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# Improving Oil Palm (*Elaeis guineensis* Jacq) Farmer Productivity in Labusona Village, Labuhan Batu Regency

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**Abstract**

Oil palm (*Elaeis guineensis* Jacq.) is a plantation crop that plays a vital role in the Indonesian economy. This study aims to analyze production costs, income, and the effect of production costs on oil palm farming income in Lobusona Village, Labuhanbatu Regency. The research sample consisted of 30 farmers selected through simple random sampling. Data were analyzed using multiple linear regression. The results show that the average production cost incurred by farmers was IDR 60,600,167 per year, while the average revenue reached IDR 136,266,783 per year. This yield resulted in a net income of IDR 75,666,617 per year, or approximately IDR 24,532,139 per hectare per year. The F-test results indicate that production costs, when considered simultaneously, have a significant effect on income (Sig. 0.000 < 0.05). Meanwhile, the t-test results reveal that fertilizer costs had no significant effect, whereas pesticide and labor costs had a significant adverse effect on income. Conversely, annual production, plant age, and the price of fresh fruit bunches (FFB) had a significant positive effect. The coefficient of determination ($R^2$) of 0.996 demonstrates that 99.6% of the variation in income is explained by the variables included in the model. These findings suggest that the efficient allocation of production costs—particularly for pesticides and labor—is crucial for improving the profitability of oil palm farming.

**Keywords:** Income, Oil Palm Farming, Palm Oil Commodities, Production Costs

## 1. Introduction

Oil palm (*Elaeis guineensis* Jacq.) is a major plantation commodity that plays a vital role in the Indonesian economy. As a key source of vegetable oil, oil palm contributes substantially to national foreign exchange earnings, generates employment, and serves as a primary source of livelihood for communities across various regions. Indonesia is recognized as the world's largest palm oil producer, with plantation areas continuing to expand in response to growing global demand (Directorate General of Plantations, 2020).

At the farm level, oil palm provides a relatively stable source of income compared to other plantation crops. However, farmers' earnings are strongly influenced by production costs, which include expenditures on fertilizers, pesticides, labor, equipment depreciation, and other cultivation-related inputs. Importantly, the costs incurred do not always correspond proportionally to the income generated, highlighting the necessity of efficient cost management as a critical factor in ensuring the profitability and sustainability of oil palm farming (Saragih, 2018).

In addition to production costs, several other factors also influence the income levels of oil palm farmers, including annual production, plant age, and the market price of fresh fruit bunches (FFB). Higher annual production generally leads to increased revenue, while optimal plant age contributes to maintaining land productivity. The prevailing price of FFB in the market is also a critical determinant of farmers' income (Lubis, 2019).

Accordingly, analyzing the relationship between production costs and income is crucial for identifying the most influential factors in oil palm farming. Previous research on rice farmers under the Integrated Crop Management (*Pengelolaan Tanaman Terpadu*, PTT) system in Naga Huta Village demonstrated that production factors significantly affect yields. However, the study also revealed that the use of production inputs in PTT rice

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farming was not yet efficient, and that there was a significant relationship between production costs and farm income (Pardede, 2017). Building on such insights, the present study aims to analyze the influence of production factors on the income of oil palm farmers in Lobusona Village, South Labuhanbatu Regency.

## 2. Material and Methods

### 2.1. Time and Location of Research

This research was conducted from May to July 2025 in Lobusona Village, Rantau Selatan District, Labuhanbatu Regency. The research location was purposively selected because it is one of the centers of palm oil production, where the majority of the community earns their living as palm oil farmers.

Lobusona Village is located in Rantau Selatan District, Labuhanbatu Regency, North Sumatra Province. Based on several sources, the coordinates of Lobusona are in the range of north latitude around 2.03°–2.06° and east longitude around 99.82°–99.85°. For example, data from Wikipedia shows the coordinates at 2.035° N and 99.824° E, while data from Kodepos.co.id is at 2.0426° N and 99.8410° E, and data from the Geospatial Information Agency (BIG) records 2.0598° N and 99.8549° E at 100 meters above sea level (masl). This slight difference is normal because the coordinates can refer to the center of the village, the location of the village office, or other administrative areas. In general, Lobusona Village is situated in a lowland area with an altitude of approximately 180 meters above sea level, and is part of the Rantauprapat urban area, which serves as the capital of Labuhanbatu Regency.

### 2.2. Method of collecting data

The data used in this study comprises both primary and secondary data. Primary data were obtained by checking land and conducting direct interviews with respondent farmers using a prepared questionnaire. Secondary data were obtained from relevant agencies, including direct field observations of plants, as well as the Plantation Service and Central Statistics Agency. Additionally, literature relevant to the research was consulted.

