UTILIZATION OF OIL PALM EMPTY FRUIT BUNCHES AS MULCH IN COMMUNITY OWNED OIL PALM PLANTATIONS (CASE STUDY IN SIMARDONA VILLAGE, NORTH SUMATRA)

Annisa Fitri Harahap[1*], Muslikhin Hidayat[2], Suhanan[3]

[1]Master in Systems Engineering, Universitas Gadjah Mada
[2]Department of Chemical Engineering, Universitas Gadjah Mada
[3]Department of Mechanical and Industrial Engineering, Universitas Gadjah Mada

Abstract

Solid Waste Oil Palm Empty Fruit Bunches have high nutrients, which significantly determine oil palm growth rate and production. Each nutrient has its role and can show specific symptoms in plants if their availability in the soil is very lacking. Dry oil palm land and the difficulty of procuring chemical fertilizers for the community that owns oil palm plantations in Simardona Village are expected to be overcome by the use of OPEFB. Utilization of Oil Palm Empty Bunches as Mulch was done manually in 4 research scenarios. Scenario 1 uses 2 kg of chemical fertilizers plus 250 kg of OPEFB, scenario 2 uses 2 kg of chemical fertilizers plus 300 kg of OPEFB, scenario 3 uses 2 kg of chemical fertilizers plus 350 kg of OPEFB, and scenario 4 uses 2 kg of chemical fertilizers plus 400 kg of OPEFB.

The results obtained are that the humidity or moisture has increased from a value of 1 to 4. Therefore, it can be seen that the effect obtained from the use of more OPEFB makes the humidity higher. The calculation of the total cost of using OPOPEFB as mulch is obtained from the sum of the price of chemical fertilizers, the price of OPOPEFB, and workers' wages. The total cost after utilization of TKKS is IDR854,000.00. The total cost before using TKKS was IDR441,600,000. The difference in costs before and after the utilization of TKKS is IDR412,400.00, an increase in costs of 48%. The cost of using TKKS is higher than before using TKKS. The total harvest obtained before the use of OPEFB is 2,000 kg or IDR4,900,000. Meanwhile, after using OPEFB, the total yield obtained was 2,700 kg or IDR6,615,000. Production income increased by 26%.

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1. Introduction

Indonesia is experiencing a relatively rapid development of the palm oil industry. Palm oil in Indonesia today is a prima donna commodity. Its area continues to grow and not only from the monopoly of the State Large Plantation (PBN) or the Large Private Plantation (PBS). Currently, the People's Plantation (PR) has also developed rapidly. Oil palm plants will produce optimally if appropriately maintained (Astuti et al., 2014). Currently, Indonesia has the largest oil palm plantation area in the world.

According to data from the Directorate General of Plantations, which publish On May 18, 2020, the area of oil palm plantations in Indonesia in 2018 reached an area of 14,327,092 Ha with a production of 40.57 million tons of CPO with the share of People's Plantations contributing 40.57% or an area of 5,811,785 Ha while PBN and PBS respectively 4.43% and 55.01% or an area of 634,690 Ha and 7,880,617 Ha (Plantation, 2020). The development of oil palm plantations is very fast these days. In addition to increasing palm oil production, the palm oil industry will also grow the production of OPEFB "waste" produced from palm oil generators. Further to producing crude palm oil, palm oil generators produce by using products inside the shape of waste.

The boom around oil palm plantations in Indonesia will increase inside the wide variety and potential of the palm oil processing enterprise. This could purpose trouble because the quantity of waste generated will even boom. Waste generated in oil palm plantations and generators consists of liquid waste originating from steaming and hydro cyclone disposal, stable waste inside the shape of OPEFB, shells, and sludge, and waste gas from burning OPEFB or shells (Wahyono, Sahwandan, & Suryanto, 2008).

Empty oil palm fruit bunches originating from mills have very abundant availability or almost equal to the yield of crude palm oil (CPO) (Erwinsyah, Afriani, & Kardiansyah,2015). Like other biomass, empty Palm Oil Bunches (TKS) are an important source of raw materials for chemicals and other materials. The CPO processing industry can produce derivative products or by-products in the form of organic fertilizers from the processing of solid waste and liquid waste. The solid waste includes empty oil palm fruit bunches (OPEFB) that contain many lignocellulosic compounds (Hatta &Permana, 2014).

