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STUDY OF FERTILIZER COSTS USING FERTILIZER SPREADER ON PALM OIL PRODUCING CROPS IN PULAU TIGA PLANTATION PT. PERKEBUNAN NUSANTARA IV REGIONAL VI KSO

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Abstract
The highest cost proportion in the maintenance costs of oil palm plantations is the cost of fertilization. One of the mechanical fertilization methods uses a Fertilizer Spreader. The purpose of this study was to examine the cost of fertilization using a Fertilizer Spreader on Mature Plants (TM) of oil palm in Afdelling II and III of Pulau Tiga Plantation of PT. Perkebunan Nusantara IV Regional VI KSO in 2024. The research method used a quantitative descriptive method. The research data were analyzed using Parametric Test Analysis, namely the Independent Sample T-Test with a level of α = 5%. The parameters observed were the components of the fertilization costs of oil palm Mature Plants (TM) at PT. Perkebunan Nusantara IV Regional VI KSO, as well as the differences in the costs of fertilizing oil palm mature plants in Afdelling II and Afdelling III at PT. Perkebunan Nusantara IV Regional VI KSO. The results of the study showed that the composition of the costs of mechanical fertilization using a Fertilizer Spreader on oil palm plantations consisted of fertilizer purchase costs, transportation costs, loading costs to trucks, loading and unloading costs to the Spreader, fuel costs and operator costs. The largest composition of mechanical fertilization costs in the last 3 years in oil palm Producing Plants (TM) in Afdelling II is in the purchase of fertilizer with a percentage of 96.68%, or Rp. 4,623,833,780 while in Afdelling II the largest composition is the cost of purchasing fertilizer with a percentage of 96.93% or Rp. 3,401,494,919. The results of the independent sample T-test analysis test show a P-Value or Sig. (2-tailed) of 0.255> 0.05, so based on the basis of decision making that, there is no significant (real) difference between the fertilization costs of Afdelling II and Afdelling III in the Pulau Tiga Plantation of PT. Perkebunan Nusantara IV Regional VI KSO.

***Keywords**: Fertilizer Spreader, fertilization costs, Yielding Crops (TM), palm oil*

INTRODUCTION

The study of fertilization costs using Fertilizer Spreader on oil palm producing plants in Pulau Tiga plantation of PT Perkebunan Nusantara IV Regional VI KSO is something new and has never been done before. The mechanical fertilization system with Fertilizer Spreader is still relatively new in Pulau Tiga Plantation, the use of this tool was only used in 2022. Therefore, researchers are interested in conducting research to find out the amount of mechanical fertilization costs with Fertilizer Spreader on oil palm Producing Plants (TM) in Afdelling II and III Pulau Tiga Plantation of PT. Perkebunan Nusantara IV Regional VI KSO. Fertilization costs are an expenditure in the form of money made by the company for a fertilization activity in rupiah per ha (Rp/ha) and the cost of fertilizing oil palm Producing Plants (TM) is the cost incurred during the activity of fertilizing oil palm Producing Plants (TM) in Rupiah (Saragih et al, 2017). Fertilization is also a crucial factor to discuss, given that fertilization costs account for nearly 50-60% of total field production costs, or 25% of total production costs (Darmawan, 2021). Research conducted by (Sinaga et al., 2017) found that fertilization accounted for the highest proportion of oil palm maintenance costs, at 71.86%. Therefore, fertilizer must be used efficiently and effectively. The cost of purchasing and applying fertilizer in the field is quite high, accounting for 40-60% of maintenance costs (Siahaan et al., 2023).

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This study aims to determine the cost components of mechanical fertilization with Fertilizer Spreader on Mature Plants (TM) of oil palm, and to determine whether there is a difference in the cost of mechanical fertilization on Mature Plants (TM) of oil palm in Pulau Tiga Plantation between Afdelling II and III in Pulau Tiga Plantation of PT. Perkebunan Nusantara IV Regional VI KSO. Mechanical fertilization using Fertilizer Spreader, according to Pramana and Afrillah (2022) Fertilizer Spreader is a tool used to apply fertilizer to oil palm plants in areas of plants that have produced (TM) from flat to undulating land with a slope of 0-5°. According to Misrianto and Widuri (2017) the need for labor in mechanical fertilization is less, only requiring 3 people, the details of which are 1 person as a tractor operator, and 2 people as helpers on the Fertilizer Spreader. The helper is responsible for putting fertilizer into the hopper which functions as a place to store fertilizer.

Mechanical fertilization with Fertilizer Spreader can load a lot of fertilizer in one application when fertilizing. According to Pramana and Afrillah (2022) mechanical fertilization with Fertilizer Spreader in one load can load 600 kg into the spreader for the needs of 4 rows or 8 rows of plants with a dose of 2.50 kg / plant. According to Misrianto and Widuri (2017) fertilization with Fertilizer Spreader has disadvantages including: there is a need for investment costs for the purchase of a tractor and Fertilizer Spreader can only be applied to flat to sloping areas with a slope of 0-5° and soil compaction occurs on the carrying road, in addition to that, weed growth and competition for nutrient absorption with weeds are more likely.