### 2.3. Sampling Method

The study population consisted of all oil palm farmers in Lobusona Village who independently cultivate oil palm plantations. The total population was 92. The sample size was determined using the Slovin formula at a precision level of 15%, resulting in a total of 30 respondents. Respondents were selected using a *simple random sampling method* to ensure that each farmer had an equal opportunity to be included in the study sample.

### 2.4. Data Analysis Methods

Production costs refer to all expenses incurred by farmers during the production process until a product is ready for sale (Hernanto, 1996). In this study, production costs comprise fertilizer, pesticide, labor, and equipment depreciation costs.

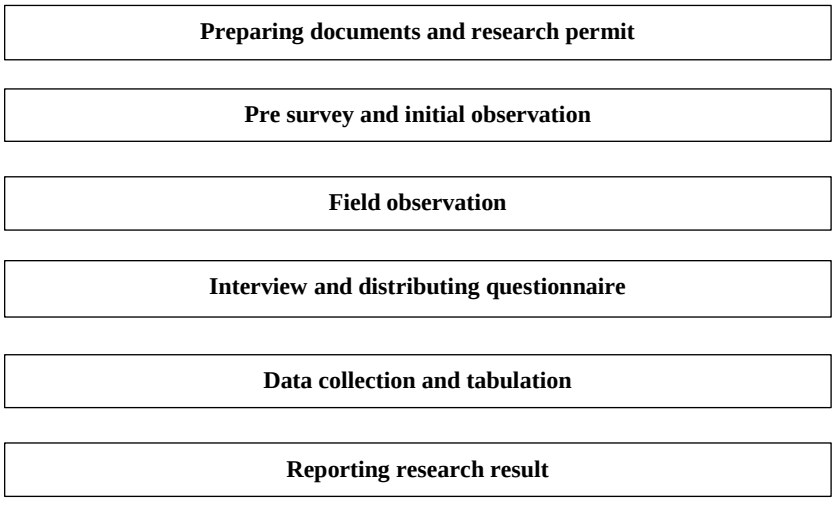


**Figure 1.** Research flow diagram

## 3. Results and Discussion

Based on the results of research on 30 respondents, the total production costs incurred were Rp 1,818,005,003 per year, with an average of Rp 60,600,167 per respondent per year, or Rp 18,638,309 per hectare per year. In terms of income, the average amount earned by farmers was Rp136,266,783 per year, resulting in an average net income of Rp75,666,617 per year, or approximately Rp24,532,139 per hectare per year.

### 3.1. Fertilizer Costs

Common types of fertilizers used by farmers include urea, KCl, TSP/SP-36, and dolomite. Urea is used to meet nitrogen needs. KCl is used as a source of potassium to improve fruit quality and plant resilience. TSP/SP-36 serves as a source of phosphorus for root growth and flower

formation. Meanwhile, dolomite plays a role in maintaining soil pH and providing calcium and magnesium.

**Table 1.** Characterization table of farmers and oil palm plantations in Lobusona Village, Labuhanbatu Regency

| Parameter | Results | Information |
|---|---|---|
| Number of Productive Farmers | 150 | farmer |
| Average age of farmers' oil palm plants | 13 | year |
| Average height of immature plants (TBM) | 0 | No There is |
| Average height of yielding plants (TM) | 10m | meters |
| Average crop production | Plant Produce (TM) | - |
| Overview of the amount of fertilization per year | 437,005,000 | Per year |
| Type of fertilizer given. | Urea, KCL, TSP / SP-36, Dolomite | - |
| Average types of seeds planted by farmers | Dxp Dami, bro | - |
| Land topography in Tebing Linggahara Baru Village, Bilah Barat District, Labuhanbatu Regency | Flat/sloping | - |
| Average production of immature plants (TBM) | 0 | None |
| Average crop yield (TM) | 63,820kg | Per year |

Based on the research results, the total fertilizer costs incurred by 30 farmer respondents in Lobusona Village reached Rp437,005,000 per year, with an average expenditure of Rp14,566,833 per respondent per year. This value indicates that fertilizer is one of the most significant cost components in oil palm farming.

Based on research data, the total urea used by 30 respondents reached 15,335 kg per year, with an average of 511.16 kg per respondent per year. Normalized to an average land area of 3.07 ha per respondent, the urea requirement is equivalent to approximately 166.5 kg/ha/year. This figure provides an overview of the intensity of N fertilization in smallholder oil palm plantations in Lobusona Village, serving as an initial reference for assessing the efficiency of fertilizer costs in terms of production and income.