The amount of OPEFB waste throughout Indonesia in 2004 had reached 18.2 million tons (Hatta & Permana, 2014). Each processing of 1 ton of fresh fruit bunches will produce 23% OPEFB or as much as 230 kg (Hatta & Permana, 2014). It is causing pollution problems such as eutrophication and increased toxicity in the soil (Stichnothe & Schuchardt, 2010). Oil palm empty fruit bunches (OPEFB) are waste that produces ± 23% of fresh fruit bunches (FFB).

According to the Directorate General of Plantations (2018), Crude Palm Oil (CPO) production in 2018 reached 41.6 million tons, with a COP yield of 25% from FFB, FFB production reached 172 million tons, and OPEFB potential got 39.5 million tons. OPEFB is a material that contains elements of N, P, K, and Mg. OPEFB can be used as compost because of its abundance and high nutrient content (Yunindanova, Agusta, & Asmono, 2013).

Each ton of OPEFB contains nutrients equivalent to 3 kg of Urea, 0.6 kg Rock Phosphate, 12 kg of KCL, and 2 kg of Kieserite (Susanto, Santoso, & Suwedi, 2017). Economically and ecologically, this utilization can be a good solution for sustainable management of the palm oil industry in the future (Yahya, Sye, Ishola, & Suryanto, 2010).

In oil palm plantations, one of the organic fertilizer ingredients that are still widely available and can be expected to replace the role of inorganic fertilizers is empty palm oil bunches that can be used as compost. Oil palm empty fruit bunches (OPEFB) are stable waste made out of the processing of oil palm; massive quantities of OPEFB have the capability for use as compost and are predicted to enhance the physical, biological and chemical homes of ultisol subsoil (HAITAMI & WAHYUDI, 2019). Oil palm empty fruit bunches have a chemical composition of 45.95% cellulose, 22.84% hemicellulose, 16.49% lignin, 2.41% oil, and 1.23% ash. So far, the utilization of oil palm empty fruit bunches is minimal, namely as a source of potassium after the combustion process (Adiguna & Aryantha, 2020).

The process of burning empty palm oil bunches produces fly ash which can cause air pollution. OPEFB compost contains total N-nutrients (6.79%), P2O5 (3.13%), K2O (8.33%) with a pH of 9.59 (TOIBY, RAHMADANI, & Oksana, 2016). The utilization of oil palm empty fruit bunches is also an effort to reduce the use of inorganic fertilizers because excessive use of inorganic fertilizers can negatively impact the environment and save costs because inorganic fertilizer prices tend to be expensive (Harahap et al., 2020).

Oil palm fertilization is one of the plant maintenance activities to produce oil palm, which is very important in oil palm cultivation, so everything related to fertilization activities is a significant concern. One thing that needs to be considered in fertilization activities is that the costs incurred for fertilization are very large, which is around 20% of production costs or about 40-60% of the cost of maintaining mature plants (Saragih, Suswatiningsih, & Santosa, 2017). The high productivity of oil palm plants depends on the type of planting material, climatic conditions, soil type, and the technical culture, applied such as fertilization, soil and water conservation, and plant protection.

Fertilization is one of the largest components of maintenance costs for oil palm plants (Butar, Ambarsari, & Listiyani, 2018). Fertilizer is one of the primary nutrients that will determine oil palm growth rate and production. Each nutrient has its own role and can show certain symptoms in plants if their availability in the soil is very lacking. The provision of nutrients in the soil through fertilization must be balanced, that is, adjusted to the plant's needs. The purpose of fertilization is an effort to get healthy and jagur growth, which can shorten the TBM period and produce earlier (Astuti et al., 2014)—taking into account the price of fertilizer which is quite expensive, which in general, compound fertilizer is more costly compared to single fertilizers (Simatupang, Palupi, & Suwarto, 2019).

In Simardona Village, there is a smallholder plantation, namely oil palm, close to the palm oil processing industry PT Paluta Inti Sawit North Padanglawas, producing solid waste in empty palm oil bunches. Currently, this OPEFB waste is sold back to people who want to use it. This OPEFB can be used as a soil improvement material and a source of nutrients for oil palm plants which a direct application can do as mulch. Dry oil palm land and the difficulty of procuring chemical fertilizers for the community that owns oil palm plantations in Simardona Village are expected to be overcome by the use of OPEFB.

