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The Effect of Land Typologies on Smallholders Palm Oil Profit

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Abstract:
The objective of research was to analyze effect of types of land typologies on smallholders palm oil profit. It also analyses comparison of smallholders palm oil profit at two types of land typologies. This study was conducted in 2019 and used data cross section about 120 samples, that was 60 producers of lowland smallholders palm oil and 60 producers of middle-land smallholders palm oil. Model used in this research was the qualitative and quantitative model. Data analysis for comparison was done using t test. The result showed that farmers in lowland palm oil, there is labor and fertilizer variables that influenced production. In terms of differences, the income of oil palm farmers with a pattern middle land and oil palm farmers with low-land patterns there are significant differences. The average level of income from oil palm farming with middle land pattern was IDR. 51,207,577 / year or IDR. 4,267,298 / month, while in low-land farming was IDR. 32,636,357 / year or IDR. 2,719,696 / month. Overall the labor variable, the number of trees, fertilizers and herbicides have a positive influence on palm oil production both in middle land and low-land patterns, seen from the calculated F value of 5.77> F table 5.66 for farmers with middle land patterns and for low-land F count 8,990> F table 5.66. Using t test, there is a difference between the income/profit of middle land oil palm farmers and low land oil palm farmers, where oil palm income/profit in middle land was higher than its income/profit in low land.

Keywords:*Land typologies, palm oil, producers income, and profit*

Introduction

The largest palm oil acreage in the world isIndonesia, which covers of 34.18 percent of global oil palm acreage but isin the second position of world producers (Glenday and Paoli, 2015).In average, Indonesian oil palm yieldfrom 2009 to 2017 was about 76 million tons of palm oil seed or covers 40.26 percent of global oil palm yield. The improvementacreage of Indonesia's palm oil in five decadebefore improvedveryquickly, it was 133.3 thousand hectare in year of 1970 to 7.51 million hectare in year of 2017 or in average, it increased of 11.12% each year. Regarding business point of view, it developedeach year after era of Indonesia economic crisis (from 2009 to 2017) which is Smallholders Plantation of 11,83 percentage, State Plantation of 1,89 percentage, and Private Estate of 8,34 percentage (Fauzi, 2016).

Sector agriculture still becomes an important sector toencourage regional development in Jambi. It contributed large portiononGRDP and used in labor force to Jambi economy. It was contributed approximately of 27.5 percentagefrom agricultural sector of Jambi GRDP and got a high portion of labor used which is of 46,88 percentage of available labor force (BPS, 2018). Therefore, palm oil estate subsector is importantcommodityin agricultural sector of Jambi Province.

Landacreageofpalmoil plantationsdevelopseachyearonJambiProvince, for example714,399hectareinyear of 2015to755,522hectareinyear of 2017which is inaverageincreaseoflandacreageof 1,81 percentageeach year. Production in year of 2015 about 1,794,874 tons increased to 2.078,463tonsinyear of 2017which

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isinaverageproductionincreasingof4,55percentageeac hyear. Landacreage developmentandsmallholderpalmoil yieldwillincreaseagain innext years (BPS,2018).

Palmoil subsectorinJambiProvinceisagoodcommoditythatcan giveimprovement of producers income if it is measured to other agricultural sub-sectorsliketea, corn, soybean,andpaddy.Sooilpalmoil plantationgives betterlifeforJambipalmoil producers each year.Moreover, in terms of landtypologies,ithasbeen picture of smallholders oil palm behavior to involve and organize for their income andprofit.Jambiprovincehasthreetypeoflandtypologie ssuchashighlandofKerinci District,middle-landofMuaroJambiDistrictandlowlandofTanjabTimur .Meanwhile, oil palm plantations grow mostly in middle-land and lowland. The farming system based on land typologies will also affect smallholders oil palm income and also profit (Janice et al. 2013). Therefore, every smallholders oil palm income may be caused by different oil palm scale because of different land typology (Edison,2018).

Producers income is affectedpalm oil production from land typology (Daniels, 2012), such as lowland and middle-land palm oil plantations. Besides dependedon production, producers income is also affected by production cost, and thenaffected by allocation pflabor used and the capital in palm oil estate (Soekartawi, 2006). Producersare eager to improvetheir income and getriel income eachtime (Asni, 2015), causing producers income to be affected by type of land typology.