NPK fertilizer is used as a source of the main macronutrients (nitrogen, phosphorus, and potassium), which function to increase vegetative growth, improve fruit quality, and support the productivity of oil palm plants. Based on research data, the total use of NPK fertilizer by 30 respondents reached 28,150 kg year$^{-1}$, with an average of 938.33 kg respondent$^{-1}$ year$^{-1}$. When calculated based on the average farmer's land area, the need for NPK fertilizer is equivalent to ±305.7 kg ha$^{-1}$ year$^{-1}$.

KCl fertilizer is provided to meet potassium requirements, which plays a role in improving fruit quality, strengthening plant tissue, and increasing resistance to pests and diseases. Total KCl fertilizer use was 11,765 kg year$^{-1}$, with an average of 392.16 kg per respondent$^{-1}$ year$^{-1}$, equivalent to 127.8 kg ha$^{-1}$ year$^{-1}$. KCl use by farmers is quite consistent because it is closely related to increased yields and FFB quality.

### 3.2. Pesticide Costs

Pesticides are a production tool used by farmers to control weeds, pests, and diseases that attack oil palm plantations. Research shows that the types of pesticides commonly used by farmers in Lobusona Village include Gramoxone, Ronup, and Paratop. These three types of pesticides are used according to the land's needs, primarily to suppress weed growth and maintain a clean garden, allowing plants to grow optimally.

The total cost of pesticides spent by 30 respondents reached Rp629,948,000 per year$^{-}$, with an average expenditure of Rp20,998,267 per respondent per year$^{-}$. This figure indicates that pesticide costs are one of the most significant components of cost in oil palm farming, exceeding even fertilizer costs. The high cost of pesticides aligns with the intensity of plantation maintenance, where farmers tend to spray regularly to prevent weeds and diseases that can reduce yields.

Gramoxone is a type of pesticide widely used by oil palm farmers in Lobusona Village. This pesticide is typically applied to control weeds, thereby maintaining plant growth and promoting optimal productivity. Based on the results of a study involving 30 respondents, the total use of Gramoxone reached 566 liters per year$^{-}$, with an average of 18.87 liters per respondent per year$^{-}$. Gramoxone pesticide use varied among farmers, with the lowest amount being 8 liters per year$^{-}$ 1 and the highest being 30 liters per year$^{-}$ 1.

Based on research data from 30 respondents, total Ronup usage reached 454 liters per year$^{-}$, with an average of 15.13 liters per respondent per year$^{-}$. Ronup usage varied among farmers, with the lowest being 6 liters per year$^{-}$ 1 and the highest being 25 liters per year$^{-}$ 1.

Based on the research results, the total use of Paratop by 30 respondents reached only 89 liters per year$^{-}$, with an average of 2.97 liters per respondent per year$^{-}$. The level of pesticide use varied widely, with most farmers not using Paratop at all, while the highest use reached 12 liters per year$^{-}$ 1 in one respondent.

### 3.3. Labor costs

Labor is a significant cost component in oil palm farming, particularly for plantation maintenance activities such as weeding, fertilizing, spraying, and harvesting fresh

fruit bunches (FFB). Based on a study of 30 respondents in Lobusona Village, total labor costs amounted to Rp566,052,000 per year$^{-}$, with an average of Rp18,868,400 per respondent$^{-}$ per year$^{-}$.

The area of land influences the amount of labor costs, the intensity of maintenance, and the number of workers needed for harvesting and plant maintenance activities.

The number of workers used in pruning activities is 430 HOK in year$^{-}$ 1. Wages given to workers range from IDR 50,000 to IDR 80,000 HOK$^{-}$ 1, according to the agreement between farmers and workers. The total costs incurred for pruning activities reach IDR 30,100,000 per year$^{-}$, with an average of around IDR 10,033,333 per respondent per year$^{-}$.

The number of workers used in the spraying activity was 341 HOK per year$^{-}$, with an average of 11,366 HOK respondents per year. The wages given to workers were around IDR 50,000 HOK$^{-}$ 1. The total cost incurred for the spraying activity reached IDR 23,870,000 per year$^{-}$, with an average of IDR 795,666.67 per respondent per year.

The number of workers used in fertilization activities is 435 HOK per year$^{-}$, with an average of 14.5 HOK respondents per year$^{-}$. Wages given to workers range from Rp70,000 to Rp80,000 HOK$^{-}$ 1, depending on the agreement with the plantation owner. The total cost incurred for fertilization activities reaches Rp30,450,000 per year$^{-}$, with an average of Rp1,015,000 per respondent per year$^{-}$.