RESEARCH METHODS

This study uses a quantitative descriptive method. The secondary data generated are analyzed quantitatively using descriptive methods. Quantitative descriptive is a statistical analysis used to describe, summarize, and analyze quantitative data. Quantitative data is data that can be measured or calculated using numbers (Aziza, 2023). To determine the difference in fertilization costs for oil palm Mature Plants (TM) between Afdelling, this study uses data analysis of two independent sample t-test means. The method used for sample collection is based on the Purposive Sampling method. This method is a sample data collection method that presents complete information data and uses considerations. This study used two samples, namely Afdelling II and III, the selection of the samples was based on several considerations, namely the area (Ha), the number of trees and in both Afdellings, mechanical fertilization was more dominant than in other Afdellings. The data collected are related data regarding costs during the mechanical fertilization process for oil palm Mature Plants (TM), including: 1) General information for the plantation including plantation profile, land topography, area, plant age composition, rainfall, and land conditions. 2) Data on plans and realization of oil palm fertilization for the last 3 years, from 2022 to 2024. 3) Data on the area (Ha) fertilized and data on the composition of mechanical fertilization costs. 4) Company Budget Work Plan (RKAP) for oil palm fertilization from 2022 to 2024. Data analysis was carried out with the help of the SPSS 25 application. The analysis stages are as follows: 1) Classical Assumption Test, this test is carried out to validate whether the data that has been collected is in accordance with the assumption of normal distribution. 2) The T test functions to determine the average difference between two independent populations/data groups. This independent T test has assumptions/requirements that must be met, namely: a) The data is normally distributed. b) both groups of data are independent (free). c) the connected variables are numeric and categorical (with only 2 groups). The data analysis used in this study is as follows: a) 95% significance level ($\alpha = 0.05$). b) Determining the hypothesis with the formula Ho: There is no significant difference in fertilization costs between Afdelling II and III. H1: There is a

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significant difference in fertilization costs between Afdelling II and III. c) Basis for T-Test Decision Making: If the sig. (significance) value > α (0.05) then H0 is accepted and H1 is rejected. If the Sig. (significance) value < α (0.05) then H0 is rejected and H1 is accepted

Research results

PT. Perkebunan Nusantara IV Regional VI KSO, Kebun Pulau Tiga is one of the agribusiness units that has a Business Use Right (HGU) covering an area of 5,274.99 Ha. It is divided into 8 Afdeling whose area is in the Aceh Tamiang Regency area (Jejaruan Muda District, Tamiang Hulu District, and Bandar Pusaka District) with an altitude of 10 - 125 meters above sea level. Kebun Pulau Tiga has 8 Afdelling, from the 8 existing Afdelling, 2 Afdelling were chosen, namely Afdelling II and Afdelling III, with the consideration that the area of Afdelling II and Afdelling III is smaller than the other Afdelling. The working area of Regional Plantation VI KSO, Pulau Tiga is divided into 2 (two) areas, namely: 1) Region I consists of Afdeling- I (Simp. Kanan Village), Afdeling- II (Plantation Village), Afdeling- III (Plantation Village), and Afdeling- IV (Plantation Village). 2) Region – II consists of Afdeling- V (Babo Village), Afdeling- VI Cempa Village), Afdeling- VII (Pidam Village), Afdeling- VIII (Batu Bedulang Village) The topography of the Regional VI KSO Pulau Tiga Plantation plantation area consists of flat, undulating and hilly areas with class III land covering 5,087.86 Ha. The following is the topographic data of Afdelling II and III land. The land contour of Afdelling II is a combination of flat to undulating land of 312.50 Ha or 46.97% and hilly land of 352.80 or 53.03% with a total area of 665.30 Ha. While the land contour of Afdelling III is a combination of flat to undulating land of 293.60 Ha or 46.02% and hilly land of 344.40 or 53.98% with a total area of 638.00 Ha. Kebun Pulau Tiga is one of the business units of PT. Perkebunan Nusantara IV Regional VI KSO. Tiga Island Gardens consists of 8 Afdelling with 1 commodity plant, namely oil palm. The following is the area of Afdelling II and III along with the number of main and main/Ha in Afdelling II and III. The area of Afdelling from which data was taken is Afdelling II covering an area of 665.30 Ha and Afdelling III covering an area of 638.00 Ha. The condition of the land area of Kebun Pulau Tiga PT. Nusantara IV Regional VI KSO Plantation consists of flat, undulating and hilly areas with class III land area of 5,087.86 Ha.