2. Methodology

This research was conducted in an oil palm plantation owned by the Simardona Village community, North Padanglawas Regency, North Sumatra Province. The research was carried out from January to April for scenarios 1 and 2. For scenarios 3 and 4 starting in June to September 2021. The data used in this study were data on oil palm plants, namely Ph, Moister, Fertility, Light, Cost, and Dosage of Fertilizer. The data collection of Fertilizer Cost and Dosage was conducted by interview. As for the pH, Light, Fertility, and Moister data using a measuring instrument.

The condition of the plantation land is rainfall with an average of 234 mm with an average of 18 days of rain each month. Solar radiation, the average solar radiation every month is 30%. Temperature, the maximum temperature every month is 33.57 degrees Celsius, and the minimum temperature is 20.44 degrees Celsius with an average temperature of 25.87 degrees Celsius every month. The average humidity is 80.67%.

Data collection was carried out before and after the OPEFB application. Where the measurement period is two weeks one time. While the measurement data collection will be carried out for eight months, there will be 16 times of data collection. OPEFB application is made manually. One truck contains 2.7 tons of OPEFB, with the price of OPEFB per truck being IDR300,000.00 (the price of OPEFB includes transportation costs from the factory to the land), so the price /kg is IDR111.00. The study was conducted on 32 oil palm trunks with four scenarios using OPEFB. Where in each scenario, there are eight trial bars.

Each scenario has four dead crosses. The application of OPEFB in dead gates (inter-principal) because the oil palm plants include TM (Producing Plants) is done to facilitate the harvesting process. The application is made by retailing OPOPEFB using a pole and rickshaw. OPEFB application is carried out once a year, while chemical fertilization occurs two times a year. The total OPEFB used in all experiments is 5,200 kg or about two trucks. Scenario 1 uses an additional 250kg of OPEFB, scenario 2 uses an additional 300kg, scenario 3 uses an additional 350kg, and scenario 4 uses an additional 400kg. The quantitative method is carried out with financial analysis to determine the cost, level of income, and benefits obtained from OPEFB and compared when not using OPEFB.

3. Results & Discussion

A. Before OPOPEFB Utilization

1. Dosage and Price of Chemical Fertilizer

The cost calculation before using OPEFB will be adjusted according to the amount of fertilizer used per scenario. Each scenario has eight stems and 32 stems or uses about Ha of land. The dose of chemical fertilizer used is 3kg per stem, and the total fertilizer used is 96kg for 32 oil palm stalks. The price of fertilizer for each palm trunk is IDR11,300.

Table 1. Dosage and price of chemical fertilizer

Type of Fertilizer	Dose (kg/stem)	Price (IDR/bag)	Net Weight (kg/bag)	Price (IDR/ stem)	Price of Fertilizer 1/4 ha
Kcl	0.5	280,000	50	2,800	IDR89,600
Tsp	0.5	310,000	50	3,100	IDR99,200
Kisrit	0.5	170,000	50	1,700	IDR54,400
Urea	0.5	270,000	50	2,700	IDR86,400
Dolomit	1	40,000	40	1,000	IDR32,000
Total	3			11,300	IDR361,600

2. Moister, Ph, Light, and Fertility

Measurement *Moister*, Ph, *light*, and *Fertility* tester for scenarios 1, 2, 3, and 4 before adding OPEFB. For scenarios 1 to 4, the results of the fertility measurement are ideal. And the pH measurement results were obtained neutral, namely 7 for each scenario. The measurement results of 8 oil palm trunks for each scenario can be seen in the following Table 2, Table 3, Table 4, and Table 5.

