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Management Fertilizer Dosage of Peatland on Plant Conditions and Average Bunch Weight (ABW) of Palm Oil in the Sembilang Dangku Landscape

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ABSTRACT

Palm oil is a prospective crop in the plantation sector. Palm oil is currently contributing large foreign exchange to the country, especially in Indonesia. The problem that occurs is the increase in the area for oil palm plantation development has been limited. One alternative way that can be done is the utilization of neglected marginal land for example peatlands. This research was carried out on the dangku crossing landscape in lowland areas or 5 m above sea level. The results show FFB and ABW have no significant effect on the regression and correlation values at the level of 0.05. The effect of significant difference was shown by the results of average bunch weight (ABW) in T1 treatment, namely the dose of N <1 Kg and P <1.5 Kg which had the highest average compared to T2 and T3 treatments. In addition, fertilizer doses affect plant conditions and visual conditions of plant leaves. The average condition at the location of the planting year which observed normality of the plant was more than 75% with green leaf conditions around 80%. Based on this, it can be explained that fertilizer doses have a good effect on plants in the Sembilang dangku landscape in terms of ABW and plant conditions.

Keywords— ABW, Oil Palm, Peat Land, Plant Conditions

I. INTRODUCTION

Palm oil is a prospective crop in the world of plantations and businesses. This is evidenced by the high demand for world palm oil both at home and abroad. This is evidenced by approximately 10 million hectares of oil palm plantations in Indonesia [3]. The limited amount of land available is a limitation that has a very large influence on this industry. One alternative that can be done is the utilization of neglected marginal land such as peatlands [9].

Indonesia's peatland area is 14.85 million ha [8] while the unproductive area of peatland in Indonesia is reported to be 4.2 million ha [2]. Peatlands in South Sumatra are quite extensive, approximately 1.42 million ha, which are spread mostly in three districts, namely Ogan Komering Ilir, Musi Banyu Asin and Banyuasin [10].

Nowadays, partial management of natural and environmental resources has not been considered successful due to being too conservative. Landscape-based management is able to combine management with exploratory economic goals and the goal of maintaining conservative environmental services [6]. Sembilang Dangku area is one of the lowland forest areas with sloping topography remaining in South Sumatra. The Province of South Sumatra has a Sembilang Dangku Landscape whose management balances the needs of the community with environmental conservation and utilization of environmental services. One part of this landscape is oil palm plantations [5]. This study discusses management fertilizer dosage on plant conditions and oil palm Fresh Fruit Bunch (FFB) production especially for Average Bunch Weight (ABW) in the Sembilang Dangku Landscape in South Sumatra, Indonesia. This study aims to look at the effect of fertilizer dosage on oil palm plants on peatland to the condition of the crop and the results obtained, namely FFB (fresh fruit bunches) and ABW (average bunch weight).

II. METHODOLOGY

This research was doing in January-March 2018 which are included data collection in the field, data

processing and analysis. The research did at six area of oil palm plantation locations owned by private companies / estates located in Sembilang Dangku Landscape, Musi Banyuasin Regency, South Sumatra Province, Indonesia. Determination of location points by the Kelola Sendang (lowland area or height <5 m above sea level). The research was using plots as object observation.

Identification of 20 sample plots observation was doing through primary and secondary data which was connected to the block map of company / estate sample locations, each observation sample plot point was identified with the condition and growth rate of the plants as much as 20 trees. Sampling treatment did with 20 plant staples by recording: (a) planted varieties, (c) planting year, (d) plant age. In addition, the nutritional status approach of oil palm plants is also based on (a) visual color of leaves (green, green-yellow, yellow), (b) plant conditions (normal, abnormal, dead plants), (c) number of midribs (d) number FFB (Fresh Fruit Bunches) per plant staples and (e) Average bunch weight (ABW) per plant staple. The calculation assumptions used are based on the consideration of field data as follows:

1. Plant population per hectare = 136 trees
2. Plant homogeneity at each sampling point
3. Last year fertilizer application data is available.