Land Conditions

Geologically, the Pulau Tiga Plantation area is mostly classified as a Tertiary Formation with clay and sandstone as its parent material. The physiography of the area is a folded area with a flat-undulating shape, but there are hilly and depressed (low) areas. The dominant soil types in the Pulau Tiga Plantation are Typic Dystrudepts and Typic Kandiudults (Red-Yellow Podzolic) and in the lowland areas, Typic Endoaquepts (Gray Hydromorphic) soil types are found. The actual Land Suitability Class (KKL) in most of this plantation is S3 with the main limiting factor in this plantation being a rather difficult topography, especially in the Serba Region, as well as the occurrence of periodic water deficits which impact plant growth/production and the effectiveness of fertilizer application. This land suitability class is further subdivided into several classes: S1 (highly suitable), S2 (moderately suitable), S3 (marginally suitable), N1 (currently unsuitable), and N2 (permanently unsuitable). These classes are based on the level of productivity of a land. Class S1 has a productivity of >80%, S2 has a productivity level of 50-80%, while S3 has a productivity level of 30-50%.

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Realization of Mechanical Fertilization

Fertilization is a crucial factor in providing plant nutrients to enhance growth and development. Fertilization implementation demonstrates the implementation of fertilizer recommendations in the Division's Operational Work Plan (RKO). Data on mechanical fertilization implementation using the Fertilizer Spreader can be seen in Table 1 below.

Table 1. Planned and Realized Fertilizer Needs for Divisions II and III.

Year	Division	Plan & Realization	Dolomite	NPK A	Mop	Urea	NPK B
2022	II	Plan	50,900	57,550	37,700	32,450	-
		Realization	50,900	57,550	37,700	32,450	-
		%	100	100	100	100	-
	III	Plan	24,350	26,950	19,100	14,950	-
		Realization	24,350	26,950	19,100	14,950	-
		%	100	100	100	100	-
2023	II	Plan	66,450	134,850	61,650	42,850	-
		Realization	66,450	134,850	61,650	42,850	-
		%	100	100	100	100	-
	III	Plan	39,200	79,050	35,550	24,850	-
		Realization	39,200	79,050	35,550	24,850	-
		%	100	100	100	100	-
2024	II	Plan	65,450	-	-	47,273	105,365
		Realization	65,450	-	-	47,273	105,365
		%	100			100	100
	III	Plan	52,750	94,700	30,374	29,909	44,741
		Realization	52,750	94,700	30,374	29,909	44,741
		%	100	100	100	100	100

Source: Pulau Tiga Plantation, PT. Perkebunan Nusantara IV Regional VI KSO.

Fertilizer Cost Plan and Realization

Fertilizer purchases are made at the Plantation and Afdelling Directorate Office. Fertilizer pricing information is provided by the annual Company Work and Budget Plan (RKAP) guidelines. Fertilizer prices and purchasing costs from 2022 to 2024 can be seen in the table below.

Table 2. List of Fertilizer Costs for Pulau Tiga Gardens.

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Year	Price (Kg/Rp)				
	Dolomite	MOP	Urea	NPK A	NPK B
2022	632	12,327	10,683	11,550	-
2023	621	9,729	8,288	6,493	-
2024	657	5,589	9,710	8,240	7,040

Description: NPK A = NPK 12:12:17:2
NPK B = NPK 13:6:27:4
Source: Pulau Tiga Plantation, PT. Perkebunan Nusantara IV Regional VI KSO.

Table 3. Planned and Realized Fertilizer Costs for Divisions II and III of Pulau Tiga Plantation.

Year	Division	Plan & Realizati on	Dolomite	NPK A	Mop	Urea	NPK B
2022	II	Plan	32,168.800	664,702.500	464,727.900	346,663.350	-
		Realization on	32,168.800	664,702.500	464,727.900	346,663.350	-
		%	100	100	100	100	-
	III	Plan	15,389.200	311,272.500	235,445,700	159,710.850	-
		Realization on	15,389.200	311,272.500	235,445,700	159,710.850	-
		%	100	100	100	100	-
2023	II	Plan	41,265.450	875,581.050	599,792.850	355,140.800	-
		Realization on	41,265.450	875,581.050	599,792.850	355,140.800	-
		%	100	100	100	100	-
	III	Plan	24,343.200	513,271.650	345,865,950	205,956.800	-
		Realization on	24,343.200	513,271.650	345,865,950	205,956.800	-
		%	100	100	100	100	-
2024	II	Plan	43,000.650	-	-	459,020.830	741,769,600
		Realization on	43,000.650	-	-	459,020.830	741,769,600
		%	100	-	-	100	100
	III	Plan	34,656.75	780,328.00	169,760.28	290,416,39	314,976.64

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			0	0	6	0	0
		Realization	34,656.75	780,328.00	169,760.28	290,416,39	314,976.64
		on	0	0	6	0	0
		%	100	100	100	100	100

Source: Pulau Tiga Plantation, PT. Perkebunan Nusantara IV Regional VI KSO.