The number of workers used in harvesting activities reached 3,366 HOK per year$^{-}$, with an average of 112.2 HOK respondents per year$^{-}$. The wages given to harvesters were approximately Rp 75,000 per hectare. The total cost incurred for harvesting activities was Rp284,910,000 per year$^{-}$, with an average of Rp9,497,000 per respondent per year$^{-}$.

Labor wages for oil palm farming in Lobusona Village vary depending on the type of work performed. For pruning and spraying activities, wages are determined based on the number of Man-Days (HOK), ranging from IDR 50,000 to IDR 80,000 HOK$^{-}$ $^{1}$, depending on the work's difficulty and the agreement between the farmer and the worker. Meanwhile, for fertilization activities, wages are also calculated based on HOK, but at a higher rate of around IDR 70,000 to IDR 80,000 HOK$^{-}$ $^{1}$ because workers are required to be precise in spreading fertilizer evenly.

Unlike these types of work, harvesting activities have a more varied wage system. In addition to the HOK (Fresh Fruit Bunch) rate, which ranges from around IDR 75,000 HOK$^{1}$, some farmers also implement a results-based payment system, where wages are based on the number of bunches or weight of fresh fruit bunches (FFB) harvested. This way aims to increase harvester productivity while ensuring the quality of the fruit produced remains high.

### 3.4. Equipment Depreciation Cost

In oil palm farming, farmers use a variety of tools to support maintenance and harvesting. The main tools include a dodos (hand picker) and an egrek (hand picker) for harvesting fresh fruit bunches (FFB), a sprayer for applying pesticides and herbicides, and a machete for weeding and pruning.

Equipment depreciation costs are calculated based on the purchase price, economic life, and usage intensity of each type of equipment. Based on the study of 30 respondents, the total equipment depreciation cost reached Rp229,192,003 per year, with an average of Rp7,639,733 per respondent per year$^{-}$.

Farmers use dodos to harvest fresh fruit bunches (FFB). Of the 30 respondents, there were 61 units, with an average of 2 units per respondent$^{-}$ 1, an average age of 9 years, and a unit price of Rp100,000–Rp300,000 per unit$^{-}$ 1. The depreciation cost of dodos reached Rp10,323,000 per year$^{-}$, or an average of Rp344,100 per respondent$^{-}$ per year$^{-}$.

Egrek is used to harvest fresh fruit bunches (FFB) on taller plants. Of the 30 respondents, there were 83 units with an average of 2 units per respondent$^{-}$ 1, an average age of 6 years, and a unit price of Rp100,000–Rp300,000 per unit$^{-}$ 1. The depreciation cost of Egrek reached Rp7,320,000 per year$^{-}$ or an average of Rp244,000 per respondent per year. Sprayers are used for pesticide and herbicide spraying activities. Of the 30 respondents, there were 37 units with an average of 1 unit per respondent$^{-}$ 1, an average age of 3 years, and a unit price of Rp1,000,000–Rp1,500,000 per unit$^{-}$ 1. The depreciation cost of the sprayer reached Rp35,745,000 per year$^{-}$ $^{1}$ or an average of Rp1,191,500 per respondent$^{-}$ $^{1}$ per year$^{-}$ $^{1}$.

Machetes are used for weeding and pruning. Of the 30 respondents, there were 113 units, with an average of 3 units per respondent$^{-}$ 1, an average age of 1 year and 4 months, and a unit price of Rp30,000–Rp50,000 per unit$^{-}$ 1. The depreciation cost of machetes reached Rp2,518,000 per year$^{-}$, or an average of Rp83,933 per respondent per year$^{-}$.

Production, Revenue, and Income

The average annual production of oil palm farmers reached 63,820 kg of fresh fruit bunches (FFB) per year$^{-}$ per respondent, with a range of 25,200–105,000 kg. Differences primarily influenced this variation in plant age, land area, and maintenance intensity in each plantation.

Fresh Fruit Bunch Price. The selling price of fresh fruit bunches received by farmers ranged from Rp 1,750 to Rp 2,350 per kilogram, with an average of Rp 2,084.83 per kilogram during the study period. Price fluctuations are a significant factor in determining farmers' annual income.

With this combination of production and price levels, the average farmer income was recorded at IDR 136,266,783 per year$^{1}$ per respondent. This value reflects the ability of smallholder plantations in the study locations to generate relatively stable cash flow, although they

remain sensitive to changes in fresh fruit bunch (FFB) prices and seasonal production figures.

