

Analysis of Production Factors of *Litopenaeus vannamei* Enlargement in Ngombol District, Purworejo Regency

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Abstract

Ngombol is one of the districts which has the business potential of enlarging *Litopenaeus vannamei* with the most quantity compared to other districts in Purworejo Regency. The purpose of this study is to analyze the factors of production of *Litopenaeus vannamei* enlargement. There were 20 respondents in this study. The production factors in this study consisted of the dependent variable of *Litopenaeus vannamei* production (Y), then the independent variable amount of feed (X1), the number of stockings (X2), the area of the pond (X3), and the experience of farmers (X4). The method of data analysis uses linear regression with the Cobb-Douglas approach. The results obtained from the equation $Y = -158,334 + 0,430 X1 + (-3,167 X2) + 0,495 X3 + (-52,907 X4) + e$. The independent variables jointly affect the production of *Litopenaeus vannamei* by 74,8%. The most influential production factors for *Litopenaeus vannamei* production are the amount of feed given to shrimp and the size of the pond used.

Keywords: Factors of production, influence, and *Litopenaeus vannamei*.

INTRODUCTION

Responsible management of fisheries resources can be realized by always preserving these resources and also by changing the orientation of exploitation of fisheries resources, through fishing, to increasing aquaculture production. Aquaculture is one of the alternative activities to increase fisheries production (Hikmayani et al., 2012; Karuppasamy et al., 2013). Then according to Landsman's research (2019), the graphs of fishing business results have not increased so that cultivation is the most feasible solution to meet future market demands. *Litopenaeus vannamei* is a type of shrimp that is often cultivated, besides *Litopenaeus vannamei* has promising prospects and

profits (Babu et al., 2014). The cultivation of *Litopenaeus vannamei* consists of 3 business segments, namely hatchery, nursery and enlargement. According to Sumeru (2009), the enlargement of *Litopenaeus vannamei* has a high level of productivity and resistance to disease. In addition, *Litopenaeus vannamei* can also be maintained in high stocking densities because they are able to use feed and space more efficiently.

Shrimp was first introduced in Indonesia in the 1990s and began trading commercially in all parts of Indonesia in 1996 (Balakrishnan, 2011). According to Wijayanto (2017), shrimp is one of the main aquaculture products in Indonesia. Whereas Purworejo is one of the regencies in Central Java Province which has the potential for enlargement of *Litopenaeus vannamei*. The enlargement of *Litopenaeus vannamei* in Purworejo Regency is found in three districts, namely Grabag, Ngombol and Purwodadi. Ngombol is the sub-district with the largest number of farmers in Purworejo Regency compared to other district. Based on 2017 statistical data, there are 176 farmers in Ngombol District. The land for growing *Litopenaeus vannamei* in Ngombol District is 54 hectares by utilizing semi-intensive technology. The productivity of *Litopenaeus vannamei* in Ngombol District, Purworejo Regency, is 7.800 kg / ha / planting season (BPS Purworejo, 2017). While the standard of *Litopenaeus vannamei* productivity according to PERMEN KP Number 75 Year 2016 is ranging from 6.000 to 10.000 kg / ha / planting season, so there is still an opportunity to optimize productivity to reach 10.000 kg / ha / planting season.

The purpose of this study was to determine the factors of production of *Litopenaeus vannamei* enlargement in Ngombol District, Purworejo Regency. In addition, this study also aims to analyze the effect of production factors on the enlargement of *Litopenaeus vannamei* on production in Ngombol District, Purworejo Regency. According to Andriyanto (2013), the factors of production of *Litopenaeus vannamei* enlargement are labor, fertilizer, feed and stocking density. Meanwhile, according to Susilo (2007), the factors of production of *Litopenaeus vannamei* enlargement are pond area, stocking density, number of workers and experience. Then the factors of production in this study were the amount of feed, the number of stockings, the area of the pond and the experience of the farmer. This research is in line with Kumaran's research (2016) which states that production / input production factors are optimized to increase the efficiency and production of *Litopenaeus vannamei*.

