Economic of Pontianak Citrus (*Citrus nobilis var. microcarpa*) Production in Sambas Regency, Indonesia

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Abstract. Sambas Regency is one of the centers of Siamese citrus production in Indonesia. The growth of Pontianak Siam citrus production in Sambas Regency in the 2011-2021 period has decreased by an average of around 1% per year. The purpose of this study was to determine whether the efficiency of Pontianak's citrus farming is feasible and to analyze the factors that influence Pontianak Siamese citrus farming. The number of respondents is as many as 300 farmers. The method of determining the research area is purposively based. The sampling of farmers at the research site used a simple random sampling method. The method of analysis is the analysis of Siamese citrus farming income, the R/C ratio, and the Cobb-Douglas production function. The results showed that Pontianak citrus farming was feasible and efficient with an R/C value of 2.02. Factors that significantly affect farm production are seeds, labor, and work experience.

1 Introduction

In 2021, there will be roughly 48,828 tons of citrus produced worldwide. Brazil, China, the European Union, Mexico, and the United States are among the countries with the biggest citrus production worldwide. About 77.74% of the citrus produced worldwide is produced in these five nations [1]. Globally significant fruit trees include the citrus family. Citrus fruits are high in fiber, folic acid, and vitamin C (ascorbic acid) [2]. About 2,406,642 tons of citrus will be produced in Indonesia in 2021. The following regions are known for their citrus production: East Java, North Sumatra, Bali, West Sumatra, South Kalimantan, Lampung, and West Kalimantan. These production hubs account for roughly 76.83% of domestic production [3].

Indonesia imports more than exports in international trade. Indonesia is the second largest importer of citrus fruits in Southeast Asia after Malaysia, with an annual growth rate of 11% [4]. There were several factors in these situations. Reasons such as increased consumer demand, domestic production bottlenecks, and citrus tariff barriers are easing [5].

Citrus fruits are commonly planted in both dry and wet climates in the high and lowlands, including wetlands. rice field. Total citrus production in 2021 was 2,406,642 tons [3].

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Tangerines, tangerines, pummelos, and other citrus fruits such as lemons, limes, and citrus high-Strix account for 80% of citrus crop production [6]. Citrus fruits are becoming increasingly popular among consumers as dietary supplements [7]. Citrus consumption in Indonesia is high, with 3.33 kilograms consumed per person per year in 2018 [8]. In terms of citrus production, he was second only to bananas in 2018, with 2.5 million tons produced [9]. Citrus imports are becoming more and more popular to meet the growing demand.

According to the 2013 Agriculture Census [10], more than 554,000 households are engaged in citrus cultivation. However, there were relatively few tree owners, with only 129 trees or 0.25 ha/hectare. This indicates that citrus cultivation is dominated by small producers. The common perception [11] that small farms are less productive probably applies to Indonesian citrus cultivation as well. Because they are not involved in the introduction of new farming methods, the advantage of smallholder farmers appears to be related to the large gap between potential yields and actual farmer productivity. Integrated plant management is highly recommended for citrus cultivation in Indonesia, especially for the following five elements: (ii) control of pests and diseases, in particular, yellow dragon disease; (iii) the orchards are in a good sanitary condition; (iv) optimal care such as fertilization, irrigation; (v)Integration with other farmers [12-14].

Citrus farming is profitable farming for farmers. The results of research on citrus farming are profitable. Citrus farming in Tanjung Beringin village is profitable with an average income per farmer of IDR 136,000,000/ha/year, R/C value = 2.7 [15]. Likewise, examined the benefits of Siamese oranges in North Sumatra, during the citrus farming cycle the profit was IDR 439,166,360/ha. Profitable citrus farming is monoculture farming. If citrus farming with other plants or intercropping, it is less profitable [16]. Ijaz et al (2014) studied the intercropping of citrus with other crops. The average production of citrus without intercropping was 12,454 kg ha-1 higher than that of intercropping 7,492 kg ha-1. The B/C ratio of monoculture citrus farming is 1.59 was higher than that of intercropping citrus farming is 1.31 [17].

Based on the foregoing, researchers are interested in knowing the income and factors that influence the production of Pontianak citrus farming in Sambas District, Sambas Regency. This study aims to 1) analyze the income efficiency of Pontianak citrus farming and 2) analyze the factors that influence the production of Pontianak citrus farming in Sambas District, Sambas Regency.

2 Research Method

2.1 Location and Time of Research

The survey was conducted in the Tebas and Sambas districts. Tebas Subdistrict has six villages: Pangkalan Kongsi Village, Serumpun Buluh Village, Tebas Sungai Village, Dungun Perapakan Village, Sejiram Village, Mensere Village, and Segarau Village. Sambas district consists of four villages: Lumbang Village, Saing Rambi Village, Sungai Rambah Village, and Semangau Village. The survey period is from July to August 2021. The survey method used the survey method. This method is a systematic method for gathering information from a population sample with the aim of describing a quantitative description of a larger population [18].