**Table 2.** Details of Production Costs for Oil Palm Farming in Lobusona Village

| No. | Land Area (ha) | Production cost | | | | Total Production Cost | |
|---|---|---|---|---|---|---|---|
| | | X1 Fertilizer Cost | X2 Pesticide Cost | X3 Equipment Depreciation | X4 Labor Cost | (Rp year) | (Rp ha year) |
| 1 | 3.2 | Rp12,220,000 | Rp. 15,300,000 | Rp6,490,000 | Rp11,240,000 | Rp. 45,250,000 | Rp14,140,625 |
| 2 | 2.5 | Rp9,050,000 | Rp13,760,000 | Rp7,455,714 | Rp10,800,000 | Rp41,065,714 | Rp16,426,286 |
| 3 | 4.2 | Rp24,870,000 | Rp. 37,500,000 | Rp11,259,429 | Rp. 34,640,000 | Rp108,269,429 | Rp25,778,436 |
| 4 | 1.8 | Rp6,160,000 | Rp8,400,000 | Rp6,615,000 | Rp. 6,120,000 | Rp27,295,000 | Rp15,163,889 |
| 5 | 3.8 | Rp14,275,000 | Rp. 25,990,000 | Rp5,716,756 | Rp. 19,000,000 | Rp64,981,756 | Rp17,100,462 |
| 6 | 2.7 | Rp8,246,000 | Rp17,270,000 | Rp6,389,000 | Rp11,925,000 | Rp43,830,000 | Rp16,233,333 |
| 7 | 3 | Rp12,130,000 | Rp14,010,000 | Rp7,884,470 | Rp14,585,000 | Rp48,609,470 | Rp16,203,157 |
| 8 | 4.5 | Rp27,285,000 | Rp43,152,000 | Rp10,390,222 | Rp. 35,665,000 | Rp116,492,222 | Rp25,887,160 |
| 9 | 3.5 | Rp15,104,000 | Rp28,397,500 | Rp5,503,864 | Rp18,940,000 | Rp67,945,364 | Rp19,412,961 |
| 10 | 2.8 | Rp11,660,000 | Rp. 15,200,000 | Rp6,215,393 | Rp13,080,000 | Rp46,155,393 | Rp16,484,069 |
| 11 | 2 | Rp7,280,000 | Rp9,308,000 | Rp5,983,333 | Rp. 5,100,000 | Rp27,671,333 | Rp13,835,667 |
| 12 | 3.3 | Rp13,695,000 | Rp20,770,000 | Rp6,520,000 | Rp. 16,750,000 | Rp. 57,735,000 | Rp17,495,455 |
| 13 | 4 | Rp25,362,000 | Rp33,182,500 | Rp11,153,143 | Rp. 30,560,000 | Rp100,257,643 | Rp25,064,411 |
| 14 | 2.4 | Rp9,515,500 | Rp12,420,000 | Rp7,633,017 | Rp11,080,000 | Rp40,648,517 | Rp16,936,882 |
| 15 | 5 | Rp. 32,790,000 | Rp49,020,000 | Rp14,315,000 | Rp39,985,000 | Rp136,110,000 | Rp27,222,000 |
| 16 | 1.5 | Rp4,937,000 | Rp7,052,000 | Rp5,647,111 | Rp3,825,000 | Rp21,461,111 | Rp14,307,407 |
| 17 | 2.7 | Rp10,984,500 | Rp16,772,500 | Rp6,952,179 | Rp14,015,000 | Rp48,724,179 | Rp18,045,992 |
| 18 | 3.1 | Rp13,201,000 | Rp19,910,000 | Rp6,057,333 | Rp. 15,470,000 | Rp54,638,333 | Rp17,625,269 |
| 19 | 1.2 | Rp4,110,000 | Rp5,728,000 | Rp6,186,667 | Rp3,060,000 | Rp19,084,667 | Rp15,903,889 |
| 20 | 4.3 | Rp27,183,000 | Rp33,767,500 | Rp10,508,889 | Rp. 30,840,000 | Rp102,299,389 | Rp23,790,556 |
| 21 | 3.6 | Rp. 15,495,000 | Rp24,170,000 | Rp5,580,909 | Rp. 18,350,000 | Rp63,595,909 | Rp17,665,530 |
| 22 | 2.9 | Rp11,998,000 | Rp14,178,000 | Rp6,414,000 | Rp13,140,000 | Rp. 45,730,000 | Rp15,768,966 |
| 23 | 4.8 | Rp30,073,500 | Rp46,332,000 | Rp11,245,500 | Rp37,120,000 | Rp124,771,000 | Rp25,993,958 |
| 24 | 2.1 | Rp8,140,500 | Rp10,578,000 | Rp7,226,333 | Rp9,810,000 | Rp35,754,833 | Rp17,026,111 |
| 25 | 3.4 | Rp14,588,000 | Rp22,110,000 | Rp6,705,000 | Rp17,705,000 | Rp61,108,000 | Rp17,973,529 |
| 26 | 1.7 | Rp6,690,000 | Rp8,850,000 | Rp6,454,633 | Rp7,205,000 | Rp29,199,633 | Rp17,176,255 |
| 27 | 4.1 | Rp26,507,700 | Rp. 33,345,000 | Rp10,558,578 | Rp. 31,960,000 | Rp102,371,278 | Rp24,968,604 |
| 28 | 3.7 | Rp15,873,200 | Rp23,077,000 | Rp6,188,417 | Rp19,675,000 | Rp64,813,617 | Rp17,517,194 |
| 29 | 1.9 | Rp7,295,500 | Rp7,946,000 | Rp6,732,335 | Rp8,065,000 | Rp30,038,835 | Rp15,809,913 |
| 30 | 2.6 | Rp10,285,600 | Rp12,452,000 | Rp7,209,778 | Rp12,150,000 | Rp42,097,378 | Rp16,191,299 |
| Total | 92.2 | Rp437,005,000 | Rp629,948,000 | Rp229,192,003 | Rp. 521,860,000 | Rp1,818,005,003 | Rp559,149,265 |
| Average | 3.07 | Rp14,566,833 | Rp20,998,267 | Rp7,639,733 | Rp17,395,333 | Rp60,600,167 | Rp18,638,309 |