Literature Review

Process to change inputs into output (product) called production process. Using output, considering other things ceteris paribus and available of input and output prices, it ismeasuredas indicator and a value of producer income or profit level (Nicholson, 2002; Hackman, 2008).Hernanto (1996) stated thatobjective of farm activities wants to produce maximum agriculture products that would earn maximum profit or gapsofincome and costs. Profitwouldgiveproducerstodistributefromalternativei nputlikeyieldexpenditure, laborcost,modal.

According toSetiawan and Mulyana (2005) rateof palm oil seed andincomewasdirectlydeterminedsuch asplant age, riel price ofpalmoil, in contrary, had negative effecttodifferentiationcosts.Rahutomoetal(2006)onstu dy onhow to use fertilizer in dryland and wetland on palm oil estate at varying age found that the palm oil plants in age range of 9 – 13 years is the highest dosage usedcomparingallranges of age.Drylandpalmoil needed8,75kilogramsperstemeachyear,and wetland palm oil needed 9,50 kilogramsperstemper year. Moreover, palm oil in dryland used urea fertilizerin the highest fertilizer rate, while wet landpalm oil used SP36 in the highest rate.

Totalproductioncostsofpalmoil contains input fertilizer, pesticide expenditure and labor cost in high portion.It absorbedabout31-35percentagepalmoilfor palm oilage of 10yearsandabout50–60percentagefor palm oilup that age. Meanwhile, labor cost was more stable about 28 – 30 percentage in total cost of palm oilalonggrowthtimeofpalmoil estate(Oemar,2007;Lifianthi and Husin,2012).

Palm oil sub-sector in Jambi becomes a reliable commodity that can contributegood producersincomeif it is measuredtootheragriculturalsub-sectorliketea, corn, soybean and paddy. So it can be found thateach year there are conversion of agricultural land into palm oil, especially among producers. In caseof land conversion, there has also foundmovement from traditional agriculture to semi-intensive agriculture (Alwarritzi et.al. 2015). The farming system can cause more capital intensive used in the agricultural system, so that its activity in dry land is bettermeasuredwith wetlandpalm oil.

Based on discussion above, it found problems:

i. Doesacreage of land, labor and capital significantly affect income of lowland and middle-land palm oilin Jambi Province?

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ii. Doesrate of production, real selling price, laborused and capital significantly affect the profit of smallholders palm oil in Jambi Province?
iii. Does the lowland oil palm profit differ significantly from middle-land oil palm profit ?

Methodology

By considering Jambi Province is one of central oil palm plantations in Indonesia, research area will be identified purposively in Muaro Jambi District for middle-land typology and TanjabTimur District for lowland typology Jambi Province. Research Samples were identified by Cluster Sampling methods. With considering sampleattentionsthathavedifferentlandareaforoilpalm plantations,thenumberof samples were 120 KK (60 samples for lowland typology of oil palm farmers, and 60 samples for middle-land typology of oil palm farmers). Research was conducted in 2019.

To explain deeply those objectives, it needs basic approach.First,itisexaminedsmallholderincomeandprofit of oil palm farmers. Second it is addressed the effect of different land typologies on householdincomeandprofitinJambi.Finally,itisdiscussedhowitiscomparedakey problem, in estimating the effect of different land typologies on household agricultural income and profit of oil palmfarmers.

It is assumed that smallholder objective is to maximize estate profit (π), expressed as(Gujarati, 2008):

$$\pi_i=\sum p_Y Y_i-\sum w_X X_i \quad (1)$$

Note:p= output prices and
w= variable input prices.
Then it can define as follows:

$$Y_i=(X_i,k_i,\omega) \quad \ldots(2)$$

Note:Y=thevalueofoutputperhectare,
=quantitiesofvariableinputs,
= quantitiesofquasi-fixedinputs,and
ω=environmental variables
Because the condition of labor and capital market imperfections are usual in developing countries, the shadow cost of labor and capital is endogenous (Sadoulet and De Janvry, 2006). In other words, the shadow cost of labor and capital is affected by smallholder labor and asset endowments, as well as by capital and accessibility to infrastructure.

