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Comparative Analysis of Income on Palm Oil Production Between the Land Application (LA) and Non Land Application (NLA) Waste Management in Lubuk Dalam Estate of PTPN V, Siak District, Riau Province, Indonesia

E Tety[1], A Rifai[1], TH Rasyid[2], Y Kusumawaty[1] and S Tarigan[3]

1Agribusiness Department, Faculty of Agriculture Riau University, Indonesia
2Research and Development Agency of Riau Province, Indonesia
3Alumnus of Agribusiness Department, Faculty of Agriculture Riau University, Indonesia

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CORRESPONDING AUTHOR

*E-mail: yeni.kusumawaty@lecturer.unri.ac.id

A B S T R A C T

This study aimed to compare the level of income on the production of Fresh Fruit Bunches (FFB) for Land Application (LA) and Non Land Application (NLA) fields. The data used was secondary data from the company in terms of information on the area of palm oil plantations, palm oil production, waste production, and the spread of palm oil liquid waste. Data analysis applied analysis of production, depreciation, cost analysis, revenue, net income, and production efficiency. Based on the results of the study, FFB income in PTPN V Lubuk Dalam Estate from Land Application (LA) field was IDR 51,816,821 / ha / year, which was higher than the income from Non Land Application (NLA) field of IDR 33,073,190 / ha / year. In conclusion, PTPN V Lubuk Dalam Estate received higher income by applying LA waste management compared to Non Land application (NLA).

1. INTRODUCTION

1.1. Research Background

Palm oil has become the largest edible oil in the world since 2005. Crude Palm Oil (CPO) is a primary commodity in Indonesia to earn foreign exchange from the agro-industry sector. Indonesia plays an important role in the world CPO market share where 80 percent of the world's palm oil is produced in Indonesia and Malaysia. In addition, the contribution of palm oil to national exports reached 60%, making palm oil the main commodity in Indonesia.

Since the early 1980s, the total area allocated for oil palm has increased rapidly globally, reaching nearly 14 million hectares in 2007. Most of this expansion has occurred in Indonesia, where the total area of oil palm plantations has increased by more than 22 times larger, expanding to 4.6 million hectares [1]. The total land area officially allocated for oil palm in Indonesia is estimated at around 6.2 million hectares (less than 4 percent of Indonesia's land area, but reaching 15 percent in several provinces in Sumatra) [2].

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The increase in CPO production causes the higher potential of by-products in the process of processing fresh fruit bunches (FFB) into CPO. During the processing of palm fruit into palm oil, solid and liquid waste is produced which still contains oil and other organic components. So far, the waste produced by palm oil mills with traditional systems is dumped into rivers without any added value obtained. Even though the waste can be used as fertilizer because the nutrient content is quite high, and it is non-toxic and harmless.

Since 1999, PTPN V Lubuk Dalam Estate in Riau Province has applied the method of application of liquid waste with a flatbed system method, namely by flowing waste through pipes to distribution tanks and then to primary and secondary trenches. This company is located in Lubuk Dalam Village, Lubuk Dalam Sub-District, Siak District. This company is engaged in palm oil plantation and palm oil processing plants into CPO and PKO (Palm Kernel Oil). The comparison of palm oil production between Land Application (LA) and Non-Land Application (NLA) fields in PTPN V Lubuk Dalam Estate, Siak Regency needs to be analyzed.

1.2. Literature Review

The major environmental burden of palm oil mills has resulted from POME (Palm Oil Mill Effluent). Each ton of CPO production will produce about 2.5–3.0 m^3 of POME [3]. POME, either in fresh or treated form, contains a high level of plant nutrients. A sound alternative for the utilization of the treated POME is applying it as liquid fertilizer on the oil palm plantation. In Indonesia, land application of POME is regulated in the decree of Ministry of Environment number 28 and 29 [4].

The Land Application (LA) waste management system has been applied in Malaysia since the end of 1970. In terms of investment, the cost of building a Land Application (LA) system is almost equal to the cost of building traditional system pools. The Land Application (LA) system requires greater operational costs than traditional systems. However, the Land Application (LA) system still provides benefits because it will reduce the cost of purchasing inorganic fertilizers between 60-105 million per year and can increase fruit bunch production between 125-310 million per year.

