton must first pay attention to the larval stages in the tub to be fed. And for stadia M2-PL 4, natural feeds are used, namely dead artemia and live artemia. The artificial feed given to the larvae of Vannamei shrimp consists of a variety of feed mixtures and auxiliaries that are tailored to the dense stocking and the needs of the larvae. The percentage of types and the number of feed mixtures is different at each stadia. Artificial feed is given after the larvae enter the zoea stadia because in these stadia the larvae need a lot of energy for the molting process. An artificial feed with a complete composition of nutrients is needed for the larvae. The frequency of feeding on the maintenance of Vannamei shrimp larvae is 6 times a day.

f. Water Quality Management

Water quality management is done by giving probiotics and molasses, giving EDTA, dolomite, measurement of water quality parameters, as well as water turnover as much as 5-20% of the water volume of the maintenance container, which is done from stadia mysis to stadia post larva (Iskandar et al., 2021).

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Tabel 2. Plankton Quality

Stadia	Plankton Density
Z1	50.000 sel/mL
Z2	60.000 sel/mL
Z3	70.000 sel/mL
ZM	80.000 sel/mL
M1	80.000 sel/mL
M2	*Artemia*
M3	*Artemia*
PL1 – PL 4	*Artemia*

Tabel 3. Larvae Feeding

No	Rearing Time	Feed Type
1	24.00	Artificial Feed
2	04.00	Artificial Feed
3	07.00	Artemia + probiotic
4	08.00	Artificial Feed + plankton
5	12.00	Artificial Feed
6	13.00	Artemia
7	16.00	Artificial Feed
8	18.00	Artemia
9	20.00	Artificial Feed

Analisis Data

The parameters observed during the study were survival rate and effort analysis.

1. Survival Rate

$$SR = \frac{Nt}{No} \times 100\%$$

Description:
SR : Survival Rate
N_t: Fish number day-t
N_o: Fish number day-0

2. Business Analysis

a. Break Even Point

$$\text{BEP Rupiah} = \frac{\text{Fixed cost}}{1 - \left(\frac{\text{variabel costs}}{\text{Sale}}\right)}$$

$$\text{BEP Pcs} = \frac{\text{Fixed cost}}{price/Head - \left(\frac{\text{variabel costs}}{\text{production amount}}\right)}$$

b. R/C Ratio

$$R/C\ Ratio = \frac{Reception}{\text{Total Cost of Production}}$$

c. PP

$$PP = \frac{\text{Investment costs}}{\text{Profit}} \times 1 \text{ Year}$$

d. ROI

$$ROI = \frac{\text{Net Profit}}{\text{Capital}} \times 100\%$$

Data Analysis

All research data were analyzed descriptively using Microsoft Excel 2019 program and tabulated.

RESULT AND DISCUSSION

Container

Vannamei shrimp hatchery cultivation container is used for larval rearing and natural feed culture. Larva rearing container consists of module a, module B, module C, and module D. larval rearing containers have different sizes. As shown in Table 4.

In the hatchery, the module is where the larvae of stadia naupli sample PL4 are kept. The larva tub is filled with seawater that has gone through Ultraviolet (UV). 12 hours before entering naupli water treatment with EDTA 10 ppm and Sanocare

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PUR 1 ppm, and given treflan 4 hours before entering naupli. EDTA serves to bind heavy metals in the maintenance tub, Sanocare Pur serves to sterilize newly entered water in the maintenance tub, and treflan serves to reduce pathogens in the water environment.

The natural and artificial feed given into the maintenance tub easily changes the quality of the water, so it requires good handling and water changes. Water change Program, probiotic and auxiliary materials maintenance of water quality and disease prevention materials in accordance with established standards.

Based on the above chart the results of water quality measurements larval rearing get numbers 30-33ºC the temperature is optimal for seeding shrimp Vannamei. This is in accordance with the opinion (Atikah, 2018) which states that a good temperature is 30 – 33ºC.(Fig. 1)

Based on the above larval maintenance water pH chart obtained 7.9-8.1 the figure is optimal for seeding shrimp Vannamei. This is in accordance with the opinion (Ramadhanthie et al., 2021) which states that a good pH is 7.5 – 8.5. (Fig. 2)

Based on the larval maintenance water salinity chart above shows the number 30-32 ppt this number shows the salinity that is optimal for the Vannamei shrimp hatchery, agreeing with (Sa'adah & Roziqin, 2018) the stable salinity is 29 – 32 ppt. (Fig. 3)