It can beexplained that analysis of land typologycan improve crop income. Improvingcrop income is crucialtoimprovesmallholderincome where it can be seen frompopulation pressure on the land and it can improve crop productivity due to reduced fallow periods. In order to increase crop income, it very crucial to apply new technology (such as using good seeds and fertilizer) in order to improvecrop income as land scarcity increases.

To apply and estimate quantitative data collected from the survey, it uses standard mathematical formula for measuring cost, revenue, and profit.

Profit = TR – TC = (P x Q) – (TFC+TVC) ……. (3)

note :
TR = Total revenue of oil palm estate (IDR/ha/year)
TC = Total production cost (IDR/ha/year)
P = FFB price(IDR/kg)
Q = FFB production (kg/ha/year)
TFC = Total fixed cost (IDR/ha/year)
TVC = Total variable cost(IDR/ha/year)

Total fixed cost includes depreciation of crop tools or equipment, land tax, management fee, etc. Total variable cost contains fertilizer and pesticide costs, loan repayment, and institutional fee based on production volume. To compare and analyzefarmprofit(income)andothermeasurementgap betweenthelow-land and middle-land palm oil estate, it is used two mean-value test using standard formulasdependingonwhetherthefirstgroupandthesec

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ondgroupshowingthesame or different variances (Huntsberger et al.,1980). It is also used benefit to cost ratio analysis in order to compare money value gain on each rupiah spent forfinancing the farm operations at the twoareas.

To see how much each factor contributes to production, the analysis used is a multiple linear regression statistical test:

$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \mu$ ……..…….. (4)

Which is stated in logarithmic form:

$\text{Log } Y = \alpha + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \mu$ …… (5)

where :

Y = Number of production (tons / ha)

X_1 =Labor (HKSP)

X_2 = Number of Trees (Stems)

X_3 = fertilizer (kg)

X_4 = pesticide (litre)

To see whether there is a difference in income, between farmers in middle land and low-land oil palm, the analysis used is the average difference t- test:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} - \frac{S_2^2}{n_2}}} \quad (6)$$

where:

$\bar{X}_1$ = the average of middle land samples;

$\bar{X}_2$ = the average of low land samples;

S_1^2 = variance of middle land samples;

S_2^2 = variance of low land samples;

n_1 = number of middle land samples;

n_2 = number of low land samples

Results and Discussion

a. Palm Oil Production Cost

a.1. Cost for Using Fertilizers and Pesticide

Production costs are costs incurred by a farmer in the production process. In oil palm farming, production costs in this study are cash production costs paid directly by farmers including the cost of fertilizer purchases, pesticide purchasing costs, and labor costs outside the family. Following is a description of the costs incurred by farmers in oil palm estate.

The use of fertilizers is divided into two types namely inorganic and organic fertilizers, then there are also some of the respondent farmers who use pesticide. The use of input costs is very varied, ranging from IDR 1 - 11 million. The biggest cost of using fertilizers and herbicides is at interval IDR 3 - 4 million and 5-6 million, each of which 34 families or 56,67% of the sample farmers in middle land oil palm farmers while those in low-land oil palm farmers 75% are in the interval IDR 1 - 2 million or as many as 45 families. Whereas the lowest cost for farmers in middle land oil palm patterns is more than IDR 11 million, or 3.3% of respondent farmers.

Fertilizer is one of the important production factors in the process of oil palm farming activities to add nutrients to the soil. The fertilizer costs referred to in the study are the amount of money spent by farmers to buy fertilizer. The average fertilizer cost incurred by the sample farmers in middle land oil palm was IDR. 6,670,834 / year. While the average fertilizer costs incurred by farmers in 1 hectare was IDR. 2,032,756 / ha / year. While the average cost per hectare was IDR 5.970.750 / year or the average cost per hectare was IDR 1.820.350 / ha / year.