Source: Primary Data (processed 2025)

The average total production cost was Rp60,600,167 per year¹ per respondent, which includes fertilizer, pesticide, labor, and equipment depreciation. Pesticides and labor accounted for the most significant components, while equipment depreciation contributed a more minor but still significant contribution.

The difference between revenue and costs resulted in an average annual income of Rp75,666,617 per respondent, equivalent to approximately Rp24,532,139 $ha^{-1}$ per $year^{-}$ . The income range among farmers was quite wide (Rp25,015,333–Rp110,640,000 per year¹), indicating room for improvement in input efficiency, particularly in pesticide management and labor allocation.

In general, this profile confirms that increasing annual production and strengthening the price position of fresh fruit bunches (FFB) are key levers for increasing revenue, while cost control—particularly in the pesticide and labor sectors—is the ultimate determinant of the size of farmers' net income.

### 3.5. Analysis Results

To determine the effect of fertilizer (X1), herbicide (X2), labor (X3), and equipment depreciation (X4) on income (Y), a multiple linear regression analysis was conducted using the SPSS version 12.0 program. The results of the regression calculations from the primary data processing can be seen in Table 4. Based on the information in the table, the multiple linear regression equation is as follows:

$$\mathbf{Y= -137192471.101 -0.215X_1 – 0.371X_2 – 1.187X_3 – 1, 1821X_4}$$

The regression equation can be described as follows:

#### 3.5.1. Fertilizer Costs

The regression coefficient value b1 = 0.215 indicates that if costs increase by one percent, income will increase by 0.215 percent, assuming all other factors remain constant. The analysis revealed a positive impact on fertilizer costs, resulting from farmers' adherence to the prescribed dosage of fertilizer. According to Sastroyono (2003), fertilizer application should be carried out at the beginning and end of the rainy season.

#### 3.5.2. Pesticide Costs

The regression coefficient value b2 = -0.371 indicates that a one percent increase in pesticide costs results in a 0.371 percent decrease in income.

#### 3.5.3. Labor costs

The regression coefficient value $b_3$ = -1.187 indicates

that if labor costs increase by one percent, income will actually decrease by 1.187 percent, assuming all other factors remain constant. The results of this analysis suggest that labor costs negatively impact revenue. This negative value suggests that the current increase in labor costs is no longer efficient, likely because it has passed the optimal labor utilization point. Under these conditions, the increase in labor costs is not offset by a commensurate increase in productivity, thus actually lowering overall revenue.

### 3.5.4. Equipment Depreciation Cost

The regression coefficient value b4 = -1.821 indicates that if the equipment depreciation cost increases by one percent, then income will decrease by 1.821 percent, assuming all other factors remain constant.

A negative value for this coefficient indicates that increased equipment depreciation costs have a detrimental effect on revenue. This may occur because the equipment in use may be inefficient or its depreciation costs are too high, while its contribution to productivity increases is disproportionate.