1.3. Research Objective

This study aimed to compare the level of income on the production of Fresh Fruit Bunches (FFB) for Land Application (LA) and Non-Land Application (NLA) fields

2. MATERIALS AND METHODS

2.1. Time and location of research

The research was conducted at PTPN V Lubuk Dalam Estate, Siak District, Riau Province, Indonesia. Site selection is based on the consideration that the company processes waste utilization based on the Land Application System. The study was conducted from November 2017 until May 2018.

2.2. Sampling method

The most extensive area which is drained by liquid waste is afdeling (department) VII in Lubuk Dalam Estate with 164 ha. However, the researchers only examined the area of about 96 ha affected by palm oil liquid waste and 18 ha of oil palm plants that were not affected by the waste, considering that these were the land plots in the same location with a similar type of seed and planting year. The application of liquid waste utilization has been carried out by PTPN V since 1999.

2.3. Data collection method

This research was carried out by using primary and secondary data. Secondary data was obtained from the company (PTPN V Lubuk Dalam Estate) and supported by the literature.

2.4. Data analysis

2.4.1. Production analysis

a. Total Cost (TC): costs that cover the total amount of production costs incurred by the company for production activities, using the formula: TC = TFC + TVC

b. Total Fixed Cost (TFC): costs which include expenses to obtain fixed production factors, for example building maintenance costs, depreciation costs [5] using the formula: TFC = TC - TVC

c. Total Variable Cost / TVC: the overall costs incurred by the company for the production factor and may vary according to the production output that will be produced. Examples: raw material costs, labor costs, fuel [5], using the formula: TVC = TC – TFC

2.4.2. Depreciation

The depreciation method used in this study is a straight-line method, where the depreciation expense is calculated as the same amount for each year. Depreciation formula: D=(NB-NS)/UE

2.4.3. Cost analysis

Calculating the amount of costs used in a business with the formula: TC = FC + VC

2.4.4. Revenue

Revenue is all revenue from the sale of goods or output as follows: TR = Q x P

2.4.5. Net income

Net income is total revenues obtained by producers after deducting the total costs incurred during the production process. Net income was calculated using the following formula:

π = TR - TC

π = Y.Py - (TVC + TFC)

π = Y.Py - (X1.PX1 + X2.PX2 + ... X.PXn + D + i)

2.4.6. Business efficiency

Business efficiency is a measurement that compares plans for using inputs with real use (actual use). Production efficiency is calculated as follows: RCR = TR / TC.

3. RESULTS AND DISCUSSION

3.1. Palm oil liquid waste production

3.1.1. Liquid waste production process (POME)

Waste from the Palm Oil Mill has flowed into the fat pit. Inside the fat pit, there is heating by using steam from the BPV. This heating is needed to facilitate the separation of oil from sludge because in this fat pit it is still possible to extract oil using a skimmer. The waste from the fat pit is then channeled to the cooling pond which is useful for cooling the waste that has been heated. Cooling the pond, in addition to cooling the waste, also serves to precipitate sludge. From waste cooling pond I the waste then enters cooling pond II to undergo the same cooling process with cooling pond I. Waste from cooling pond II then flows to anaerobic ponds 1, 2, 3.

In anaerobic ponds, biological treatment of waste occurs by using metagonic bacteria that already exist in the pond. Organic elements contained in liquid waste are used by bacteria as food in the process of converting liquid waste into materials that are not harmful to the environment. In anaerobic ponds, there is a decrease in BOD and a minimum pH increase of 6. Scum thickness in anaerobic ponds should not be thicker than 25 cm, if the thickness has exceeded 25 cm it is a sign that the bacteria is not functioning properly.

After the anaerobic pool, the waste enters the maturity pond which serves to ripen the waste (as well as increasing pH and

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decreasing BOD). At the maturity pond, there is a pump that functions to circulate waste back into the anaerobic pond. The use of circulation is to help reduce temperature and increase pH in anaerobic pools 1, 2, 3. After the maturity pond, the waste then goes into the application pool which is the waste disposal site. The waste contained in this application pool is used for oil palm fertilizer (Land Application).