Based on the ammonium graph above shows the number 0.1 – 3 which means it shows the right number for the Vannamei shrimp hatchery. (Fig. 4)

Based on the results of the graph nitrite yield figures 0.1 - 3 which means it is still viable for breeding shrimp Vannamei. (Fig. 5)

Based on the alkalinity chart above produces numbers 151 – 164 checks with a period of 2 days. (Fig. 6)

Based on the data contained in the graph above, the survival rate of Vannamei shrimp fry is quite good for the survival of the Vannamei shrimp hatchery business. (Fig. 7)

Table 4. Larval Container

Units	Capacity (ton)	Total
A. 01 – 15	35	14
A. 09	70	1
B. 01 – 15	35	14
B. 09	70	1
C. 01 – 15	35	14
C. 09	70	1
D. 01 – 15	35	14
D. 09	70	1

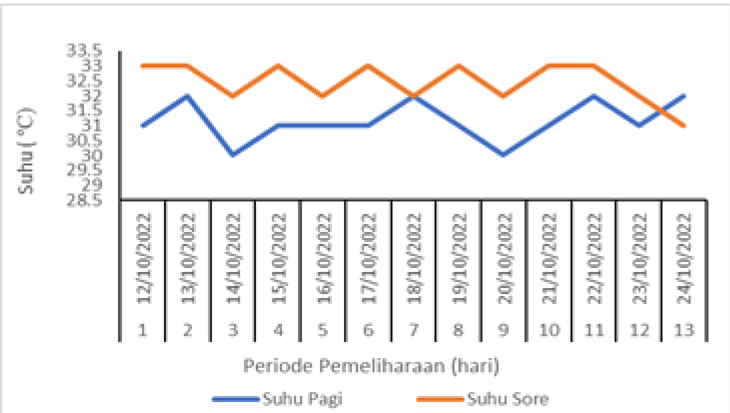

Figure 1. Maintenance Water Temperature Chart

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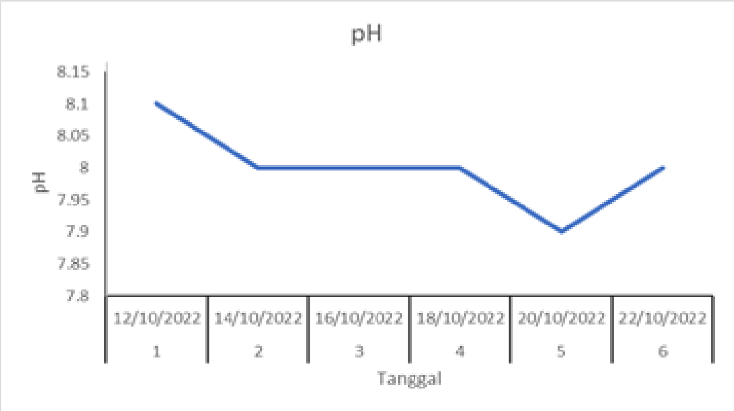