Table 3 shows a comparison of planned and actual mechanical fertilization costs for Divisions II and III. The higher fertilizer prices and the greater the amount of fertilizer required in a given year, the higher the cost of purchasing fertilizer materials. The table above shows the planned and actual fertilizer costs for 2022 to 2024. For more details, see the graph below:

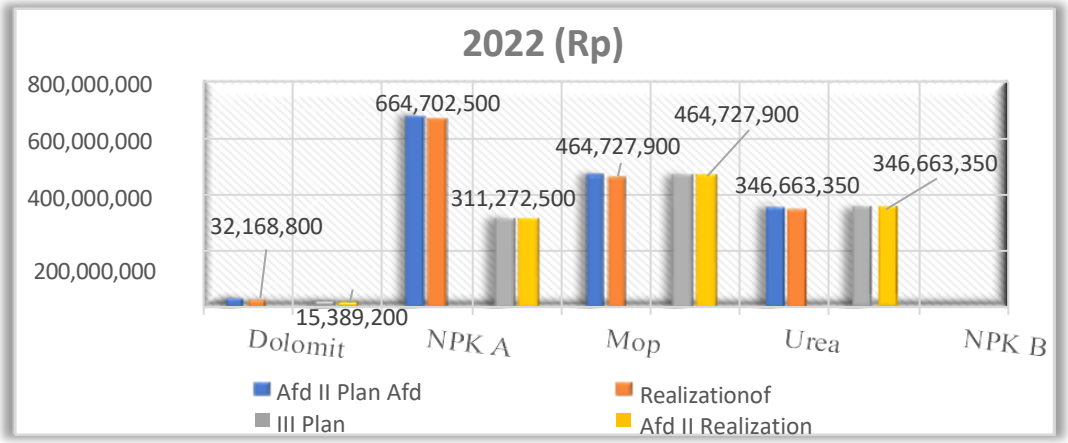

Figure 1. Graph of Planned and Actual Fertilizer Requirement Costs for Divisions II and III in 2022.

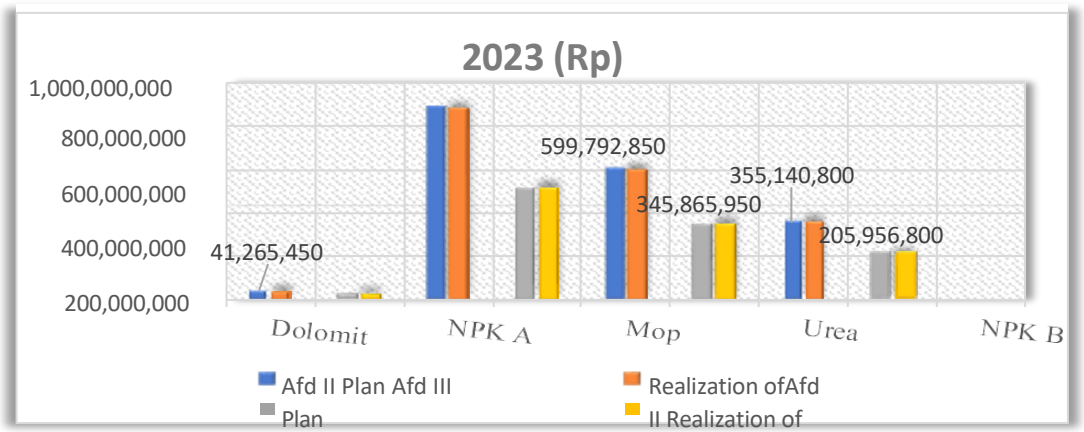

Figure 2. Graph of Planned and Actual Fertilizer Requirement Costs for Divisions II and III in 2023.

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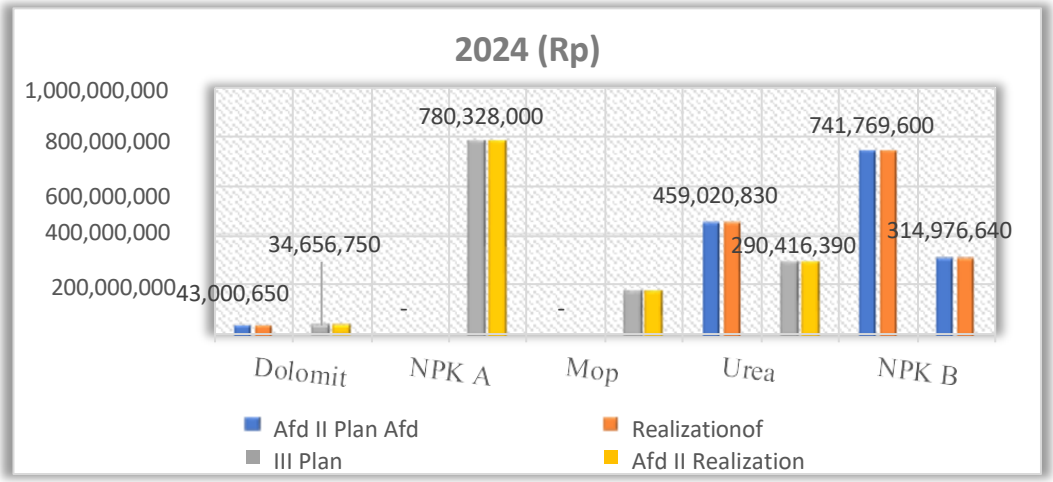