Pesticide used costs are costs incurred by farmers to buy pesticide. Based on research conducted in the field, there are two types of pesticide used by farmers, namely Round-up and Gramoxone. The average cost incurred by farmers in middle land oil palm was IDR. 1,399,776 / year. While the average cost per hectare was IDR. 425,302 / ha / year. While in low land oil palm, it was IDR 1.118.650 / year or the average cost per hectare was IDR 340.015 / ha / year.

a.2. Cost for Using of InputLabor

Labor cost used for oil palm farming here varied, ranging from above IDR 1-8 million per year. The largest paying of labor cost is in the interval IDR 5 -8 million, which is 37 households or 61.67% of the sample in middle land oil palm farmers while in

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low land oil palm farmers are in the interval of IDR 4 -7 millionwhich is as many as 39 households or 62.90% of farmers respondent.

Cost for the use of labor are cost incurred in farming activities. Labor cost outside the family in this study area include workers who come from outside the family. Outside family labor is used by farmers when labor in the family is inadequate and farmers have difficulty in managing their farming for fertilization, spraying or harvesting. Labor is measured in units of Workers' Day (HOK). The average cost of labor outside the family of IDR. 6,038,448 per farmer per year, or 1,845,635 per hectare per year. Research results showed that the average cost of labor outside the family is more spent on harvesting activities compared to other activities, which is IDR. 5,728,966 / farmer / year or IDR. 1,761,662 / farmer / ha / year.

a.3. Depreciation Cost

Depreciation of durable equipment is not experienced by all farmers because for farmers who use labor from outside of family, then all equipment is borne or charged to workers. Whereas for farmers who devote labor from within family, the cost of depreciating durable equipment can be calculated. For middle land oil palm farming, its cost was IDR 235.000 each year, while for low land oil palm farming, its cost was IDR 227.500 each year.

a.4. Total Palm Oil Production Costs

The total cost consists of labor costs, the cost of using fertilizers and herbicides and the cost of depreciating durable equipment. The highest total cost is in the range of IDR 4.6 - 7.8 million, which is 36 households or 60% of the sample farmers in middle land oil palm farming while in low land oil palm farming is in the range of IDR 3.6 - 7.2 million, as many as 29 households or 48.33% of the number of respondents farmers. While the lowest total cost of farmers in middle land oil palm farming is in the range of more than IDR 1.5 million, which is as many as 3 households or 5% of the total number of respondent farmers. Then in low-land oil palm farming, the lowest total cost is more than IDR 1 millions per year, namely 4 households or 6,67% of the total sample farmers.

The total cost of cash production is the total cash expenditure paid by farmers for farming including the cost of purchasing fertilizer, the cost of purchasing pesticides and the cost of labor outside the family. In this study the total cost of oil palm is the cost paid directly by farmers in managing their farms, which is an average of IDR. 14,344,058 per year for middle land oil palm farming, and IDR 11,594,443 per year for low land.

b. Palm Oil Production

The production of oil palm farming is greatly influenced by climatic factors and activities in the farming business. And also it was influenced by land typologies. The level of production of each farmer varies greatly, this results in differences in the level of income and ultimately differences in the level of income.

By using 60 samples for each typologies during production period in 2018 (January - December) it was known thatit can produceabout 15.5 tons per hectare per year for middle land palm oil with the highest production 21.2 tons and the lowest production 7.9 tons with an average acreage of 3.2 hectare. While, in low land oil palm production was the average acreage of 2.8 tons, with the highest production of 18.5 tons and the lowest production of 6.5 tons.

While the lowest production in farmers with middle land oil palm farmers is in the range of 7.9 – 11.8 tons, which is as much as 38 households or 63.33% of farmer respondent. And the highest production in middle land oil palm is in the range of 17.3 – 21.2. Then in the low land oil palm farmers the lowest production is in the range of 6.5-9.8 tons, which is as many as 34 households or 56.67% of farmer respondents. And the highest production in the range of 15.2 – 18.5 tons.

c. Oil Palm Farming Income/Profit

Farm income referred to in this study are the total revenues derived from oil palm farming calculated within one year. The amount of revenue

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received by farmers in this study can be determined by multiplying the amount of FFB production per year by the average price of FFB per year.

Acceptance of oil palm farming income respondent farmers vary starting from IDR 10 million - 70 million per year. The highest income is in the range of IDR 50 - 60 million, which is 38 households or 63,33% of sample farmers with middle land oil palm, while in low land oil palm is in the range of IDR 30 -40 million, which is 44 households or 73.33% of the total respondents farmers. While the lowest income for farmers in middle land oil palm is in the range of IDR 24-35 million, namely as many as 5 households or 8,33% of the total number of respondent farmers. Then in the low land oil palm farming, the lowest income is in the range of IDR 20 - 30 million, namely as many as 6 households or 10 % of the total number of respondent farmers.