3.1.2. Palm oil liquid waste production

Each ton of processed palm oil fresh fruit bunches (FFB) will produce 50% of the content of palm oil liquid waste. Table 1 describes the production of palm oil liquid waste (POME) in the PTPN V Lubuk Dalam plantation company. The research was conducted at PTPN V Lubuk Dalam Estate, Siak District, Riau Province, Indonesia. Site selection is based on the consideration that the company processes waste utilization based on the Land Application System.

Table 1. Production and Amount of Wastewater in 2017

No.	Month	Fresh fruit bunch production (ton)	Amount of liquid waste (m^3)
1.	January	12,296	7,377.60
2.	February	12,078	7,365.80
3.	March	12,301	7,40.00
4.	April	12,056	7,351.00
5.	May	12,045	7,351.00
6.	June	12,296	7,400.01
7.	July	12,072	7,364.60
8.	August	11,712	6,590.00
9.	September	11,699	6,990.00
10.	October	11,692	6,989.77
11.	November	12,295	7,377.60
12.	December	12,286	7,371.02
Total		**144,828**	**86,929.4**

Table 1 shows that oil palm liquid waste production in PTPN V Lubuk Dalam Estate is 86,929.4 m^3 with the number of Fresh Fruit Bunches (FFB) of 144,898 tons FFB / year. The average production of Fresh Fruit Bunches (FFB) is 12,069 tons/month, and the average amount of liquid waste produced is 7,244.11 m^3 / month.

3.1.3. Characteristics of palm oil liquid waste (POME)

Alternative use of POME wastewater that provides yield or added value, as it can be used as organic fertilizers or diluent for composting. Table 2 shows the characteristic of liquid waste. Liquid waste itself contains nutrients including N (Nitrogen), P (Phosphorus), K (Potassium) Ca (Calcium), and Mg (Magnesium).

Table 2. Characteristics of liquid waste (POME)

No.	Parameters	Unit	Range
1.	BOD	Mg/l	20.000-30.000
2.	COD	Mg/l	40.000-60.000
3.	Suspended Solid	Mg/l	15.000-40.000
4.	Total Solid	Mg/l	30.000-70.000
5.	Fat and Oil	Mg/l	5.000-7.000
6.	NH3 – N	Mg/l	30-40
7.	Total N	Mg/l	500-800
8.	Temperature	Mg/l	90-100
9.	PH	-	4-5

3.1.4. The nutritional content of liquid waste

Table 3 shows the content of N, P, K, and Mg in 100 tons of palm oil liquid waste

Tabel 3. The content of N, P, K, and Mg in 100 tons of palm oil liquid waste.

Element	BOD 25.000 (mg/l)	BOD < 5.000 mg/l
Nitrogen, Kg	50-90 (70)	50-67,5 (55)
phosphate, Kg	9-14 (12)	9-11 (9)
Potassium, Kg	100-200 (150)	100-185 (85)
Magnesium, Kg	25-34 (30)	15-32 (18)

3.2. Palm oil liquid waste treatment process

Recently, biological treatment of POME using series of open ponds followed by land application of treated POME is a common practice for wastewater treatment in palm oil industries. Studies by various groups have demonstrated that such application has been beneficial to palm oil [6]. The processing of palm oil mill effluent must be carried out to comply with government regulations and environmental laws [7]. The pool system that is mostly applied is as follows:

3.2.1. Neutralization Tank (Neutralizing Tank)

This tank is used to increase the pH of the waste from 4.2 to 7.0. Materials that are often added are caustic soda, calcium oxide (CaO), empty bunch ash, and neutral liquid waste.

3.2.2. Cooling Tower

Cooling towers are used to reduce the temperature of factory waste before being put into ponds from ± 70 ^{0}C to ± 40 ^{0}C. This is applied because at ± 70 ^{0}C the decomposing bacteria (methane gas producer) dies, while the optimum temperature is ± 40 ^{0}C.

