

## Effects of Different Fertilizers Program to the yield potential of Oil Palm Planted on Peat Soil Area in Rompin, Pahang

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**Abstract:** Peat soils have been regarded as problematic soils due to its natural state and are not suitable for the cultivation of most crops including oil palm. The research was done at three different oil palm plantations in Rompin, Pahang due to the reason where most of the oil palms planted on peat soil were located. The objectives of this study were to identify the types of fertilizer program on different peat soil area and to determine the most effective fertilizer program to the production of oil palm on peat soil area in Rompin Pahang. The research was done by collecting the secondary data from three different oil palm plantations on peat soil area in Rompin, Pahang. The oil palm plantations that involved in this study were Far East Delima Estate, Yayasan Pahang Sungai Kembar Estate, and Yayasan Pahang Sungai Mentelong Estate. Yield of the oil palm from these estates was taken to compare the effectiveness of the fertilizer program applied. The selection of oil palm field area was only restricted to oil palm planted on year 2006. The data obtained from these estates were analyzed using the statistical software called Statistical Packages for Social Science (SPSS). The result showed that there was significant difference between each fertilizer program to the yield of oil palm and Yayasan Pahang Sungai Mentelong Estate have the most effective fertilizer program. It is recommended that the best fertilizer program should also be introduced for the other low yield estate or smallholder as to increase their income.

**Keywords:** fertilizer program, peat soil, yield potential

### 1. Introduction

The oil palm tree (*Elaeis guineensis*) originates from West Africa where it grows in the wild and later was developed into an agricultural crop. It was introduced to Malaysia, then Malaya, by the British in early 1870's as an ornamental plant. The oil palm plantations in Malaysia are largely based on the estate management system and smallholder scheme (Anthony, 2013). According to statistics recorded by Malaysian Palm Oil Board (MPOB) in 2008, Malaysia used 4.5 million hectare of land area for plantation the oil palm and found less compared with Indonesia and currently account 55% of world palm oil production and about 62% of world exports, it as occupied 8% and 22 % of the world's total production and export of oil and fats, respectively (Hudzari et al., 2012).

Peat soils are classified as Histosols and are differentiated from mineral soils by having more than half of the upper 80 cm of the soil as organic soil materials. If these organic soil materials of any thickness rest on rock or fragmented materials, then the interstices must be filled with organic materials (Kheong et al., 2010). There are 2.43 million hectare of peatland in Malaysia which are mostly located in Sarawak (Wahid et al., 2010).

#### 1.1 Fertilizer Application for Oil Palm on Peat Soil

Although oil palm is a highly tolerant crop and can grow well in a wide range of soils, the characteristics of peat soil imposed severe constraints on the growth and yield of oil palm.

Thus oil palm development on peat has generally been restricted compared with development on mineral soil areas (Arif, 2003).

Peat soils are, generally, classified as poor soils for farming. Peat soil have both physical and chemical constraints. Very low soil bulk density and poor nutrient retention capacity increase the risk of loss of fertilizer applied due to leaching process. Other than that, low nutrient especially potassium and other macronutrient, high C:N ratio and very low pH also need to be considered in fertilization requirement (Arfan et al., 2013). Therefore, the most effective fertilization technique should be introduced and the amount of fertilizer that needs to be applied must be known.

## 2. Methodology

The study was carried out at three different plantations which established on peat soil area in Rompin, Pahang. The plantations are Far East Delima Estate (FED), Yayasan Pahang Sungai Kembar Estate (YPK), and Yayasan Pahang Sungai Mentelong Estate (YPM).

### 2.1 Data Collection

#### a) Fertilizer program and yield

The fertilizer program and yield of oil palm planted on peat soil area in 2010 from Far East Delima Estate, Yayasan Pahang Sungai Mentelong Estate and Yayasan Pahang Sungai Kembar Estate was collected.

#### b) Data Analysis

The ANOVA is used to determine the difference between the mean yields. Other than that, Duncan test was employed to make the comparison between the groups. Microsoft Excel was used to interpret the collected in form of calculations, analyze information and visualize data in spreadsheets.