The results of the study in middle land oil palm farming of the total acceptance, the smallest farm income of IDR. 38,266,800 and the highest farm income of IDR. 205,632,000 with an average oil palm farming income of IDR. 78,551,635 farmers / year or IDR. 31,420,654 ha / year. Research showed that farmer income varied, of course, according to the typology land of farm. The highest of farmers' income is in the low land oil palm farming of IDR 187,423,500. While the lowest of farmers' income was of IDR. 25,745,803 farmers / year or IDR. 9,194,930, per hectare per year.

Oil Palm Farming Income is the amount of income from oil palm farming that is obtained from the difference between the total revenue and the total costs paid by farmers. The income earned is the amount of palm oil production multiplied by the price then reduced by the total production costs paid directly during the production process. In the household, income is a tool to meet family consumption needs. With the income, then the household will be able to meet their needs in accordance with the income earned. The amount of oil palm farm income in middle land plantationcan be seen in the following Table 1.

Table 4.1. Average of Palm Oil Farming Income in Middle-land Plantation

No	Item	Amount (Farmer/Year)	Amount (Ha/Year)
1	Production of Palm Oil (kg / year)	49,200	15,537
2	Price (IDR / kg)	1,329	1,329
3	Revenue (IDR. / year)	65,551,635	20,688,917
4	Production Costs (IDR / year)		
	- Fertilizers cost	6,670,834	2,072,756
	- Herbicide cost	1,399,776	425.302
	- Farming Labor Paid	6,038,448	1.845.635
	- Depreciation	235.000	94.000
5	Total Cost (IDR)	14,344,058	4,437,693
	Income/Profit (IDR/year)	51,207,577	16,251,224

Based on Table 1 it can be seen that the average palm oil production is 15,537 / kg / ha / year or 1,295 / kg / ha / month at a price of IDR. 1,329 / kg and the total cash production cost is IDR. 5,697,624 / ha / year, so that the average income obtained from palm oil farming in middle land area is IDR 51,207,577 / farmer / year or IDR.16,251,224 / ha / year.

Table 4.2. Average of Palm Oil Farming Income in Low-land Plantation

No	Item	Amount	Amount

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		(Farmer/Year)	(Ha/Year)
1	Production of Palm Oil (kg / year)	36,859	13,164
2	Price (IDR / kg)	1,200	1,200
3	Revenue (IDR. / year)	44,230,800	15,796,800
4	Production Cost (IDR / year)		
	- Fertilizers cost	6,557,950	2,342,125
	- Herbicide cost	1,375,420	491,265
	- Labor cost	3,411,873	1.218,526
	- Depreciation	249.200	89.000
5	Total Cost (IDR/year)	11,594,443	4,140,916
	Income/Profit	32,636,357	11,655,482

While from Table 2 it can be seen that the average palm oil production is 12,624 / kg / ha / year or 1,052 / kg / ha / month at a price of IDR. 1,100 / kg and the total cash production cost is IDR. 5,141,978 / ha / year, so that the average income obtained from palm oil farming in middle land area is IDR 21,861,055 / farmer / year or IDR.8,744,422 / ha / year.

4.2. Analysis of Production Factors in Palm Oil Farming

To analyze the factors that influence palm oil production in the study area, the Cobb-Douglas regression model is used using natural logarithmic transformation data, with the following mathematical equation:

$$\text{Log } Y = -0{,}970 + 0{,}237 \log X1 + 0{,}753 \log X2 + 0{,}109 \log X3 + 0{,}009 \log X4 + \varepsilon \ldots\ldots \quad 7$$

Where: Y = Production or tangible results produced by farmers (kg)

X1 = Labor (HKSP)

X2 = Number of trees (Stems)

X3 = Amount of fertilizer application (kg)

X4 = Amount of herbicide use (liter)

Table 4.3. Estimation of Palm Oil Production Functions with Middle-land

Variable	Coefficient Regression	Standard Error	T-value	Significance level
Intercept	-0,970	0,700	-1,384	0,175
Labor	0,237	0,094	2,508	0,017
Plant	0,753	0,274	2,753	0,009
Fertilizer	0,109	0,044	2,506	0,017
Herbicide	0,009	0,025	0,359	0,722

Production regression is a production function of the factors of production. In increasing the factors of production, it must be considered factors of production that are used together. Analysis of the various variables of palm oil production functions in middle land palm oil in the study area can be seen in the following Table 4.