3.2.3. Breeding Pond (Seeding Pond)

Breeding ponds are used to breed bacteria that will work in anaerobic ponds. This pool capacity is ± 350 m^3 which contains a high concentration of bacteria. Some bacteria will be put into anaerobic ponds at certain times.

3.2.4. Anaerobic Pond (Anaerobic Pond)

The main processing of palm oil mill waste occurs in anaerobic ponds, where fat is converted into methane gas.

Anaerobic ponds can accommodate wastewater from the processing of palm oil mills for 60 days, the fat is converted into organic acid and then the organic acid is converted into methane gas by anaerobic bacteria.

3.2.5. Aeration Pool

Aeration ponds are used to enrich waste fluids with oxygen and kill anaerobic bacteria by spreading liquid waste into the air using an aerator, or by entering air into the waste liquid using a compressor.

3.2.6. Aerobic Pool (Aerobic Pond)

This pool is the last in the process of treating wastewater and is used to provide the opportunity for liquid from the settling pond to absorb more oxygen from the air.

3.2.7. Settling Pond

Sedimentation ponds are used to precipitate solids, which are contained by liquids originating from anaerobic ponds. The pool can hold waste liquid for 15 days of processing. Figure 1 explains the flow of wastewater treatment of Land application (LA) system, which starts from palm oil liquid waste produced in the processing of Fresh Fruit Bunches (FFB) at the Palm Oil Mill (PKS) until it becomes the final result of useful waste that will be flowed to the afdeling VII plantation of Lubuk Dalam Estate.

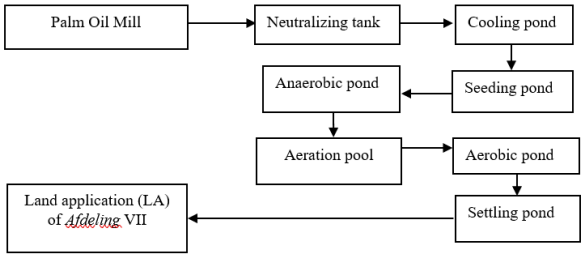

Figure 1. The flow of palm oil wastewater treatment of Land application (LA) system in Lubuk Dalam Estate of PTPN V

3.3. Production cost analysis

3.3.1. Planting area

Palm oil plantations for LA and Non-Land Application (NLA) plant areas also have similarities, namely the state of the soil having the same physical characteristics, and the same type of seeds and age (Table 4).

Table 4. Planting Area of the palm oil per block

Land Application (LA)		Non-Land Application (NLA)	
Block	Area (ha)	Block	Area (ha)
R 19	25	S 23	13
S 19	25	U 19	2
T 19	20	U 21	3
T 21	20		
T 23	6		
Total	96		18

3.3.2. Number of plants

The decision related to planting density or stand per hectare (SHP) is an important decision that will have a long-term impact, especially related to productivity (Table 5).

Table 5. Number of Plant and Planting Year of the Palm Oil

	Afdeling	Block	Planting area (ha)	Number of plants	Planting year
LA	VII	R19	23.00	3,401	1991
		S19	23.50	3,461	
		T19	17.09	2,661	
		T21	20.00	2,885	
		T23	6.00	1,052	
Total			86,59	13.460	
	Afdeling	Block	Planting area (ha)	Number of plants	Planting year
NLA	VII	S23	13	1,564	1991
		U19	2	210	
		U21	3	348	
Total			18	2,122	

3.3.3. Fresh fruit bunch (FFB) production.

Factors influencing the level of oil palm production include soil type, climate, and water availability. Tree density also determines production, where the age of 7-9 years of oil palm plants has reached the maximum leaf midrib length while high production is obtained from plants aged 7-11 years [8]. Table 6 shows the comparison of FFB production on land flowed with palm oil wastewater (LA) which is greater (total production of 38,431 kg/ha/year) compared to palm oil production with Non-Land Application (total production of 24,495 kg/ha/year).