Data Analysis

The data obtained was analyzed descriptively and quantitatively, some of the data obtained were analyzed statistically using simple linear regression equations and Pearson correlation for ABW and FFB to see the significance value of the data, with a significant level of α = 0.05. The following is conveyed simple linear regression equation (Pratisto 2014):

$$Y = a + bX$$

i.e : $a = \frac{(\sum Y)(\sum X2)-(\sum X)(\sum XY))}{n\sum X2-(\sum X)2}; b = \frac{n\sum XY-(\sum X)(\sum Y)}{n\sum X2-(\sum X)2}$

Pearson correlation equation : $rxy = \frac{\sum xy}{\sqrt{\sum x2y2}}$

Description : rxy = correlation coefficient of ABW and FFB, $x = x_{i-(}$average $x)$, $y = y_i -$ (average y)

If the value exceeds the significance of α = 0.05, it means that it is not significantly different or has no effect, if the value is smaller (<α = 0.05) it is significantly different or there is an influence on the response.

Phosphor (P) element in data content follows the standard company or estate data, so it is not analyzed. Nitrogen (N) and Potassium (K) elements are also related to the FFB and ABW regression values to see the significance value of the data so that it can determine the study of the dependence of one variable, with the aim to estimate or predict population averages or variable mean values depending on its relation [4]. All quantitative data in this content analyzed by using software Ms. Excel, SPSS 16 and Minitab 17.

III. RESULTS AND DISCUSSION

Fertilizer Dosage

The following will explain the type of fertilizer and fertilizer dosage used by the company / estate at the research location. The effect of fertilizer will be related to ABW (average bunch weight) and FFB (fresh fruit bunches). The type of fertilizer used in these locations are :

A : Hi kay plus 13.6.27 (Location 1) dose 3 Kg each treatment with 3x application every year,

B : NPK 15.10.23 (Location 2) dose 2-3 Kg each treatment with 2x every year,

C : NK21.32 and RP.11 (Locations 3, 4 and 5) dose 3 Kg each treatment with 3x every year,

D : NPK 15.15.15 (Location 6) dose 2 Kg each treatment with 2x every year.

Based on the results obtained, L6 location has the least dose and treatment values compared to L1 to L5. The results of the fertilizer type formula will produce different FFB and ABW production. The results obtained in the Minitab 17 application on the Pearson correlation value between FFB and ABW is -0.418 which means that the value of FFB is inversely proportional to ABW and it is also consistent with the p-value results (0.007> 0.005) which means that it is not significantly different. So, there is no correlation between FFB and ABW. Observation of regression value between FFB and ABW shows p-value: 0.007> 0.05, meaning that it is not significantly different so, there is no influence between FFB and ABW.

Regression equation obtained by ABW = 16.72 – 1.109 FFB, meaning that each increase in ABW is one Kg, then the value of FFB decreases by 1.109 units. In addition, the coefficient of determination (R^2) shows a value of 17.5% meaning that the influence given is only 17.5%, remaining influenced by other factors not addressed in the model. this explanation is illustrated in Figure 1 and figure 2.

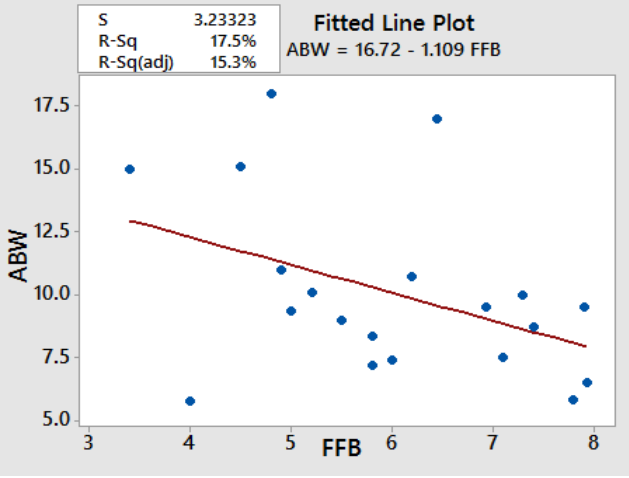

Figure 1. Regression equation and Coefficient Determination (R^2) FFB to ABW

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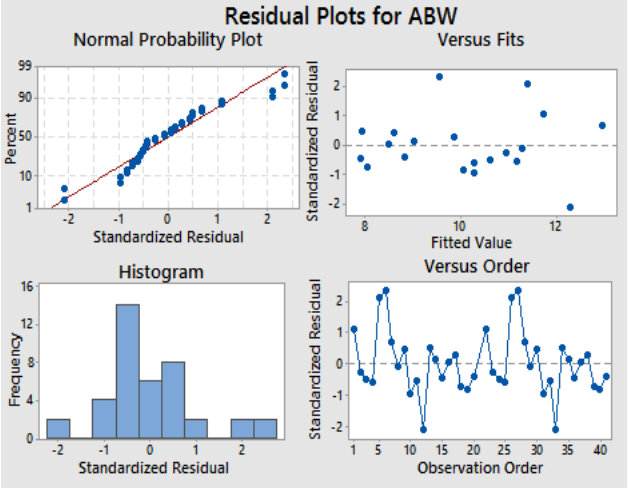