Figure 3. Graph of Planned and Actual Costs for Fertilizer Requirements for Divisions II and III in 2024.

From the three graphic images above, it can be seen that the cost of mechanical fertilization using a spreader, the highest fertilizer cost was in 2023 with a total cost of IDR.2,961,217,750Meanwhile, fertilizer costs in 2022 were Rp. 2,230,080,800. This condition occurred because mechanical fertilization using a Fertilizer Spreader was only carried out in 2022, so adjustments were needed to the course of mechanical fertilization with a Fertilizer Spreader.

Fertilizer Cost Summary

A summary is a summary of all available data to facilitate easier viewing and understanding of the overall data. This summary includes data on fertilizer purchase costs, fertilizer transportation costs, fertilizer fuel costs, truck loading costs, spreader loading and unloading costs, and operator costs.

Recapitulation of Fertilization Costs for Division II

Table 4. Recapitulation of Fertilization Costs for Division II of Pulau Tiga Plantation.

Division II					
Year	2022	2023	2024	Total	Rearata
Fertilizer Purchase	1,508,262,550	1,871,780,150	1,243,791,080	4,623,833,780	1,541,277,927
Transportation Rates	9,287,200	16,819,000	11,994,840	38,101,040	12,700,347
Fuel Costs	10,985,800	20,953,086	16,234,313	48,173,199	16,057,733
Loading FeeTo the Truck	2,678,850	4,586,850	3,271,320	10,537,020	3,512,340
Loading and Unloading Costs to Spreader	2,678,850	4,586,850	3,271,320	10,537,020	3,512,340

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Operator Fees	18,064,716	20,676,462	12,920,405	51,661,583	17,220,528
Total (Rp)	1,551,957,966	1,939,402,398	1,291,483,278	4,782,843,642	1,605,789
Land area (Ha)	700	1,302	976.5	2,978.50	992.83
Principal Amount	90,623	162,000	108,046	360,669	121
Cost/PKK (Rp)	17,125	11,972	11,953	41,050	13,261

Source: Pulau Tiga Plantation, PT. Perkebunan Nusantara IV Regional VI KSO.

Table 4 shows the fertilization costs, which include purchasing fertilizer materials, transportation costs, fuel costs, truck loading costs, spreader loading and unloading costs, and operator costs in Division II. Of all the fertilization costs mentioned above, purchasing fertilizer materials is the largest cost in fertilization. Meanwhile, loading and unloading costs into trucks and spreader loading and unloading costs are the lowest compared to other fertilization costs.

The cost of mechanical fertilization on oil palm yielding plants (TM) in Division II was Rp. 4,782,843,642 with a cost per hectare of Rp. 1,605,789 and a cost per tree of Rp. 13,261.