2.2 Data processing and sampling procedure

This study included farmers growing Pontianak citrus. The sampling method used a random sample in each village surveyed 300 respondents.

2.3 Data processing and analysis techniques

The collected data is displayed in tabular form. To calculate farmers' income, the authors use gross income analysis and net income analysis in the following formulations. Gross revenue is the product of the price level generated in the market and the output produced [19]. Total sales can be calculated by following Formula 1.

$$TR = P.Y. \quad (1)$$

where *TR* was Total Revenue (IDR); *P* was Market Price (IDR), and *Y* was Production

Income is the difference in the value of revenue (R) with the cost (C) of farming. Family labor is not counted as an expense. Farm income is calculated as gross income (Gross Income = GI). Revenue is expressed in rupiah/hectare. Income calculation uses the following formula [19]:

$$\Pi = TR\text{-}TC \quad (2)$$

Where, Π was Income; *TR* was Total Revenue, and *TC* was Total Cost

R/C Ratio Analysis. The income of farmers who use the farming system was studied. Farmers were interviewed in order to find out if their farming practices enhanced their household income. The structure of revenue (R) and farming expenses (C) from the intercropping system were analyzed, and the R/C analysis was used to compute two critical components. The revenue-to-cost ratio indicates how much revenue will be generated from each cost incurred in agricultural production [20]. The revenue-to-production-cost ratio can be used to assess the relative profitability of farming operations. This means that the revenue-to-cost ratio can be used to determine if a production process is profitable or not. R/C analysis, often known as Cost/Revenue analysis, is a type of financial analysis.

$$R/C = \frac{TR}{TC} \quad (3)$$

If the R/C ratio is more than 1, the firm is lucrative or developable. If the R/C Ratio is less than one, the business will lose money (not feasible to be developed). Moreover, if the R/C When the ratio equals 1, the company has reached break-even. The T-test was used to compare the mean income between polyculture and monoculture farming systems [21].

2.4 Cobb-Douglas Production Function Analysis

Cobb-Douglas Production Function Analysis is used to describe the functional relationship between factors of production [19]. The production factor of Siam Pontianak citrus farming is the independent variable (X). Income as an affected variable or dependent variable (Y). In operation, the Cobb-Douglas function is transformed in the form of a logarithmic equation, which is as follows

$$Ln\ Y = \beta 0 + \beta 1 LnX1 + \beta 2 LnX2 + \beta 3 LnX3 + \beta 4 LnX4 + \beta 5 LnX5 + \beta 6 LnX6 + \beta 7 LnD1 + \beta 8 LnD + e \quad (4)$$

where, *Y* was Pontianak Citrus Production (ton/ha); X_1 was the Number of orange seeds; X_2 was the Number of N fertilizer (kg/ha); X_3 was the Number of P fertilizer (kg/ha); X_4 was the Number of K fertilizer (kg/ha); X_5 was Number of Labor (hour/year); X_6 was Number of Pesticide (lt/ha); X_7 was Dummy Variable of Education (0= education level below high school, 1= high school education level); and X_8 was Dummy Variable of Experience (0 = less than 10 years of experience, 1= more than 10 years experience).

3 Result and Discussion

3.1 Characteristics of Respondents

The average age of respondents is 47.85 years, which means this has entered the less productive period. The average farming experience is 13.70 years which indicates that the farmers are quite experienced in running their farming. The number of children borne by about 2 people. The average education of the head of the household is 7.69 years, which means that on average they only graduated from elementary school (Table 1).

Table 1. Characteristics of respondents in Sambas District.

No.	Characteristics of respondents	$\bar{x} \pm SE$
1.	Age (years)	47.85 ± 0.57
2.	Farming experience (years)	13.70 ± 0.68
3.	Number of borne children (person)	1.88 ± 0.07
4.	Education of head of household (years)	7.69 ± 0.13

Land tenure by farmer households in the surrounding rainfed rice fields is 0.3 ha, 0.51 ha citrus gardens, 0.55 ha rubber gardens, and 0.12 yards with a total of 1.48 ha.

3.2 Income Analysis of Pontianak Citrus Farming

Pontianak Siamese citrus farming production costs consist of fixed costs and variable costs. Production costs are the value of various inputs during production to produce maximum production output. Fixed costs are costs incurred by farmers whose size does not affect production results. Fixed costs consist of land taxes, seeds, and equipment depreciation costs. The fixed cost of Siam Pontianak citrus farming is IDR 2,542,641/ha. Variable costs or non-fixed costs, namely the costs incurred, the size of which affects the results of production. The variable costs include fertilizers, pesticides, and labor. The average total variable cost is IDR 24,917,941.