RESEARCH METHODS

Research sites

The study was conducted in the range of January - April 2019 with the coordinates of the study location at 7°48'30.00' South Latitude and 109°52'30.04' East Longitude. Determination of the study location was based on the quantity of *Litopenaeus vannamei* in Purworejo District. The area of Ngombol District is 5.524 Ha. The Ngombol District area is divided into 57 villages, six of which are located on the south coast of Purworejo Regency, namely Keburuhan, Malang, Pagak, Wero, Girirejo and Ngentak. The six villages were the location of the study with a total of 176 farmers.

Research Variable

The variables observed in this study were production (Y) and production factors in *Litopenaeus vannamei* cultivation (X). The dependent variable (Y) is the amount of *Litopenaeus vannamei* production obtained from district in the clustered sub-district. While the independent variables are the amount of feed (X1), the number of stockings (X2), the area of the pond (X3) and the experience of the farmer (X4)

Sample Determination and collection

The study used a purposive sampling method with 20 respondents. Purposive sampling is the determination of samples made with certain considerations. Twenty people who were sampled in this study were farmers who at the time of the study were doing the process of enlarging *Litopenaeus vannamei*.

Data collection techniques include the collection of primary data and secondary data. Primary data is obtained through observation and interviews (Aedi, 2010; Musfiquon, 2012), while secondary data is obtained from previous research reports and journals (Hartono, 2014). Interviews were conducted on samples, stakeholders, and officials in the Ngombol District area, Purworejo Regency in order to obtain primary data on the factors of production and production of *Litopenaeus vannamei*. In addition, secondary data was used to support research data obtained by making direct visits to RTs, RWs, village halls, sub-district offices and related agencies.

Data Analysis

The data analysis used quantitative analysis with the Coob-Douglas equation approach. According to Soekartawi (2002), the Cobb-Douglas is a function where one variable is called the dependent variable, which is explained (Y), and the other is called the independent variable, which explains (X). The model equation for the Coob-Douglas function is formulated as follows:

$$Y = aX_1^{b_1} aX_2^{b_2} aX_i^{b_i} \dots aX_n^{b_n} e$$

To estimate the parameters in the Cobb-Douglas function equation, the equation must be changed first in the form of linear regression, the form of the equation being:

$$\ln Y = \ln \alpha + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 \dots + b_n \ln X_n + e$$

where :

Y = Output (dependent variable)

X = Input (independent variable)

α = constant/ *Intercept*

b = regression coefficient values for each variable

e = *error term*

Then after the data has been tested for requirements and it has been concluded that the data is good, then to find out the effect of the independent variables on the dependent variable, the SPSS assisted statistical test is carried out as follows:

1) R²-test (Determination Coefficient)

According to Sahri et al. (2006), the coefficient of determination is the unit used to indicate how much variation in the dependent variable is explained by the independent variable. If in the summary model table, the adjusted R² = 1, means the magnitude of the influence of the independent variable on the rise and fall of the dependent variable is 100%, so that no other factors influence it. But if the adjusted R² = 0, means that the independent variable does not affect the dependent variable.

2) F-test

The purpose of this test is to see whether the independent variables that have been jointly used, have a significant effect on the dependent variable. The test is carried out using annova. If F count > F table then jointly there is a positive effect between the independent variable and the dependent variable.

3) t-test

The purpose of this test is to find out whether the significance values of each independent variable (X) that are used separately have a significant effect or not on non-independent variables (Y). Drawing conclusions from the t test is if the significance value is < 0,05, there is a significant effect of the independent variable on the dependent variable.

RESULTS AND DISCUSSION

Enlargement of *Litopenaeus vannamei* in Ngombol District

Enlargement of *Litopenaeus vannamei* in Ngombol District is carried out with semi-intensive technology. The location of the ponds is 20 - 100 meters from the southern coastline of Java Island. The source of water used comes from wells with a depth of 5-10 meters. The initial preparation of the pond is carried out in a simple way and there are even some district who do not provide additional fertilizer or medicines for the water to be used. Benur comes from various regions such as Lampung, West Java, Bali and Sulawesi. The shrimp maintenance is done until the age of the shrimp is ready to sell which is between 60 - 90 days. The given treatment is by replacing water regularly, feeding, and adding drugs to make the water condition stable. Harvesting is done by mutual cooperation among districts one another, from partial harvesting to total harvesting. The stages of enlargement of *Litopenaeus vannamei* are in accordance with Arsad (2017) research stating that the management stages of vaname enlargement