Figure 2. Graph pH Water Conservancy

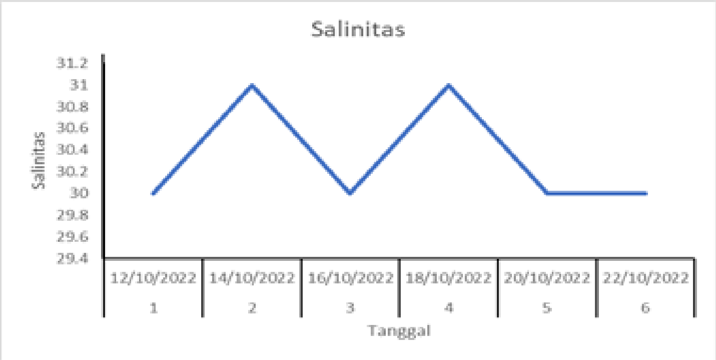

Figure 3. Salinity Water Maintenance

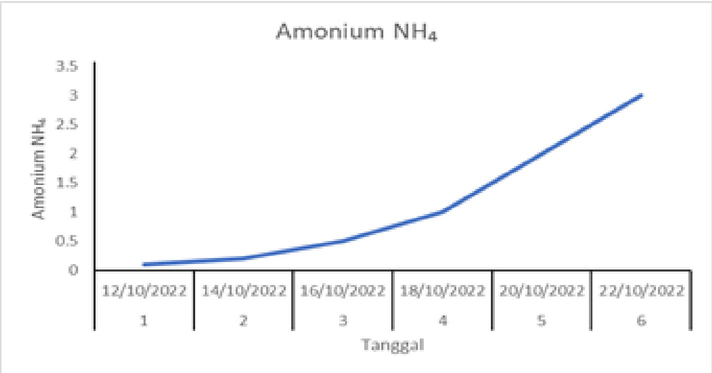

Figure 4. Ammonium nitrate

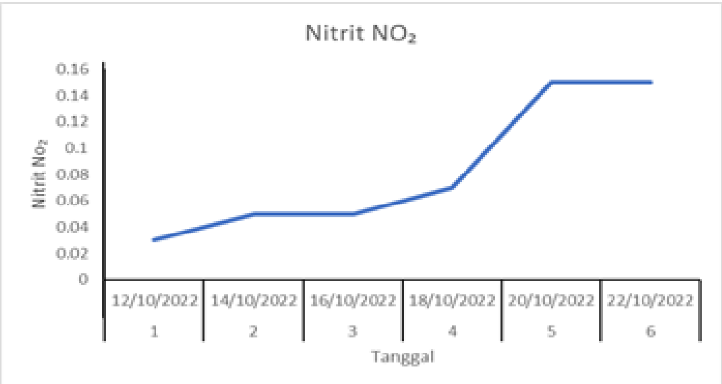

Figure 5. Graphene nitrite NO_2

Figure 6. Alkalinity Chart

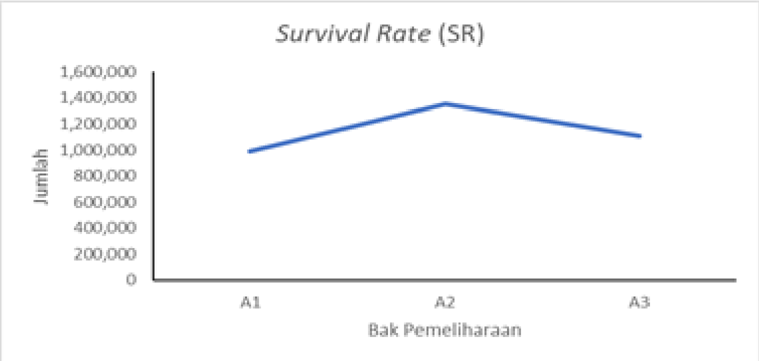

Figure 7. Graph Survival Rate (SR)

Vannamei Shrimp Hatchery Business Analysis Cost

1. Investment Costs

A large investment was spent in the Vannamei shrimp hatchery business at PT. Ndaru Laut is Rp. 3,563,800,000, with a depreciation of Rp 369,819,998. the investment cost is obtained from PT. Ndaru Laut.

2. Fixed Costs

Fixed costs are costs incurred, whether they are used or not. Vannamei shrimp hatchery business in PT. Ndaru Laut requires a fixed cost in one year is RP 1,307,819,998.

3. Variable Costs

Variable cost is a cost that is used to meet the aspects of production that will be produced. These costs will affect the size of the production capacity. Variable costs incurred in the Vannamei shrimp hatchery business at PT. Ndaru Laut is Rp 7,058,842,600 / year. The fee is used for the maintenance period of one year.

Acceptance Of Seeding Sales

PT. Ndaru Laut has 60 preservation tanks with a density of 2-2.5 million naupli per tank. Based on the results of interviews and observations in the field, stocked Fry will produce SR 50%. Each cycle filled tubs totaling 60 tubs in turn. Fry produced each cycle is a total of 1.25 million times 60 tubs equal to 75,000,000 fries. One year there are 12 cycles, with the number of Fry produced being 75,000,000 times 12 equal to 900,000,000 fries. Sales of Fry from PT. Ndaru Laut to farmers usually gives a bonus of 15%. The number of Fries sold is 765,000,000 fry. The Fry price offered is Rp 52 per head, so the receipts obtained:
Total receipts

= 765,000,000 shrimp seeds x Rp 52

= 39,780,000,000 / year

Total Seeding Costs

The Total cost of the Vannamei shrimp hatchery is the overall cost used for hatchery needs in each cycle up to one year. The total cost of seeding:
Total cost

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= 1,307,819,998 + 7,058,842,600 = 8,366,662,598 / year

Profit

The company will be said to be worth it if it gets profits and its business is sustainable.

Profit = 39,780,000,000-8,366,662,598
= 31,413,337,402 / year

Break Event Point (BEP)

Break Event Point (BEP), is an analysis parameter used to determine the limit of production value in the Vannamei shrimp hatchery business to breakeven, ie no profit or no loss. In this situation, the gain or loss is equal to zero (Wawoh et al., 2019).