The calculated F value is 1000.856, and the F table value is 2.464 at a significance level of $\alpha = 0.05$. Because the calculated F-value exceeds the F-table value, then $H_0$ is rejected and $H_a$ is accepted. This means that production costs have a significant effect on income simultaneously. In other words, the independent variables, which consist of fertilizer costs, herbicide costs, labor costs, and equipment depreciation costs, collectively have a significant effect on the dependent variable, namely the income from oil palm farming in Lobusona Village.

**Table 3.** Details of Farming Income in Lobusona Labuhanbatu Village 2025

| No | Land Area (ha) | Production cost | Reception | Income | |
|---|---|---|---|---|---|
| | | (Rp Year) | (Rp Year) | (Rp year) | (Rp ha year) |
| 1 | 3.2 | Rp. 45,250,000 | Rp142,800,000 | Rp97,550,000 | Rp30,484,375 |
| 2 | 2.5 | Rp41,065,714 | Rp97,500,000 | Rp56,434,286 | Rp22,573,714 |
| 3 | 4.2 | Rp108,269,429 | Rp198,000,000 | Rp89,730,571 | Rp21,364,422 |
| 4 | 1.8 | Rp27,295,000 | Rp. 66,600,000 | Rp39,305,000 | Rp21,836,111 |
| 5 | 3.8 | Rp64,981,756 | Rp155,800,000 | Rp90,818,244 | Rp23,899,538 |
| 6 | 2.7 | Rp43,830,000 | Rp87,075,000 | Rp43,245,000 | Rp16,016,667 |
| 7 | 3 | Rp48,609,470 | Rp126,000,000 | Rp77,390,530 | Rp25,796,843 |
| 8 | 4.5 | Rp116,492,222 | Rp217,350,000 | Rp100,857,778 | Rp22,412,840 |
| 9 | 3.5 | Rp67,945,364 | Rp161,700,000 | Rp93,754,636 | Rp26,787,039 |
| 10 | 2.8 | Rp46,155,393 | Rp123,480,000 | Rp77,324,607 | Rp27,615,931 |
| 11 | 2 | Rp27,671,333 | Rp79,800,000 | Rp52,128,667 | Rp26,064,333 |
| 12 | 3.3 | Rp. 57,735,000 | Rp147,262,500 | Rp89,527,500 | Rp27,129,545 |
| 13 | 4 | Rp100,257,643 | Rp183,120,000 | Rp82,862,357 | Rp20,715,589 |
| 14 | 2.4 | Rp40,648,517 | Rp99,540,000 | Rp58,891,483 | Rp24,538,118 |
| 15 | 5 | Rp136,110,000 | Rp246,750,000 | Rp110,640,000 | Rp22,128,000 |
| 16 | 1.5 | Rp21,461,111 | Rp. 56,700,000 | Rp35,238,889 | Rp23,492,593 |
| 17 | 2.7 | Rp48,724,179 | Rp117,652,500 | Rp68,928,321 | Rp25,529,008 |
| 18 | 3.1 | Rp54,638,333 | Rp144,847,500 | Rp90,209,167 | Rp29,099,731 |
| 19 | 1.2 | Rp19,084,667 | Rp44,100,000 | Rp25,015,333 | Rp20,846,111 |
| 20 | 4.3 | Rp102,299,389 | Rp205,432,500 | Rp103,133,111 | Rp23,984,444 |
| 21 | 3.6 | Rp63,595,909 | Rp163,296,000 | Rp99,700,091 | Rp27,694,470 |
| 22 | 2.9 | Rp. 45,730,000 | Rp127,281,000 | Rp81,551,000 | Rp28,121,034 |
| 23 | 4.8 | Rp124,771,000 | Rp234,360,000 | Rp109,589,000 | Rp22,831,042 |
| 24 | 2.1 | Rp35,754,833 | Rp84,892,500 | Rp49,137,667 | Rp23,398,889 |
| 25 | 3.4 | Rp61,108,000 | Rp159,222,000 | Rp98,114,000 | Rp28,857,059 |
| 26 | 1.7 | Rp29,199,633 | Rp66,937,500 | Rp37,737,867 | Rp22,198,745 |
| 27 | 4.1 | Rp102,371.2 78 | Rp194,586,000 | Rp92,214,722 | Rp22,491,396 |
| 28 | 3.7 | Rp64,813,617 | Rp171,717,000 | Rp106,903,383 | Rp28,892,806 |
| 29 | 1.9 | Rp30,038,835 | Rp72,817,500 | Rp42,778,665 | Rp22,515,087 |
| 30 | 2.6 | Rp42,097,378 | Rp111,384,000 | Rp69,286,622 | Rp26,648,701 |
| Amount | 92.2 | Rp379,301,369 | Rp873,775,000 | Rp494,473,631 | Rp161,971,670 |
| Average | 3.07 | Rp60,600,167 | Rp136,266,783 | Rp75,666,617 | Rp24,532,139 |