include pond preparation, fries and acclimatization, feed monitoring, water quality monitoring, and harvesting. Whereas according to Mangampa (2010), shrimp enlargement activities begin with the preparation of ponds, namely: complete drying / processing of subgrade (characterized by a '+' redox potential), eradication of pests and calcification. Water preparation for stocking is attempted by growing plankton as basic fertilization needs to be done with organic (granular) and inorganic fertilizers (Urea + TSP). Maintenance of this water lasts for 3 weeks and probiotic application 1 week before stocking. Bacterial cultures use probiotics with an average dose of 3,5 - 5,5 L / ha every week and cultured through a fermentation process for 3 days. Culture media are fish flour, fine bran, yeast, molasses, salt, and fresh water that have been cooked in doses according to existing guidelines. Provision of commercial feed begins at the time of stocking with a dose and frequency of 2% - 100% for treatment A and 2% - 20% for treatment B with a frequency of 3 - 5 times / day.

In this study, data was taken about the factors of production of *Litopenaeus vannamei* enlargement from 20 respondents. The production factors include the amount of feed (X1), the amount of stocking (X2), the area of the pond (X3) and the experience of the farmer (X4). For more details, see Table 1.

Table 1. Data on Factors of *Litopenaeus vannamei* Production with 20 Respondents

No	Name	Production (kg)	Feed Amount (kg)	Number of stockings (tail)	Area (m ²)	Experience (th)
1	Rudi	900	1.600	160.000	1.000	2
2	Sarpanto	1.700	2.500	150.000	1.700	3
3	Sumino	1.100	1.400	180.000	1.800	5
4	Heri	800	875	60.000	1.400	4
5	Andri	1.000	1.085	70.000	1.925	4
6	Edy	1.300	1.440	80.000	1.925	4
7	Wagino	555	600	100.000	1.200	5
8	Giman	700	1.000	250.000	2.000	5
9	Teguh Marno	600	700	100.000	1.200	3
10	Harno	1.100	1.400	150.000	1.800	2
11	Purwoseputro	2.000	2.300	280.000	2.500	5
12	Suripto	1.600	4.100	150.000	1.600	5
13	Keman	2.100	2.700	150.000	1.300	3
14	Mesran	1.200	1.700	150.000	1.500	5
15	Subandiyono	400	500	55.000	1.000	1
16	Tujan	500	850	120.000	1.250	2
17	Sunarno	1.149	1.500	110.000	1.200	1
18	Supeno	647	1.300	130.000	1.200	3
19	Buana	450	550	75.000	1.200	2
20	Suroso	500	600	75.000	1.200	4

In table 1. The data obtained from the field has been tested for requirements and the results are normal. Then the data is tested statistically to determine the effect of production factors on *Litopenaeus vannamei* enlargement with the Cobb-Douglas equation approach. The following are presented in the results of multiple linear regression tests in Table 2.

Table 2. Multiple Linear Regression Tests

Variable	Regression Coefficient	T _{count}	Sig.
constant	-158,334		
Feed (X1)	0,430	5,767	0,000
Number of Stockings (X2)	-3,167	-0,024	0,981
Area (X3)	0,495	2,336	0,034
Experience (X4)	-52,907	-1,013	0,327
Fcount : 15,121			
R Square : 0,801			

The results of multiple linear regression test obtained a constant value of -158,334 with the regression coefficient of the variable feed (X1), the number of stockings (X2), the area of the pond (X3) and the experience of farmers (X4) of 0,430; -3,167; 0,495 and -52,907. So that the equation value is :

$$Y = \alpha + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + e$$

$$Y = -158,334 + 0,430 X_1 + (-3,167 X_2) + 0,495 X_3 + (-52,907 X_4) + e$$

Then from the significance of the four independent variables above there are two variables that have a significance value smaller than 0,05, namely the amount of feed (X1) with a significance value of $0,000 < 0,05$ and pond area (X3) with a significance value of $0,034 < 0,05$. So that it can be interpreted that the effect of the amount of feed (X1) given to shrimp and pond area (X3) used for the production of *Litopenaeus vannamei* in Ngombol District is very significant. After obtaining multiple linear regression results, then the R Square test (R^2) is carried out. The following are the results of the R Square test (R^2) in Table 3.