Table 2. Moister, pH, light, and fertility scenario 1

Measurement								
Stem	1	2	3	4	5	6	7	8
ph	7	7	7	7	7	7	7	7
Moist	1	1	1	1	1	2,5	2,5	2,5
Light	300	300	300	300	300	300	300	300
Fertility	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

Table 3. Moister, pH, light, and fertility scenario 2

Measurement								
Stem	1	2	3	4	5	6	7	8
ph	7	7	7	7	7	7	7	7
Moist	2,5	2,5	2,5	2,5	2,5	2,5	3	3
Light	250	250	250	250	250	250	250	250
Fertility	ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

Table 4. Moister, pH, light, and fertility scenario 3

Measurement								
Stem	1	2	3	4	5	6	7	8
ph	7	7	7	7	7	7	7	7
Moist	2,5	2,5	3	3	3	3	3	3
Light	300	300	300	300	300	300	300	300
Fertility	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

Table 5. Moister, pH, light, and fertility scenario 4

Measurement								
Stem	1	2	3	4	5	6	7	8
ph	7	7	7	7	7	7	7	7
Moist	3	3	3	3	3	3	3	3
Light	300	300	300	300	300	300	300	300
Fertility	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

3. Harvest

Harvesting is done every two weeks. In one fertilization period, 12 harvests were carried out. The average yield for each fertilization period is 2,000 kg with a price per kg of IDR2,450 with a total yield of IDR4,900,000 for one fertilization period. The yield before the use of OPEFB can be seen in the following Table 6.

Table 6. Harvest

Result Harvest	Harvest 1	Harvest 2	Average Yields per Periode Fertilization
Kg	163	180	2 ton
Price/kg	2,450	2,450	2450
Total price	IDR399,350	IDR441,000	IDR4,900,000

B. After OPOPEFB Utilization

1. Dosage of Chemical Fertilizer

Dosage of chemical fertilizer use Scenario 1 when adding 250 kg of OPOPEFB, Scenario 2 when adding 300 kg of OPOPEFB, Scenario 3 when adding 350 kg of OPOPEFB, Scenario 4 when adding 400 kg of OPOPEFB. The total use of chemical fertilizers after the use of OPOPEFB is 2 kg, with the price of fertilizer per stem being IDR. 6,150, the dose of fertilizer can be seen in the following Table 7.

Table 7. Dosage of chemical fertilizer

Type of Fertilizer	Dose (kg/stem)	Price (IDR/bag)	Net Weight (kg/bag)	Harga (IDR/ stem)	Price of Fertilizer 1/4 ha
Kcl	0.25	280,000	50	1,400	IDR11,200
Tsp	0.25	310,000	50	1,550	IDR12,400
Kisrit	0.25	170,000	50	850	IDR6,800
Urea	0.25	270,000	50	1,350	IDR10,800
Dolomit	1	40,000	40	1,000	IDR8,000
Total	2			6,150	IDR49,200

2. Moister, Ph, Light, and Fertility

Moister and light after using OPEFB have different values for scenario 1 to scenario 4. Meanwhile, pH and fertility before and after adding OPOPEFB have the same results: pH seven and ideal fertility. Measurements were carried out on eight oil palm stems with a measurement time of every two weeks. The following Table 8, Table 9, Table 10, and Table 11 are measures fertility, moister, light, and ph.

Table 8. Moister, pH, light, and fertility scenario 1

	January															
Measurement	1								2							
Stem	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Ph	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Moist	1	1	1	1	1	2,5	2,5	2,5	1	1	1	1	1	2,5	2,5	2,5
Light	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Fertility	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

Table 9. Moister, pH, light, and fertility scenario 2

	January															
Measurement	1								2							
Stem	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Ph	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Moist	2,5	2,5	2,5	2,5	2,5	2,5	3	3	2,5	2,5	2,5	2,5	2,5	2,5	3	3
Light	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Fertility	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

Table 10. Moister, pH, light, and fertility scenario 3

	June															
Measurement	1								2							
Stem	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Ph	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Moist	2,5	2,5	3	3	3	3	3	3	2,5	2,5	3	3	3	3	3	3
Light	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Fertility	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

Table 11. Moister, pH, light, and fertility scenario 4

	June															
Measurement	1								2							
Stem	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Ph	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Moist	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Light	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Fertility	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

3. Production Income

Harvesting is done two times every month. In one fertilization period, 12 harvests were carried out. The average yield for each fertilization period is 2,700 kg with a price per kg of IDR 2,450 with a total yield of IDR 6,615,000 for one fertilization period. Harvest yields after the use of OPOPEFB increased by 48%. It can be seen in the following Table 12.