Source: Primary Data (processed 2025)

**Figure 2.** Morphology of Farmers' Oil Palm Plants

**Table 4.** Results of Multiple Linear Regression Analysis

| Independent Variable | B | T Count | Sig. t |
|---|---|---|---|
| (Constant) | -137192471.101 | -7,910 | 0.000 |
| X1 | 0.215 | 0.637 | 0.530 |
| X2 | -0.371 | -2,562 | 0.018 |
| X3 | -1,187 | -2,614 | 0.016 |
| X4 | -1,821 | -6,674 | 0.000 |

| | |
|---|---|
| Multiple R | = 0.997 |
| $R^2$ | = 0.996 |
| F count | = 1000.856 |
| Sig. F | = 0.000 |
| $F_{table\ (0.05:30)}$ | = 2.464 |
| $t_{table\ (0.05:30)}$ | = 2,074 |

Source: Results of multiple linear regression analysis (SPSS *version* )

These results indicate that the regression model used is statistically significant at the 95% confidence level (α = 5%), so it can be concluded that the production cost factors studied simultaneously influence the income level of oil palm farmers in the region.

The effect of production costs on income can be partially explained as follows:

1. Fertilizer Costs (X1): The calculated t-value for the fertilizer cost variable (X1) against income (Y) is **0.637**, while the t-table value at α = 0.05 with degrees of freedom (df) = 30 is 2.464. Because the calculated t < t-table, $H_0$ is accepted and $H_a$ is rejected. This shows that the fertilizer cost variable does not significantly influence income at the 95% confidence level (α = 5%).
2. Herbicide Cost (X2): The calculated t-value for the herbicide cost variable (X2) on income (Y) is -2.562, while the t-table value remains 2.464. Because |t count| > t table, $H_0$ is rejected and $H_a$ is accepted. This indicates that the herbicide cost variable has a significant effect on income at the 95% confidence level (α = 5%).
3. Labor Cost (X3): The calculated t-value is -2.614, and the t-table value is 2.464. Because | calculated t | > t table**,** $H_0$ is rejected and $H_a$ is accepted**.** Thus, labor costs have a significant effect on income at the 95% confidence level.
4. Equipment Depreciation Cost (X4): The calculated t-value is -6.674, while the table t-value is stated as 2.04. Because |calculated t| > t table**,** then $H_0$ should be rejected And $H_a$ is accepted **.** This means that equipment depreciation costs have a significant impact on revenue.

Based on the results of the t-test on the four independent variables, herbicide costs (X2) and labor costs (X3) were found to have a significant effect on income (Y), whereas fertilizer costs (X1) and equipment depreciation costs (X4) did not exhibit a significant effect.

The lack of significance for fertilizer costs and equipment depreciation may be attributed to their relatively small proportion compared to other expenditures, such as herbicides and labor. In particular, equipment depreciation costs tend to be minimal because most farmers rely on durable, shared, or pre-existing equipment, thereby reducing the impact of these costs on overall income.

The correlation coefficient (R) between the independent variables (fertilizer costs, herbicide costs, labor costs, and equipment depreciation) and income (Y) was 0.997. This value indicates a very strong relationship, as it approaches a value of 1. Furthermore, the coefficient of determination ($R^2$) was 0.996, suggesting that 99.6% of the variation in income (Y) can be explained by the variables included in the regression model. The remaining 0.4% is likely influenced by factors not captured in the analysis, such as climate variability, soil conditions, farmer experience, or other external influences.

## 4. Conclusion

Based on the results of the data analysis and discussion, the following conclusions can be drawn:

1. The total costs incurred in oil palm farming in Lobusona Village amount to Rp379,301,369 per year, with an average of Rp60,600,167 per respondent annually, or Rp18,638,309 per hectare per year.
2. The total annual income from oil palm farming in Lobusona Village is Rp494,473,461, with an average income of Rp75,666,617 per respondent per year, or Rp24,532,139 per hectare annually.
3. Production costs significantly influence oil palm farming income in Lobusona Village. Specifically, herbicide and labor costs have a substantial impact on income, whereas fertilizer and equipment depreciation costs do not.

The relationship between production costs—including fertilizer, herbicide, labor, and equipment depreciation—and oil palm farming income in Lobusona Village is strong and positive, as evidenced by a correlation coefficient (R) of 0.997.

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