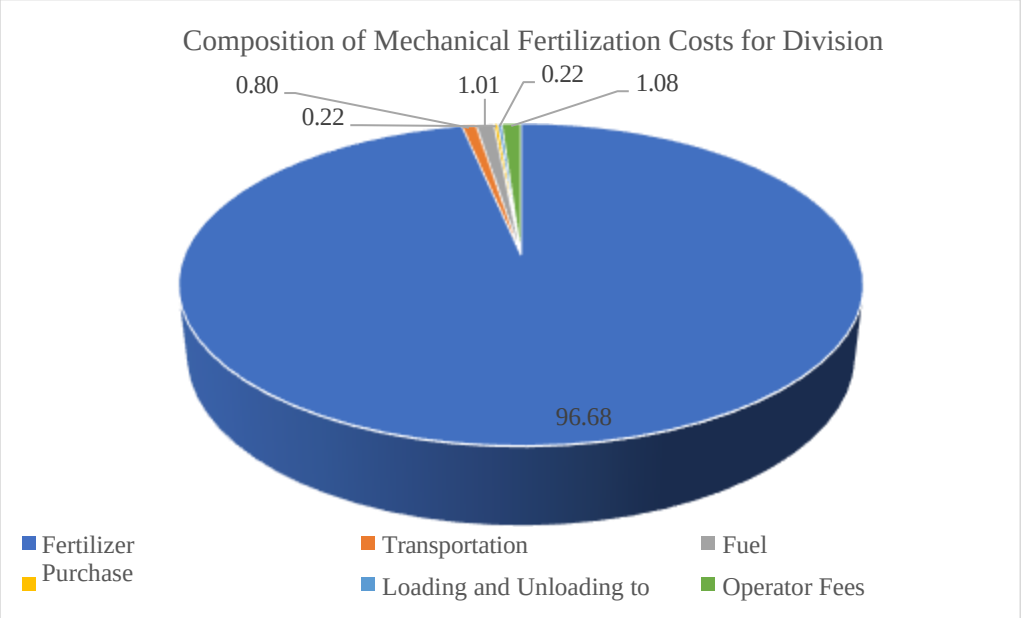

Figure 4. Components of mechanical fertilization costs for Division II.

The components of the mechanical fertilization costs for oil palm are fertilizer purchase costs of 96.68%, transportation costs of 0.80%, fuel costs of 1.01%, loading costs to trucks of 0.22%, loading and unloading costs to spreaders of 0.22% and operator costs in Afdelling II of 1.08%.

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Recapitulation of Fertilization Costs for Division III

Table 5. Recapitulation of Fertilization Costs for Division III of Pulau Tiga Plantation.

Division II					
Year	2022	2023	2024	Total	Average
Fertilizer Purchase	721,919,250	1,089,437,600	1,590,138,069	3,401,494,919	1,133,831,640
Transportation Rates	4,438,200	9,825,750	13,886,070	28,150,020	9,383,340
Fuel Costs	6,026,496	11,812,262	13,705,650	31,544,408	10,514,803
Loading FeeTo the Truck	1,280,250	2,679,750	3,787,110	7,747,110	2,582,370
Loading FeeUnload to Spreader	1,280,250	2,679,750	3,787,110	7,747,110	2,582,370
Operator Fees	9,925,271	11,656,315	10,907,918	32,489,504	10,829,835
Total (Rp)	744,869,717	1,128,091,427	1,636,211,927	3,509,173,071	1,806,617
Area (Ha)	384	734	824.4	1,942.40	647.46
Principal Amount	54,830	98,118	135,410	288,358	148
Cost/Principal (Rp)	13,585	11,497	12,083	37,166	12,170

Source: Pulau Tiga Plantation, PT. Perkebunan Nusantara IV Regional VI KSO.

Table 5 shows the fertilization costs, which include purchasing fertilizer materials, transportation costs, fuel costs, truck loading costs, loading and unloading costs to the spreader, and operator costs in Division III. Of all the fertilization costs mentioned above, purchasing fertilizer materials is the largest cost in fertilization. Meanwhile, loading and unloading costs to the truck and loading and unloading costs to the spreader are the lowest compared to other costs in fertilization.

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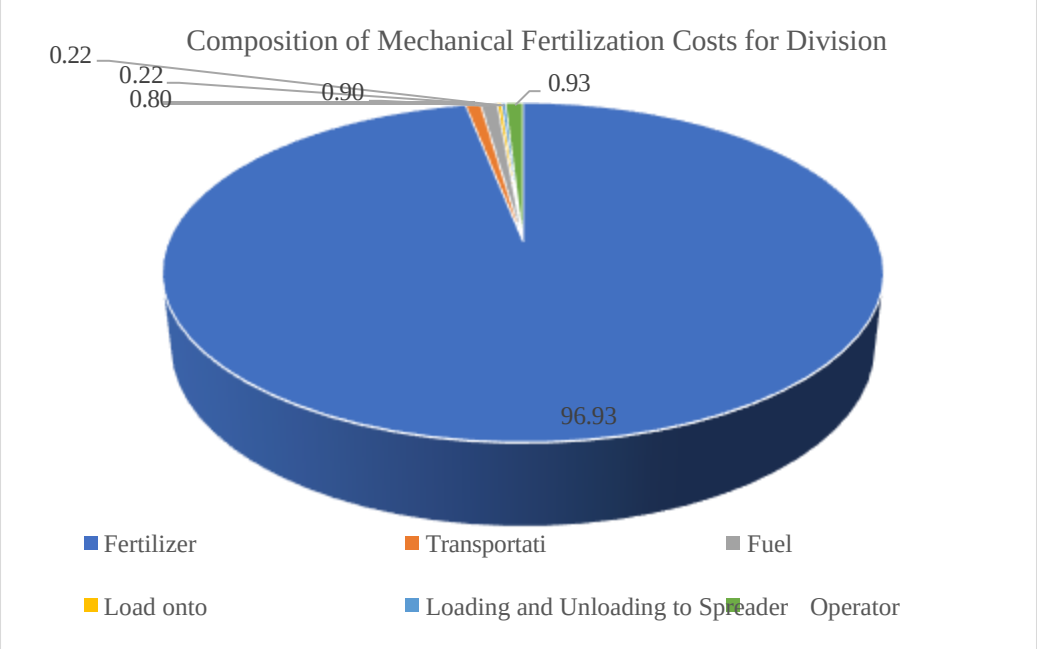
In Division III, fertilization costs amounted to Rp. 3,509,173,071 with a cost per hectare of Rp. 1,806,617 and a cost per tree of Rp. 12,170.