Table 2. Total Cost of Pontianak Citrus Farming.

No.	Description	Average Cost (IDR)
1.	Fixed Cost (tool depreciation, seeds)	2,542,641
2.	Variable Cost	
	-Fertilizer Cost	2,476,893
	-Pesticide Cost	905,229
	-Labor Cost	18,993,178
Total		**24,917,941**

3.3 Pontianak Citrus Farming Revenue, Income, and R/C ratio

Farming revenue is the result obtained by farmers after their farming activities. The averageproduction of Pontianak Siamese oranges obtained by respondents in Sambas District, Sambas Regency is 9,068 kg with a price per kg IDR 546 so the farm income is IDR 50,529,128. The income (profit) of Siam Pontianak citrus farming is the value of revenue minus fixed costs and variable costs. The average income of Pontianak Siamese citrus farming is IDR 25,373,187. The R/C ratio of Pontianak Siamese citrus farming in Sambas District, Sambas Regency is 2.02. This means that for every 1 rupiah spent, a revenue of 2.02 rupiah will be generated. The value of the R/C ratio above 1 means that Siam Pontianak citrusfarming in the Sambas District is efficient and profitable.

Table 3. R/C ratio of Pontianak citrus farming in Sambas District, Sambas Regency.

No.	Information	Amount (IDR)
1.	Total Receipt	50,291,128
2.	Total Cost	24,917,941
3.	Revenue	25,373,187
R/C		2.02

3.4 Analysis of Factors Affecting Pontianak Citrus Farming Production

The production function used in this research is the Cobb-Douglas production function. The respondents of Pontianak citrus farmers are around 300 respondents. The production function in Pontianak citrus farming involves two or three variables described as the dependent variable (Y) and the independent variable (X). In farming, determining the variables that influence and do not have an effect, it can be done by testing using the Cobb-Douglas function in the SPSS 21 application. The analysis used is multiple regression analysis. The results of the analysis are listed in Table 4.

The results of the Cobb-Douglas regression analysis show that the variables that have a significant effect on citrus production are seeds, labor, and farming experience. From the results of the analysis, the Cobb-Douglas production function equation model is obtained as follows:

Y=3,731.76 +16,512 Number of seeds+ 1,491 amount of fertilizer N-6,799 amount of fertilizer P-0.265 amount of K+ 5,264 total workforce -60,069 amount of pesticides + 370.44 education -605.32 farming experience.

Table 4. Cobb-Douglas production function analysis results.

Predictor	Coef.	SE Coef.	T-Value	P-Value	VIF
Constant	3,731.76	394.37	9.46	0.00	0.00
Seed	16.51	2.17	7.60*	0.00	6.38
N Fertilizer	1.49	1.96	0.75	0.44	1.01
P Fertilizer	-6.79	5.97	-1.14	0.26	1.97
K Fertilizer	-0.26	4.08	-0.06	0.95	1.97
Pesticide	-60.07	60.02	-1.00	0.32	1.14
Labor	5.26	2.71	1.94*	0.05	6.31
D1 Education	370.45	448.68	0.82	0.41	1.04
D2 Experience	-605.33	358.03	-1.69*	0.09	1.03
S=0.987		R-Sq=64.20%		R-Sq(adj)=63.20%	
Analysis of Variance					
F-Value		P-Value			
65.31		0.00			

Note: *) significant at the level of 5%

3.4.1 F Count test analysis results

F_{count} test is a test used to determine the effect of independent variables simultaneously. The results of the F test show the F_{count} value of 65.31 with a probability of 0.000 at the 95% confidence level. This shows that the independent variables simultaneously have a significant effect on the dependent variable.

3.4.2 Coefficient of Determination

The coefficient of determination is the proportion of the value of the independent variable studied in influencing the dependent variable. In this study, the resulting R square of 64.2%, which means that Pontianak Siamese citrus farming is influenced by the variable number of seeds (X_1), Amount of Fertilizer N (X_2), Amount of Fertilizer P (X_3), Amount of Fertilizer K (X_4), Number of Pesticides (X_5), Number of Workers (X_6), Education of the head of the family (D_1), Pontianak Siamese citrus farming experience (D_2) of 64.2%. The remaining 35.8% of other variables affect the production of Pontianak Siamese oranges which were notmentioned in the study.