Table 12. Production income

Yields	Harvest 1	Harvest 2	Average Yield/ Period
kg	235	220	2.7 tons
Price/kg	2,450	2,450	2,450
Total price	IDR399,350	IDR441,000	IDR6,615,000

4. Dose of OPEFB

OPEFB is only given once a year or only at the beginning of fertilization (fertilization I). Each scenario consists of 8 palm trunks with four dead shoots with a dose of 250 kg for scenario 1, 300 kilograms for scenario 2, 350 kilograms for scenario 3, and 400 kg for scenario 4.

Table 13. Dose of OPEFB

Scenario	Price (IDR/kg)	Number of OPEFB (kg)	OPEFB price per scenario
1	IDR111	250	IDR 111,000.00
2	IDR111	300	IDR 133,200.00
3	IDR111	350	IDR 155,400.00
4	IDR111	400	IDR 177,600.00

C. Comparison of Costs Before and After Utilization of OPEFB

1. Cost Before Utilization of OPEFB

Prior to using OPOPEFB based on Table 1, the price of chemical fertilizer per stem was IDR. 11,300.00 so that the fertilization period 1 was IDR11,300.00 x 32 stems was IDR361,600.00. When viewed in 4 scenarios where each scenario only uses 8 sticks, chemical fertilization costs are IDR90,400.00/scenario. When added to the cost of workers IDR80,000.00 and the cost for each scenario is IDR110,400 so the total cost of using chemical fertilizers is IDR441,600.00

2. Cost After Utilization of OPEFB

After using OPEFB, the price of fertilizer chemical/stem is IDR6,150.00, so the first fertilization is IDR6,150.00 x 32 stems is IDR196,800.00. When viewed in 4 scenarios where only eight stems are chemical fertilization costs are is IDR49,200.00/scenario. The difference is that after the use of OPEFB where OPEFB is used during the first stage of fertilization, the cost becomes IDR111,000.00 for scenario 1, the price of OPEFB is added to IDR49,200.00, the price of chemical fertilizer is IDR160,200.00.

Coupled with the workers' wages of IDR20,000 per scenario, the costs incurred for scenario 1 are IDR180,200. Scenario 2, the costs incurred are IDR133,200.00, the price of OPEFB plus IDR49,200.00, the price of chemical fertilizers is IDR182,400.00. Coupled with the workers' wages of IDR 20,000 per scenario, the costs incurred for scenario 2 are IDR202,400. In scenario 3, the costs incurred are 155,400.00, the price of OPEFB plus IDR49,200.00 the price of chemical fertilizers is IDR204,600.00.

Coupled with the workers' wages of IDR20,000 per scenario, the costs incurred for scenario 3 are IDR224,600. Scenario 4, the costs incurred are IDR177.600.00, the price of OPEFB plus IDR49,200.00, the price of chemical fertilizers is IDR226,800.00. Added to the wages of workers of IDR20,000 per scenario, the costs incurred for scenario 4 are IDR246,800. So, the total cost required for the utilization of OPEFB is IDR854,000.00. The difference in costs before and after the utilization of OPEFB is IDR412,400.00. There is an increase in costs of 48%. Then the cost incurred for scenario 3 is IDR224,600.

Scenario 4, the costs incurred are IDR177,600.00, the price of OPEFB plus IDR49,200.00, the price of chemical fertilizers is IDR226,800.00. Added to the wages of workers of IDR20,000 per scenario, the costs incurred for scenario 4 are IDR246,800. So, the total cost required for the utilization of OPEFB is IDR854,000.00. The difference in costs before and after the utilization of OPEFB is IDR412,400.00. There is an increase in costs of 48%. The total cost required for the utilization of OPEFB is IDR854,000.00.

The difference in costs before and after the utilization of OPEFB is IDR412,400.00, there is an increase in costs of 48%. the total cost required for the utilization of OPOPEFB is IDR854,000.00. The difference in costs before and after the utilization of OPEFB is IDR412,400.00, there is an increase in costs of 48%.