Table 6. Fresh Fruit Bunch Production in Lubuk Dalam Estate of PTPN V

No.	Month	FFB Production (kg)	
		LA	**NLA**
1.	January	2,304	1,938
2.	February	2,244	1,908
3.	March	3,216	1,996
4.	April	3,446	2,019
5.	May	4,513	2,086
6.	June	3,480	2,049
7.	July	3,511	2,013
8.	August	3,196	2,034
9.	September	3,180	2,083
10.	October	3,401	2,105
11.	November	2,870	2,155
12.	December	3,070	2,109
Total		**24,495**	**38,431**

Peak productivity of palm oil plantations is achieved in the 9th year of plant life [9]. Data in North Sumatra shows that in large private plantation companies the productivity is 27.6 tons (27,600

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kg) of FFB per hectare per year while in smallholders' farms the productivity is only 13.6 tons (13,600 kg) of FFB per hectare per year. Related research concluded that the application of treated POME also extensively saves the fertilizer cost as well as increased the productivity of plantation. The utilization of treated POME for land application has increased FFBs production by about 13% compared to that plantation without land application.

3.3.4. Number of bunches (janjang)

Table 7 shows data on the number of bunches (*janjang*) harvested during the year 2017. The number of bunches on Non-Land Application (NLA) land is 1,214 bunches per year per hectare. Whereas on Land Application (LA) plots, the number of bunches harvested is much less than that on NLA plots.

Table 7. Number of bunches harvested during the year 2017

No.	Month	Number of bunches per ha	
		LA	**NLA**
1	January	123	98
2	February	113	98
3	March	116	106
4	April	113	105
5	May	114	106
6	June	115	94
7	July	115	94
8	August	116	98
9	September	118	99
10	October	118	105
11	November	118	105
12	December	114	106
Total		**1,214**	**1,394**

3.3.5. Weight of fresh fruit bunch

Table 8 shows that the total weight of bunches in LA plots is higher than those in NLA plots.

Table 8. Average Weight of Fresh Fruit Bunch in Lubuk Dalam estate of PTPN V

No.	Month	Weight of Bunch (kg)	
		LA	**NLA**
1.	January	20.61	19.82
2.	February	20.41	20.36
3.	March	20.85	20.78
4.	April	20.85	20.57
5.	May	19.50	15.96
6.	June	20.73	18.86
7.	July	16.19	15.48
8.	August	16.89	15.54
9.	September	17.45	15.64
10.	October	21.71	19.87
11.	November	21.71	15.50
12.	December	19.87	18.86
	Total	**247.44**	**217.20**

Palm oil production is usually calculated by weighing the overall fruit bunches produced. However, to maintain product quality, acceptable fruit bunches for processing must meet certain requirements, including fruit bunch weight.

3.4. Financial analysis

This research shows that there is an increase in production with the application of liquid waste in palm oil compared to land that does not use palm oil liquid waste. Based on the increase in production, it can be calculated how many financial benefits are obtained from the application of liquid waste, such as the amount of fertilizer costs saved and company profits from the increased production.

3.4.1. Use of fertilizer

Table 9 explains that in PTPN V, fertilizers are not used in the Land Application (LA) plots, whereas in Non-Land Application (NLA) plots, fertilizers are used in cultivation, precisely in Afdeling VII, Za, KCL, Urea, MOP, Dolomite, and Borate were applied.

Table 9. Cost of Fertilizer in 2017

No.	Type of fertilizer	Areas	
		LA	**NLA**
1.	Za	-	32.256.000
2.	KCL	-	60.480.000
3.	Urea	-	58.907.520
4.	MOP	-	62.818.560
5.	Dolomite	-	11.924.640
6.	Borate	-	54.583.200
Total		**0**	**80.969.920**

3.4.2. Labor cost

Table 10 shows the costs incurred for labor in the process of providing liquid waste to palm oil plants. The standard for fertilizer spreader labor at PTPN V of Lubuk Dalam in 2017 is 24 working days (HK) per month.

Table 10. Labour Costs in 2017

Land Application (LA)			
Activity	Amount	Working Day (HK)	Value
Supervisor	1	24.00	34,560,000
Operator (Labor)	8	24.00	184,320,000
Harvesting cost	-	-	3,650,945
Total			9,222,530,945
Non Land Application (NLA)			
Activity	Amount	Working Day (HK)	Value
Supervisor	1	36.18	4,646,633
Fertilizer disassembling	2	36.18	4,703,400
Fertilizer Spreader Labor	8	36.18	18,813,600
Harvesting Cost	-	-	2,327,025
Total			1,130,490,658

3.4.3. Maintenance cost

Costs incurred in one year for maintenance on Land Application Land (LA) amounted to IDR 343,403,520 for an area of 96 ha, while for Non-Land Application (NLA) maintenance costs were IDR 651,000 / year with an area of 18 ha.