Table 3. R^2 -test

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,895 ^a	,801	,748	257,696

a. Predictors: (Constant), Experience (X4), Feed (X1), Number of Stockings (X2), Area (X3)

b. Dependent Variable: Production (Y1)

R Square (R^2) test results obtained Adjusted R Square value (R^2) of 0,748. This number has the intention that the independent variable number of feed (X1), the amount of stocking (X2), the area of the pond (X3) and the experience of the farmer (X4) jointly affect the production of vanname shrimp by 74,8%. The 25,2% is influenced by other factors not present in this study. Then a further test is carried out, namely the F-test. The following are the results of the F test in Table 4.

Table 4. F-test

ANOVA^a					
Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	4016692,856	4	1004173,214	15,121	,000 ^b
Residual	996112,094	15	66407,473		
Total	5012804,950	19			

a. Dependent Variable: Production (Y1)

b. Predictors: (Constant), Experience (X4), Feed (X1), Number of Stockings (X2), Area (X3)

Based on the results of the F-test $F\text{-count} > F\text{ table}$ $15,121 > 3,01$ was obtained then there is a positive influence between the independent variables of the amount of feed (X1), the number of stockings (X2), the area of ponds (X3) and experience of farmers (X4) on the dependent variable of *Litopenaeus vannamei* production. This research is in line with the research of Andriyanto (2013), which states that the feed and experience of farmers and the amount of stocking have a significant effect on the production of *Litopenaeus vannamei*. Then according to Susilo (2007), pond area has a positive effect on *Litopenaeus vannamei* production. Management of production factors that determine the success of *Litopenaeus vannamei* enlargement (Soares M., 2015). Then the last t test, the following are the results of the t test in Table 5.

Table 5. t-test

Variable	t-value	t-table	Sig.	Description
Feed (X1)	5,767	1,75305	0,000	Signifcant
Number of Stockings (X2)	-0,024	1,75305	0,981	Not Signifcant
Area (X3)	2,336	1,75305	0,034	Signifikant
Experience (X4)	-1,013	1,75305	0,327	Not Signifcant

The t-test is conducted to determine the effect of each independent variable. The t-test results show that production factors that have a significant effect on the amount of vannamee shrimp production are the amount of feed given to shrimp (X1) and pond area (X3) with a significance value of $0,000 < 0,05$ and $0,034 < 0,05$. The results of this study are in line with the research of Tahe (2011) which states that feed is a factor that influences growth and survival. The accuracy of feed use can be done through anco control which is fed as much as 1% of the total feed given (Subyakto, 2009). The area of the pond has a significant effect because the farm with a larger area will provide more space and oxygen than a narrow pond. This is in line with the research of Purnamasari (2017), which states that the area of ponds used for enlargement of shrimp vaname berperan is important to determine the amount of shrimp fry stock.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The conclusions from the results of the research on the analysis of factors in the production of *Litopenaeus vannamei* enlargement in Ngombol District, Purworejo Regency are as follows:

1. Production factors in the enlargement of *Litopenaeus vannamei*, namely the amount of feed (X1), the amount of stocking (X2), the area of the pond (X3) and the experience of the farmer (X4).
2. The results of data analysis obtained the Cobb-Douglas function equation $Y = -158,334 + 0,430 X1 + (-3,167 X2) + 0,495 X3 + (-52,907 X4) + e$. All factors of production jointly influence the production of vannamee shrimp at 74,8%. The 25,2% is influenced by other factors not present in this study. Factors of production of the amount of feed given to shrimp and the size of the ponds used respectively have a very significant effect on shrimp production compared to other production factors.

Suggestions

The results of the study on the analysis of the factors of production of *Litopenaeus vannamei* in Ngombol District Purworejo Regency can be suggested as follows:

1. Increased production of *Litopenaeus vannamei* in Ngombol District, Purworejo Regency can be done by increasing feed management in the enlargement of *Litopenaeus vannamei* and expanding the ponds used.
2. There is a need for further counseling and training on the techniques of enlarging *Litopenaeus vannamei* in order to increase the farmer's knowledge of shrimp in Ngombol District, Purworejo Regency.

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