D. Comparison of OPEFB Utilization Costs

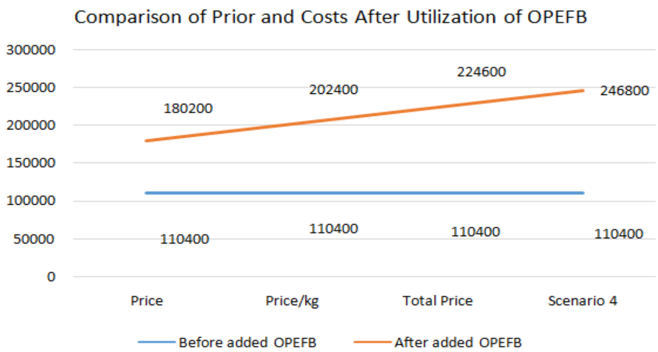

Figure 1. Comparison of prior and costs after utilization of OPEFB

Each scenario for scenario 1, when OPEFB 250 kg/gate dies, the total price for chemical fertilizer, OPEFB, and labor costs is IDR180,200.00, while scenario 2 is when using OPEFB 300 kg/gate dies, the total price is IDR202,400.00, scenario 3 is when using OPEFB 350 kg/dead goal the total price is IDR224,600.00, scenario 4 when using OPEFB 400 kg/dead goal the total price is IDR246,800.00. There is a price difference per scenario of IDR22,200.

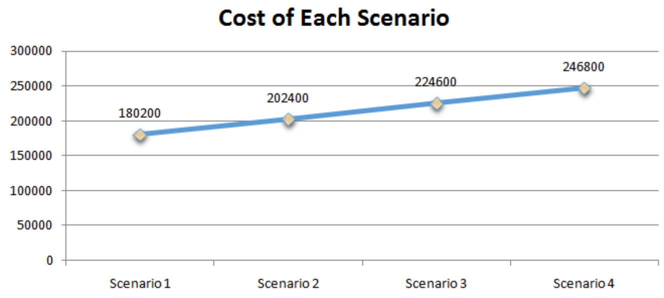

Figure 2. Cost of each scenario

E. Comparison of Ph, Moister, and Light

Ph in scenario 1 to scenario 4 has the same result, namely 7 For moister measurement, there are differences in the measurement results from each scenario. Light measurements also have differences in each scenario.