## 3. Results and Discussion

This study only confined to the oil palm plantation cultivated on peat soil area in Rompin, Pahang due to time constraint. Besides, due to time and logistic constraints, the oil palm plantation covered in this study was only Far East Delima Estate (FED), Yayasan Pahang Sungai Mentelong Estate (YPM), and Yayasan Pahang Sungai Kembar Estate (YPK). The selection of oil palm plantation only restricted to oil palm planted on year 2006.

### 3.1 Fertilizer Program

There are different fertilizer program being applied by these three different oil palm plantation in Rompin, Pahang. Each oil palm plantation have their own fertilizer program practiced.

#### a) Far East Delima Estate

**Table 1.** Fertilizer Program of Far East Delima Estate

Fertilizer type	Rate (kg per palm per year)	Application Round Per Year
Urea (46%N)	2.00 kg	Split 3 round
Muriate of Potash (60%K <sub>2</sub> O)	3.75 kg	Split 2 round
Rock Phosphate (32% P <sub>2</sub> O <sub>5</sub> )	1.00 kg	1 round
Mix D* (35:20:34:10:1)	1.25 kg	1 round

\*N:P:K:Mg:S

**b) Yayasan Pahang Sungai Menteleng Estate**

**Table 2.** Fertilizer Program of Yayasan Pahang Sungai Menteleng Estate

Fertilizer type	Rate (kg per palm per year)	Application Round Per Year
Compound* (10:0:25:4 +0.5% B <sub>2</sub> O <sub>3</sub> )	2.50 kg	Split 3 round
Compound* (10:6:25:4 + 0.5% B <sub>2</sub> O <sub>3</sub> +3%S)	2.50 kg	Split 2 round
Rock Phosphate (32% P <sub>2</sub> O <sub>5</sub> )	1.50 kg	Split 2 round

\*N:P:K:Mg

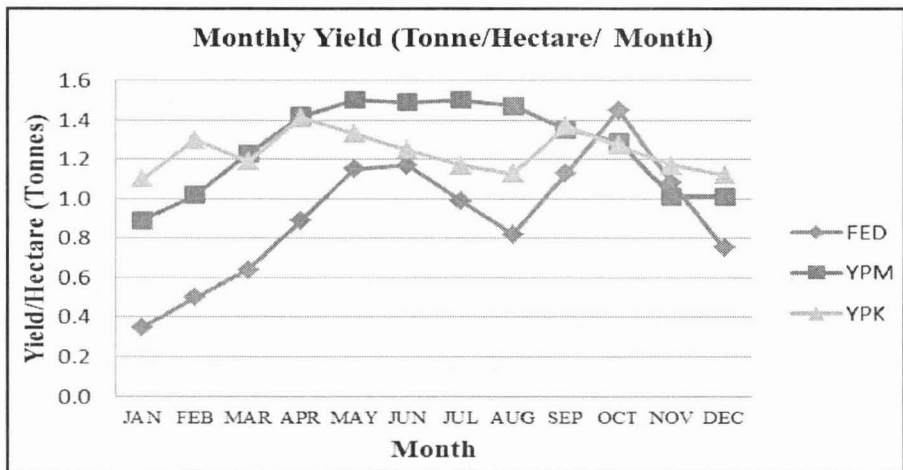
**c) Yayasan Pahang Sungai Kembar Estate**

**Table 3.** Fertilizer Program of Yayasan Pahang Sungai Kembar Estate

Fertilizer type	Rate (kg per palm per year)	Application Round Per Year
Compound* (10:0:25:4 +0.5% B <sub>2</sub> O <sub>3</sub> )	7.50 kg	Split 3 round
Compound* (10:6:25:4 + 0.5% B <sub>2</sub> O <sub>3</sub> +3%S)	2.50 kg	1 round

\*N:P:K:Mg

**3.2 Yield Comparison**



**Fig. 1** Monthly yield of oil palm (tonne/hectare) for Far East Delima Estate (FED), Yayasan Pahang Sungai Menteleng (YPM) and Yayasan Pahang Sungai Kembar (YPK)

Based on Figure 1, Yayasan Pahang Sungai Menteleng estate showed highest yield compared to the other estates for five consecutive months start from April 2011. On the other hand, Far East Delima estate showed the lowest yield compared to other from the beginning of

the year to September. Thus, Yayasan Pahang Sungai Mentelong showed the highest yield whereas Far East Delima estate showed the least yield throughout the year.