Table 4. Analysis of Functional Analysis of Palm Oil Production Functionin Middle-land

F-test	Significant	R^2
6,132	0,001[a]	0,516

The F statistical test basically shows whether all independent variables entered in the model have a joint influence on the dependent variable. From Table 4, it can be seen that the calculated F value of 6.132 is greater than the F table of α 5% = 2.65. This shows that together (F test) the independent variables

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consisting of labor, number of trees, fertilizers and herbicides have a significant influence on the variables of palm oil production in middle land in the study area. Furthermore, to see the estimated value of low land palm oil production function pattern in the study area can be seen in the following Table 5.

Table 5. Estimation of Palm Oil Production Functions with Low-land

Variable	Coefficient Regression	Standard Error	T-value	Significance level
Intercept	2.307	0,700	3.296	0,006
Labor	0,418	0,094	4,447	0,005
Plant	0,693	0,274	2,529	0,026
Fertilizer	0,206	0,102	2,019	0,037
Herbicide	0,017	0,025	0,680	0,728

That to determine the effect of partially independent variables on palm oil production in low land palm oil in the study area, then proceed with the t test on the coefficient of independent variables. From Table 4 above shows that only the variable labor, the number of trees and the use of fertilizers that affect the increase in palm oil production in low land palm oil in the study area, this can be seen from the t count of each variable namely 4.447 and 2.529 and 2.019 greater than t table α 0.025 = 1.960. Means that the use of labor work, the use of the number of trees and the use of the amount of fertilizer affect the production of palm oil farming in low land in the study area. While the use of herbicides did not significantly influence the increase in palm oil production in low land in the study area, it can be seen from the t count 0.680 variables smaller than t table α 0.025 = 1,960, means that the use of herbicides does not affect low land palm oil farming production in the study area at a 95% confidence level.

Analysis of the various functions of palm oil production in low land in the study area can be seen in the following Table 6.

Table 6. Analysis of Various Functions of Palm Oil Production Functions with Low-land

F-test	Significant	R^2
8.990	0,010[a]	0,857

From Table 6 it can be seen that the calculated F value of 8.990 is greater than the F table α 5% = 2.65. This shows that together (F test) the independent variables consisting of labor, number of trees, fertilizers and herbicides have a significant effect on palm oil production variables in low land in the study area.

4.3. Analysis of the Differences in Oil Palm Farming Income with Middle-land and Low-land

In this research it was hypothesized that there is a difference in income between palm oil farmers in middle land and palm oil farmers in low land. To see if there is a difference farmer's income in the study area is then used the average difference test formula From these formulas the Z count was 3.635 and the Z table value was α 0.05 = 1.96. Thus, the Z count is greater than the Z table means, reject Ho, which means that there is a difference between the income of middle land palm oil farmers and low land palm oil farmers.

Conclusion

The average level of income from palm oil farming in middle land palm oil is IDR. 51,207,577 / year or IDR. 4,267,298 / month, while in low-land palm oil farming is IDR. 32,636,357/ year or IDR. 2,719,696 / month. Overall the labor variable, the number of trees, fertilizers and herbicides have a positive influence on palm oil production both in middle land and low-land patterns, seen from the calculated F value of 6.132> F table 2.65 for farmers with middle land patterns and for low land-farmers intensive F count 8,990> F table 2.65.

Partially only the labor variable, number of trees, and fertilizer have an effect on increasing the production of palm oil in middle land pattern. Furthermore, for farmers with a low-land pattern, the variables that influence the increase in production are also the labor and number of trees and fertilizer variables. In terms of differences, the income of palm

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oil farmers with middle land pattern and palm oil farmers in low-land patterns there are significant differences.

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