Figure 5 Components of mechanical fertilization costs for Division III.



The components of the mechanical fertilization costs for oil palm are fertilizer purchase costs of 96.93%, transportation costs of 0.80%, fuel costs of 0.90%, loading costs to trucks of 0.22%, loading and unloading costs to spreaders of 0.22% and operator costs in Afdelling II of 0.93%.

The fertilization cost component for oil palm producing plants (TM) in Division II is Rp. 4,782,843,642 (57.68%), while for Division III it is Rp. 3,509,173,071 (42.32%), of the total costs for Divisions II and III.

Total and Average Fertilization Costs for Divisions II and III

Table 6. Total and Average Fertilization Costs for Divisions II and III of Pulau Tiga Plantation.

Year	Total	Average
2022	2,296,827,683	765,609,228
2023	3,067,493,825	1,022,497,942
2024	2,927,695,205	975,898,402

Source: Pulau Tiga Plantation, PT. Perkebunan Nusantara IV Regional VI KSO.

Table 6 shows the total and average fertilizer costs for Divisions II and III. In 2023, total fertilizer costs reached Rp 3,067,493,825, the highest total cost over the past three years. The lowest total cost occurred in 2022, with a total fertilizer cost of Rp 2,296,827,683.

Data analysis

Classical Assumption Testing

The normality test used in this study was the Shapiro-Wilk test. The Shapiro-Wilk test is one of the most commonly used statistical tests for normality, especially for small to medium sample sizes. This test provides a W value and a p-value, which are used to determine whether

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the data is normally distributed. If the p-value is greater than 0.05, the data is considered normally distributed (Budiyono, 2013).

Table 7 Normality Test.

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Afd	Statistic	df	Sig.	Statistic	df	Sig.
Biaya	Afdelling 2	.218	3	.	.987	3	.785
	Afdelling 3	.204	3	.	.993	3	.846

a. Lilliefors Significance Correction

Source: Data processing with SPSS

Based on table 7 shows that the normality test in Division II shows a Sign value or p-value of 0.785 and Division III of 0.846 with 3 data in each Division. The sign value above shows that both data are normally distributed because the sign value is > 0.05 so that the data above can be continued with parametric independent sample t-test analysis. According to Budiyono (2013) If this normality assumption is not met, the results of statistical analysis can be invalid or misleading. In the world of research and data analysis, data collection is a very important initial step to obtain valid and reliable information. Data collection aims to provide information that will later be processed, analyzed, and interpreted to answer research questions or test the proposed hypothesis.

Analysis of Fertilization Costs in Divisions II and III, analyzed using an independent sample t-test with the following decision making:

If the Sig value (significance) > α (0.05) then H_0accepted and H1rejected. If the Sig value (significance) < α (0.05) then H0rejected and H1accepted.The first output is Groups Statistics

Table 8. Group Statistics

	Group	Amount	Mean	Std. Deviation	Std.Error Mean
Fertili zer Costs	Division 2	3	1594281214	326026439	188231452
	Division 3	3	1169724357	447127173	258148994

Source: Data processing with SPSS

Table 8 shows the average fertilization costs of Division II and III (1,594,281,214 > 1,169,724,357) with a low difference and it is clear that the average fertilization costs of

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Division II is higher than those of Division III. To see whether this difference is statistically significant, we must look at the output of the second part (Independent Sample Test). According to Ghozali (2021), there are 2 stages of analysis carried out, first, we must test the assumption whether the population variance of the two samples is the same (Equal Variance Assumed) or different (equal Variance not assumed) by looking at the Levene Test value. After knowing whether the variance is the same or not, the next step is to look at the t-test to determine whether there is a significant difference in value.

Table 9 Results of Independent T-Test of Sample Fertilization Costs for Divisions II and III.