3.4.4. Cost of analysis

Cost analysis is only used for Land Land Application (LA), which is for analyzing waste, whether the treated waste still contains poison or not. Costs incurred for the cost of waste analysis are IDR 12,600,000 / year.

3.4.5. Electricity

The cost of electricity usage in the Land Application (LA) plots is IDR 35,941,835 per month. This electricity usage level is 14 hours per day, each usage is 7 hours and the electricity is used for pumping wastewater into LA lands twice a day. Therefore in a year, the electricity usage for the sewage pumping machine is IDR 431,302,008.

3.4.6. Depreciation costs of equipment, machine, and building

The total cost of depreciation for equipment, machinery, and buildings for the land area of 96 ha is IDR 73,214,406 / year, therefore the average depreciation cost for Land Application (LA) per ha is IDR 762,650 / year/ha.

Table 11. Depreciation costs of Equipment, Machines, and Buildings

No	**Land Application (LA)**		
	Equipment and machines	Unit	Value/year
1.	Machines (pumps)	2	11,960,000
2.	Electric motor	2	883,258
2.	Pipes	340	44,438,000
3.	Pipe connectors	340	12,767,000
4.	Taps	18	778,500
5.	Tap connectors	18	675,900
6.	Land Application Building	-	1,711,748
Total			**73,214,406**
No.	**Non-Land Application (NLA)**		
	Equipment and machines	Unit	Value/year
1.	Plastic buckets	10	180,000
2.	Fertilizer measuring cups	10	109,992
3.	Hoes	8	146,664
4.	Bowls (*cepuk*)	10	186,000
5.	Gloves	10	219,996
6.	Maskers	10	219,996
7.	Wheelbarrow	5	75,600
8.	Flat machete (*parang*)	4	60,492
9.	Fertilizer warehouse	1	7,404,000
Total			**8,404,000**

3.4.7. Transportation cost for liquid waste fertilizer

The application of liquid waste fertilizer is conducted by opening the faucets in each distribution basin in each block and some operators are responsible to turn the faucets on and off. The cost for employees who manage the fertilizer faucets is presented in Table 12. The company determines the cost of transporting fertilizer, which is IDR 50 / kg of fertilizer. Table 12 shows the amount of fertilizer used in fertilizing plants as many as 46,684 kg, and the transportation cost of the fertilizer is IDR 2,334,200.

Table 12. Transportation Cost for Liquid Waste Fertilizer in 2017

No.	**Land Application (LA)**		
	Type of Fertilizer	Amount (kg)	Cost (IDR)
Total		**0**	**0**
No.	**Non-Land Application (NLA)**		
	Type of Fertilizer	Amount (kg)	Cost (IDR)
1.	Za	8.488	424,400
2.	KCL	8.488	424,400
3.	Urea	8.488	424,400
4.	MOP	8.488	424,400
5.	Dolomite	8.488	424,400
6.	Borate	4.244	212,200
Total		**46.684**	**2,334,200**

3.4.8. Total Cost

The total expenditure in a month is IDR 90,254,240 per month, whereas for Non-Land Application (NLA) land the cost that must be issued per month is IDR 26,662,887 (Table 13).