In the peat soil area, total Nitrogen nutrient content can be high up 1.5%. However, its availability are rather low due to the high content of C:N ratio (Tayeb, 2005). Yayasan Pahang Sungai Mentelong and Sungai Kembar estate have been applied more Nitrogen nutrient in the fertilization program compare to Far East Delima Estate. Therefore, Far East Delima oil palm may experience deficiency of Nitrogen nutrient, thus, resulting in the reduction of yield.

### 3.3 Analysis of Variance for yield of Far East Delima Estate, Yayasan Pahang Sungai Mentelong and Yayasan Pahang Sungai Kembar

**Table 4.** Analysis of Variance for yield of Far East Delima Estate, Yayasan Pahang Sungai Mentelong Estate and Yayasan Pahang Sungai Kembar Estate

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.935	2	6.468	34.391	.000
Within Groups	78.420	417	.188		
Total	91.356	419			

Table 4 showed the ANOVA for the yield of Far East Delima Estate, Yayasan Pahang Sungai Mentelong Estate, and Yayasan Pahang Sungai Kembar Estate showed a significant level at 0.000. Thus it can be concluded that there was significant different between each fertilizer program to the yield of oil palm. Shen et al., (2011), stated that different level of NPK nutrient in fertilization significantly influence the growth and yield of the crop.

### 3.4 Duncan mean of yield comparison of Far East Delima Estate, Yayasan Pahang Sungai Mentelong and Yayasan Pahang Sungai Kembar

**Table 5.** Duncan mean of yield comparison of Far East Delima Estate, Yayasan Pahang Sungai Mentelong Estate and Yayasan Pahang Sungai Kembar Estate

FERTILIZER	N	Subset for alpha = 0.05	
		1	2
FED	192	.9099	
YPK	24		1.2358
YPM	204		1.2650
Sig.		1.000	.718

Table 5 showed fertilizer program from Yayasan Pahang Sungai Mentelong Estate, and Yayasan Pahang Sungai Kembar Estate gave no significant difference ( $p < 0.05$ ) to each other in term of yield with the value of 0.718. Whereas Far East Delima Estate give significant difference ( $p < 0.05$ ) for both Yayasan Pahang estate.

The most noticeable different between the fertilization program was the application of straight and compound fertilizer. Both Yayasan Pahang Sungai Mentelong Estate and Sungai Kembar Estate used the combination of compound fertilizer. Thus, the yield produced is almost similar. However, Far East Estate used different fertilizer program which is the combination of straight fertilizer and mix fertilizer. From the application of compound fertilizer, the oil palm have been supplied with all needed nutrients present. In the other hand,

with the application of straight fertilizer or mix fertilizer, the individual plant may face a rather unbalanced supply situation although the same nutrient amount have been supplied.

Besides, Far East Delima Estate did not apply any Boron nutrient based fertilizer in the year 2010. According to Mutert and Uexküll (1999), the presence of Boron gave sufficient micronutrient to meet the requirements of vigorously growing oil palms. The absence of micronutrient Boron at Far East Delima estate could reduce the yield.

The application of straight fertilizer urea in Far East Delima Estate was experiencing high N loss through ammonia volatilization. According to Lija et al., (2012), nitrogen fertilizers such as ammonium nitrate and urea were noted for high N loss through ammonia volatilization. The application of compound fertilizer reduces ammonia loss due to volatilization (Ahmed et al., 2010).

#### 4. Conclusion

The yield gained by Yayasan Pahang Sungai Mentelong Estate is proven to be the highest followed to Yayasan Pahang Sungai Kembar Estate and Far East Delima Estate. Thus, Yayasan Pahang Sungai Mentelong has the most effective fertilizer program as compared to fertilizer program used by other company. There was significant effect of fertilizer program on the potential yield of oil palm on peat soil area. It showed that the yield of oil palm could be improved by choosing the right fertilizer program. The best fertilizer program was the one applied by Yayasan Pahang Sungai Mentelong Estate fertilizer program.

Those estates with peat soil area should apply the right fertilizer program in order to obtain greater yield in future. Other than that, it is recommended that the best fertilizer program should also be introduced for the other low yield estate or smallholder as to improve their income.

#### 5. Acknowledgement

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