Independent Samples Test

		Fertilizer Costs	
		Same variance assumption	Equal variance isnot assumed
Levene's Test of Equality of Variance	F	0.240	
	Sig.	0.650	
T-test for equality of means	t	1,329	1,329
	df	4	3,658
	Sig. (2-tailed)	0.255	0.261
	Mean Difference	424556857	424556857
	Std. error Difference	319487062	319487062
	95% level	-462481433	-496164421

Source: Data processing with SPSS

Based on the results of the analysis above, it is known that the calculated F Levene's Test is 0.240 > 0.05, which means that the data variance between group A and group B is the same. Thus, the analysis of the t-test difference test must use the Equal Variance Assumed Assumption. Based on the output table of the "Independent Samples test" in the "Equal Variances Assumed" section, the Sig. (2-tailed) value is 0.255 > 0.05, so as the basis for decision making in the independent sample t-test, it can be concluded that H0accepted and H1rejected. Thus it can be concluded that there was no significant difference in mechanical fertilization using Fertilizer Spreader between Division II and III. According to one (2015) in processing with SPSS, researchers do not need to compare the calculated t-value with the t-table value but only need to see the significance of the t-value. If the significance value is less than 0.05 ($p < 0.05$) it means that the calculated t-value is significant, which means that the scores of the two groups are significantly different. Conversely, if the significance value is greater than 0.05 ($p > 0.05$) it means that the calculated t-value is not significant, meaning that there is no significant difference in scores between the two groups.

The implementation of mechanical fertilization in Pulau Tiga plantation includes transporting fertilizer from the warehouse to the truck, from the truck to the area, fertilizer distribution at the supply point, loading and unloading fertilizer from the supply point to the

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Fertilizer Spreader tank followed by mechanical fertilization or commonly called fertilization with a Spreader car where the implementation is adjusted to rainfall conditions. The type of fertilizer used in Pulau Tiga Plantation of PT. Perkebunan Nusantara IV Regional VI KSO is a type of fertilizer specially ordered by PTPN III group. Inorganic fertilizers that are not available in the plantation market in Indonesia. In addition to using inorganic fertilizers, Pulau Tiga Plantation also uses organic fertilizers derived from palm oil mill waste. The types of inorganic fertilizers used are dolomite, borate, NPK 12.12.17.2, NPK 13.6.27.4, MOP and Urea while there are empty and solid fruit bunches which are organic fertilizers from palm oil mill waste. Some inorganic fertilizers are quite expensive when compared to other fertilizers. MOP was the most expensive fertilizer, reaching Rp. 12,327/kg in 2022, while dolomite was the cheapest inorganic fertilizer, with a purchase price of Rp. 621/kg in 2023. The organic fertilizer, in the form of empty and solid fruit bunches, was obtained free of charge from the Pulau Tiga Plantation palm oil mill waste.

According to the guideline or work manual of PT. Perkebunan Nusantara IV Regional VI KSO, there are detailed costs in fertilization, namely the costs of transport and retail fertilizer, unloading/loading fertilizer from the warehouse to the truck, unloading/loading fertilizer to the Fertilizer Spreader, fertilizing with mechanical tools (operator wages) and there are costs directly related to mechanical fertilization, namely the costs of purchasing fertilizer materials and fuel costs for the spreader car. Of all types of fertilization costs above, purchasing fertilizer materials is the largest cost in fertilization. Meanwhile, the cost of unloading/loading fertilizer to the truck and unloading/loading fertilizer to the Fertilizer Spreader is the lowest cost compared to other costs in fertilization. The total cost of fertilization in Afdelling II and III in 2023 reaches Rp. 3,067,493,825, - and was the largest total cost over the past 3 years. While the lowest total cost occurred in 2022 with a total fertilizer cost of Rp. 2,296,827,683, - These costs include the costs of transporting and retailing fertilizer, unloading/loading fertilizer from the warehouse to the truck, unloading/loading fertilizer to the Fertilizer Spreader, fertilizing with mechanical tools (operator wages), the cost of purchasing fertilizer materials, and the cost of fuel for the spreader car. The results of the analysis of fertilizer costs in divisions II and III did not show a significant difference. Fertilizer costs for the last 3 years from 2022 to 2024, Division II incurred a total fertilizer cost of Rp. 4,782,843,642, while the total fertilizer costs for Division III for the last 3 years from 2022 to 2024 amounted to Rp. 3,509,173,071, with a difference that was not that large compared to Division III.

CONCLUSION

The composition of mechanical fertilization costs using Fertilizer Spreader on oil palm plants consists of fertilizer purchase costs, transportation costs, loading costs to trucks, loading and unloading costs to spreaders, fuel costs and operator costs. The largest composition of mechanical fertilization costs in the last 3 years in Oil Palm Producing Plants (TM) in Afdelling II is the purchase of fertilizer with a percentage of 96.68%, or Rp. 4,623,833,780 while in Afdelling II the largest composition is the cost of purchasing fertilizer with a percentage of 96.93% or Rp. 3,401,494,919. The results of the independent sample T-test analysis test show a P-Value or Sig. (2-tailed) of 0.255> 0.05, so based on the basis of decision making that, there is no significant difference (real) between the fertilization costs of Afdelling II and Afdelling III in the Pulau Tiga Plantation of PT. Nusantara IV Plantation Regional VI KSO.

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