Table 13. Total Cost Incurred in 2017

No.	**Land Application (LA)** Activity	Costs (IDR)
1.	Use of fertilizer	-
2.	Labor costs	222,530,945
3.	Maintenance costs	343,403,520
4.	Waste analysis costs	12,600,000
5.	Electricity cost	431,302,008
6.	Depreciation costs for equipment, machinery and buildings	73,214,406
7.	Fertilizer transportation costs	-
Total		**1,083,050,884**
No.	**Non-Land Application (NLA)** Activity	Costs (IDR)
1.	Use of fertilizer	280,960,920
2.	Labor costs	30,490,658
3.	Maintenance costs	651,742
4.	Waste analysis costs	-
5.	Electricity cost	-
6.	Depreciation costs for equipment, machinery and buildings	717,005
7.	Fertilizer transportation costs	2,334,200
Total		**315,154,525**

3.4.9. Revenue

Revenue is a benefit that can be expressed with the money received by the company. Table 14 shows the revenue of PTPN V Lubuk Dalam Estate for Land Application (LA) and Non Land Application (NLA) plots, where the revenue from LA plots (IDR

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51,816,821 per ha per year) are higher than that of NLA plots (IDR 33,073,190).

Table 14. Revenue per hectar for the company for Land Application (LA) and Non Land Application (NLA) plots

No.	Land Application (LA)			
	Month	Production (kg/ha)	FFB Price (IDR/kg)	Revenue (IDR)
1.	January	2,304	1,668	3,744,000
2.	February	2,244	1,701	3,646,500
3.	March	3,216	1,727	5,226,000
4.	April	3,446	1,483	5,599,750
5.	May	4,513	1,492	7,333,625
6.	June	3,480	1,508	5,655,000
7.	July	3,511	1,286	5,705,375
8.	August	3,196	998	5,193,500
9.	September	3,180	965	5,167,500
10.	October	3,401	1,115	5,526,625
11.	November	2,870	1,115	4,663,750
12.	December	3,070	1,220	4,988,750
Total			**38,431**	**51,816,821**
No.	**Non Land Application (NLA)**			
	Month	Production (kg/ha)	FFB Price (IDR/kg)	Revenue (IDR)
1.	January	1,938	1,668	3,232,584
2.	February	1,908	1,701	3,245,508
3.	March	1,996	1,727	3,447,092
4.	April	2,019	1,483	2,994,177
5.	May	2,086	1,492	3,112,312
6.	June	2,049	1,508	3,089,892
7.	July	2,013	1,286	2,588,718
8.	August	2,034	998	2,029,932
9.	September	2,083	965	2,010,095
10.	October	2,105	1,115	2,347,075
11.	November	2,155	1,115	2,402,825
12.	December	2,109	1,220	2,572,980
Total			**24,495**	**33,073,190**

3.3.10. Income

The value of R / C ratio is a comparison between total revenue and total cost, which shows the value of revenue obtained from each rupiah issued. To analyze the level of economic efficiency of farming, the RCR formula according to [10] was applied. Table 15 shows that RCR value of Land Application plots (4.4) is higher than that of Non Land Application plots (1.8). Moreover, as stated by [11], the treatment of POME is very critical to conserve the environment due to the emissions of biogas from POME and the concern on quality of the final discharge to the watercourse causing environmental degradation.

Table 15. Income for Land Application (LA) and Non Land Application (NLA) land at PTPN V Lubuk Dalam Estate

No.	**Land Application (LA)**		
	Total Revenue (TR) (IDR)	Total Cost (TC) (IDR)	RCR Value (RCR = TR/TC)
1.	4,831,354,320	1,083,050,884	4.4
No.	**Non Land Application (NLA)**		
	Total Revenue (TR) (IDR)	Total Cost (TC) (IDR)	RCR Value (RCR = TR/TC)
1.	595,695,934	315,154,525	1.8

4. CONCLUSION

This study compares the net income from palm oil production that utilizes palm oil liquid waste with net income of palm oil production which does not use liquid waste. For the plots using liquid waste, the production of Fresh Fruit Bunches (FFB) is 38,431 kg / ha / year with company revenue of IDR 51,816,821 / ha / year compared to palm oil production which does not use palm oil liquid waste which is 24,495 kg / ha / year with company revenue of IDR 33,073,190 / ha / year. It can be concluded that the application of palm oil liquid waste as a substitute for the use of fertilizers in oil palm plantations (Land Application) is very profitable for the company. The increase in net income from the utilization of palm oil liquid waste is due to higher oil palm production, more fruit bunches and higher bunch weight compared to oil palm production which does not use palm oil wastewater (Non Land Application).

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