Brek event point (BEP) On Vannamei shrimp seeding efforts in PT. Ndaru Laut Banyuwangi there are several aspects one of which can be seen from the price is Rp. 52.

BEP Rupiah

$$\text{BEP Rupiah} = \frac{\text{fixed cost}}{1-\left(\frac{\text{variabel cost}}{\text{Sale}}\right)} = \frac{1.307.819.998}{1-\left(\frac{7.058.842.600}{39.780.000.000}\right)}$$

$$= \frac{1.307.819.998}{1-0{,}17}$$

$$= 1.307.819.997$$

BEP result (Rp) from Vannamei shrimp hatchery at PT. Ndaru Laut is Rp 1,307,819,997 so that PT. Ndaru Laut will break even if the receipt of Rp 1,307,819,997.

a. BEP (pcs)

$$\text{BEP Tail} = \frac{\text{Fixed cost}}{Prics/Head-\left(\frac{\text{Variabel cost}}{\text{Production Amount}}\right)}$$

$$= \frac{1.307.819.998}{RP\ 52-\left(\frac{7.58.842.600}{756.000.000}\right)}$$

$$= \frac{1.307.819.998}{\text{RP } 52-9{,}33}$$

= 25.150.375 pcs

The result of BEP from Vannamei shrimp hatchery at PT. Ndaru Laut is 25,150,375 tail, so PT. Ndaru Laut will experience a breakeven point in producing a product of 25,150,375 heads.

Return Cost Ratio (R/C Ratio)

The result of BEP from Vannamei shrimp hatchery at PT. Ndaru Laut is 25,150,375 tail, so that PT. Ndaru Laut will experience a breakeven point in producing a product of 25,150,375 heads.

$$\text{R/C Ratio} = \frac{\text{Reception}}{\text{Total Cost Prodution}}$$

$$= \frac{39.780.000.000}{8.366.662.598} = 4$$

Return Cost Ratio obtained from Vannamei shrimp hatchery business in PT. Ndaru Laut is 4 in this case indicating the Vannamei shrimp hatchery business in PT. Ndaru Laut is feasible because it is in accordance with the indicator return cost ratio with a value > 1 which is considered profitable and feasible to run this business.

Payback Period (PP)

The payback period was obtained from the calculation of the Vannamei shrimp hatchery business analysis at PT. Ndaru Laut to find out in what year will return the capital. Here is the payback period of the Vannamei shrimp hatchery in PT. Ndaru Laut.

$$PP = \frac{\text{Investment Cost}}{\text{Profit}} \text{ x 1 year}$$

$$PP = \frac{3.563.800.000}{31.413.337.402} \text{ x 1 year}$$

$$= 1{,}3 \text{ year}$$

Then the investment costs incurred at the beginning of the business will return on a period of 1 Year 3 months or will return the investment costs.

Return On Investment (ROI)

$$ROI = \frac{\text{Net Profit}}{\text{Capital}} \text{ x } 100\%$$

$$= \frac{31.413.337.402}{3.563.800.000} \text{ x } 100\%$$

= 8,814%

Return On Investment on Vannamei shrimp seeding efforts in PT. Ndaru Laut is

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8.814% which means the ROI value the meaning that every Rp 100, - invested capital, will generate a profit of Rp 8,814.

CONCLUSION

Based on the results and discussion obtained in the Vannamei shrimp hatchery business at PT. Ndaru Laut as follows :
Seeding techniques start from container preparation to harvesting with yields that are always good and increase with each cycle. The growth rate of Fry is quite good so as to produce a Survival Rate (SR) of 50% and the water quality in the maintenance process is very good for the Vannamei shrimp hatchery by reaching a temperature of 33ºC, pH 7.9 - 8 and salinity 30-32 ppt.
Vannamei shrimp hatchery business in PT. Ndaru laut is a viable business to run with a profit value of Rp 31,413,337,402, R/C ratio of 4, Payback Period of 1.3, Break Even Point in the price of Rp 1,307,819,997, BEP in the tail 25,150,375 tail and Return of Investment 8,814%

SUGGESTIONS

Based on the results of observations and observations after carrying out research at PT. Ndaru Laut, Banyuwangi. Companies must improve in terms of management of aquaculture waste by adding a WWTP (Wastewater Management Installation) in order to protect the marine environment which has begun to decline in water quality by protecting the environment. So that the cultivation process can run smoothly and well.

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