3.4.3 Factors Affecting the Production of Pontianak Citrus

a. Seeds
From the analysis results, it can be seen that the seeds have a significant effect on Pontianak citrus farming with a probability value of 0.001 (<0.05) which means Ho is rejected and H1 is accepted. The results of a positive regression coefficient of 16,512 means that for every 1% addition of seeds, citrus farming will increase by 16,512. This shows that the elasticity of the use of Ep<0 is in the II region or the irrational efficient region.

b. Labor
From the results of the analysis, it can be seen that the number of workers has a significant effect on citrus farming with a probability of 0.05 (<0.05) which means Ho is rejected and H_1 is accepted. The positive regression coefficient is 5.26, which means that for every 1% increase in the number of workers, there will be an increase in citrus production Pontianak by 5.26%. This shows that the elasticity of the number of workers is in Region II which means it is rational and efficient.

c. Farming practice
From the results of the analysis that farming experience has a significant effect on citrus farming with a probability of 0.09 (<0.05) which means Ho is rejected and H_1 is accepted. The result of the negative regression coefficient is -605.33 (Due to the 2-sided hypothesis test, it is considered positive). This means that for every 1% additional farming experience, there is an increase in Pontianak Siamese citrus production by 605.33 This shows the elasticity of farming experience in Region II which means it is rational and efficient.

3.4.4 Factors that do not affect the production of Pontianak Siamese oranges

a. Fertilizer N
The amount of N fertilizer had no significant effect on Pontianak e citrus farming with a probability value of 0.44 (>0.05). This means that H_0 is accepted and H_1 is rejected. The positive regression coefficient is 1.491, which means that for every 1% increase in the amount of N fertilizer, there will be an increase in production of 1.491%. This indicates that the elasticity of N fertilizers is in region II or the rational and efficient area.

b. Fertilizer P
The amount of P fertilizer had no significant effect on Pontianak citrus farming with a probability value of 0.26 (> 0.05). This means that H0 is accepted and H1 is rejected. The regression coefficient is negative 6.79, which means that for every 1% increase in the amount of N fertilizer, there will be a 6.79% decrease in production. This indicates that the elasticity of P fertilizer is in region III or the irrational region and is inefficient.

c. Fertilizer K
The amount of K fertilizer has no significant effect on Pontianak citrus farming with a probability value of 0.95 (> 0.05). This means that H_0 is accepted and H_1 is rejected. The regression coefficient is negative 0.26, which means that for every 1% increase in the amount of N fertilizer, there will be a 0.26% decrease in production. This shows that the elasticity of K fertilizer is in the III region or the irrational area and is inefficient

d. Pesticides
The amount of pesticide has no significant effect on Pontianak Siamese citrus farming with a probability value of 0.32 (> 0.05). This means that H0 is accepted and H1 is rejected. The regression coefficient is negative 60.07, which means that for every increase in the number of pesticides by 1%, there will be a decrease in the production of 60.07%. This shows that the elasticity of the pesticide is in area III or the irrational area and is inefficient

e. Education of head of household
The education of the head of the household has no significant effect on Pontianak citrus farming with a probability value of 0.41 (> 0.05). This means that H_0 is accepted and H_1 is rejected. The positive regression coefficient is 370.45, which means that for every 1% increase in the education level of the head of the household, there will be an increase in production of 370.45%. This shows that the education elasticity of the head of the household is in area II or the rational and efficient area.

The results of research regarding the production factors of Pontianak citrus farming in Karangwidoro Village, Dau Subdistrict, Malang Regency, state that Siamese citrus farming was viable and efficient to produce in the research region, with an average R/C ratio of 2,41. Pesticides, manure NPK, ZA, and labor are all important factors that affect farm yield [22]. Citrus research was also carried out in Pal VII Village, Berman Ulu Raya District, Rejang Lebong Regency, Bengkulu Province. The results showed that the limiting factors for the productivity of RGL oranges were (1) the environment, especially climate, soil, and pest attacks. The limiting climatic factor is the high rainfall that has been produced, and (2) the low nutrient content factor due to not applying the right fertilization technology based on plant needs. (3) pest and disease factors that reduce the productivity and quality of citrus fruits. Pests are fruit borer, and scurvy [23]. The results of this study are in line with research that states that the use of labor has a positive effect on the production of mandarin oranges [24]. The use of labor and the use of drum fertilizer has a positive effect on the production of mandarin oranges. While the number of citrus trees, the area of land cultivated does not affectthe production of mandarin oranges [25].

4 Conclusion

Based on the results of the study it was concluded that the Siam Pontianak citrus farming business in Sambas District, Sambas Regency is efficient and feasible to operate with an average R/C value of 2.02. The factors that affect the production of Siam Pontianak citrus farming in Sambas District, Sambas Regency are seeds, labor, and farming experience, while those that have no effect are N fertilizer, P fertilizer, K fertilizer, pesticides, and the education level of the head of the family.

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