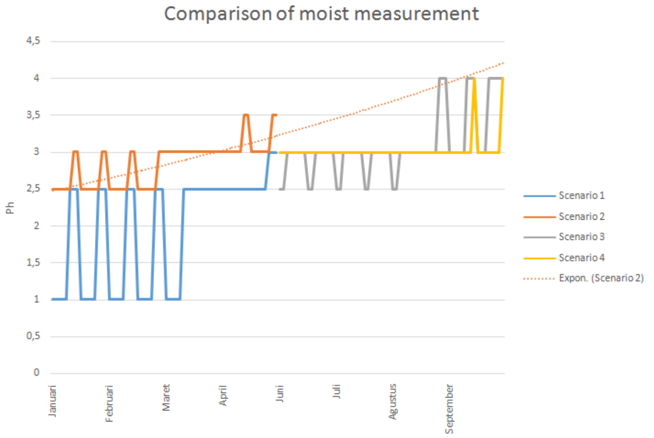

Figure 3. Comparison of moister measurements

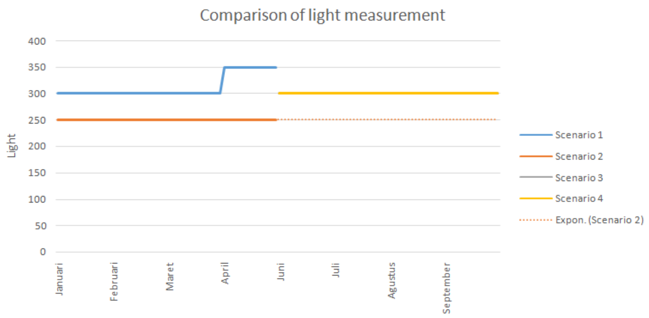

Figure 4. Comparison of light measurements

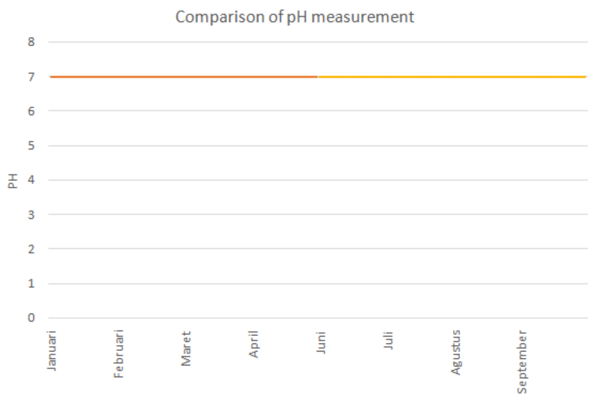

Figure 5. Comparison of Ph measurements

F. Comparison of Harvest

The yields before and after the use of OPEFB have differences. For the harvest before the use of OPEFB as much as 163 kg for the first harvest and 180 kg for the second harvest. The average yield per fertilization period is 2,000 kg or 2 tons with a price per kg of IDR2,450. The total harvest income obtained is IDR4,900,000. Meanwhile, the yields obtained after using OPEFB are 235 kg for the first harvest and 220 kg for the second harvest. The average yield per fertilization period is 2,700 kg or equivalent to 2.7 tons with a total income of IDR6,615,000. Production income increased by 26%.

The total income earned is the total revenue earned minus the total expenditure. The total income earned for 1 fertilization period is IDR5,761,000/ fertilization period. The effect after the use of OPEFB can be seen from the results of the moister measurement, which after adding 250kg of OPOPEFB for scenario 1, 300 kg for scenario 2, 350 kg for

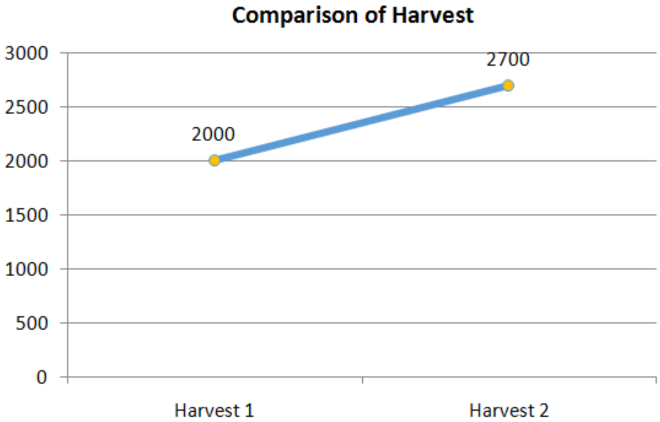

Figure 6. Comparison of harvest

scenario 3, and scenario 4, 400 kg. Soil moisture has increased from a value of 1 to 4. Thus, it can be seen that the effect obtained from the use of more OPEFB makes the moister higher. The more OPEFB used, the greater the increase in humidity levels.

For effect on yields, the yields obtained after the use of OPEFB have an increase of 48%. Thus, OPEFB affects crop yields. This happens because of the increase in humidity, making oil palm plants better in quality with the nutrient content in OPEFB.The costs incurred for the use of OPEFB appear to be higher when compared to the costs that only use chemical fertilizers. However, this does not have much effect because the yields obtained have increased. Thus, the costs incurred when using OPEFB can still be balanced with the income from the harvest.

4. Conclusion

Comparison of costs before and after the use of OPEFB has a difference. The cost required for one fertilization period is IDR110,400 for each scenario. With the total cost of using only chemical fertilizers is IDR441,600. The costs after using OPEFB for each scenario are IDR180,200, IDR202,400, IDR224,600, and IDR246,800. With a total cost of IDR854,000. The costs incurred for the use of OPEFB in this study depend on the number of OPEFB used, the fewer doses of OPEFB used, the cost will be cheaper.

The dose of chemical fertilizer used before and after OPEFB has a difference. The quantity before the use of OPEFB is 3 kg, while after the use of OPEFB the chemical fertilizer used is 2 kg. Meanwhile, the OPEFB doses used for each scenario 1 to 4 are 250 kg, 300 kg, 350 kg, and 400 kg. The dose of OPEFB in each scenario is different, but the quantity of chemical fertilizer used remains the same, which is 2 kg each. The effect obtained after using OPEFB for oil palm plantations is seen in increasing soil moisture and increasing yields of oil palm crops.

Previously, the plantations were dry and sandy with an average moister value of 1.5, and after the use of OPEFB, the moister value obtained increased to 4. The amount of OPEFB used also affected the increase in moister. For effect on crop yields, the yield obtained has a rise of 48% with the number of harvests per fertilization period before the use of OPEFB of 2,000 kg with total revenue of IDR4,900,000.00. And for the harvest after the use of OPEFB is 2,700 kg with total revenue of IDR6,615,000.00. The utilization of OPEFB can increase crop yields.

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