Figure 2. Residual Plots for ABW

Regression Analysis elements N and K

Wet areas generally have N availability in low soils and organic matter that can decompose is very quickly mineralized. In addition, the availability of element K is also low so that the need for fertilizer for nutrients is important (Pahan 2013). This is because the nature of the two elements is quickly washed out and quickly decomposes. Based on this, an effect of N and K levels on ABW have to analyze to see the influence of the elements. Regression analysis of N and K elements to see the significance of data from factors N and K whether related to FFB and ABW values.

Another basis is the observation of correlation values aiming to measure the strength (strength) or degree (linear) of a linear relationship between two variables, to measure the strength of a linear relationship correlation coefficient is needed. Whereas, regression does not make such measurements. Regression aims to make estimates or predict the average value of one variable based on the fixed values of other variables [4]. so that in this study both of them do to see whether there is a response effect of the strength of the correlation on the estimated average variable value of regression results. The following will show the results of the correlation analysis and regression data.

Table 1. Regression Analysis : FFB versus N, K

Term	Coef	SE Coef	T-value	p-value
Constant	5.731	0.798	7.18	0.00
N	2.44	1.66	1.47	0.16
K	-1.42	1.1	-1.29	0.22

Based on the results in Table 1, the equation obtained is FFB = 5.731 + 2.44 N - 1.42 K meaning that each increase in FFB value of one unit then the value of N increases by 2.44 and the value of K decreases by 1.42 besides that, the p-value value has no value <0.05 means that it is not significantly different, so that the N and K values have no effect on the number of FFB.

The Pearson correlation of N and FFB values is 0.190 with a p-value of 0.422 so that N and FFB elements are small or weak. In addition, the Pearson correlation of K and FFB = 0.101 with p-value = 0.673 This also means that the element K is weakly correlated to FFB production.

Table 2. Regression Analysis : ABW versus N, K

Term	Coef	SE Coef	T-value	p-value
Constant	15.07	1.77	8.52	0.00
N	-3.77	3.68	-1.02	0.32
K	0.27	2.44	0.11	0.91

Based on the results in Table 2, the equation obtained is ABW = 15.07 - 3.77 N + 0.27 K means that each increase in ABW value of one unit then the value of N decreases by 3.77 and the value of K decreases by 0.27 besides, the p-value value does not have a value <0.05 means that it is not significantly different, so the N and K values do not affect the number of ABW.

The results of different analyzes are shown by the Pearson correlation of N and ABW with a value of -0.621. although it is negative the p-value shows a value of 0.003 This indicates that the correlation is strong but the opposite means that if the value of N is small then the ABW value will be large. This is supported also by the Pearson correlation of K and ABW of -0.590 with p-value = 0.006. This indicates that the element K is strongly correlated with ABW but its opposite nature. The overall results regarding the correlation of N and K to ABW are significantly different because the results of p-value <0.05 but have opposing properties. So, that it can be explained that if the N and K values increase, the ABW value will decrease.

Subsequent testing of plant conditions. This is certainly related to fertilizer dosage, because if fertilization is done properly, the plant will grow fresh and normal. This can also be seen visually and explained in table 3. Table 3 describes the condition of plants and the condition of plant nutrition through the visual color of the leaves. The results obtained were planted normality, leaf color, number of midribs, FFB and ABW. The results obtained are the results of the average planting year in the observed block.

Table 3 Plant conditions in the Sembilang Dangku Landscape

LS	Year	Plant Conditions (%)			Leaves condition(%)			NM
		N	A	D	G	G-Y	Y	
L1	2007	100	0	0	100	0	0	56
	2008	98	3	0	96	4	0	47

	2009	93	8	3	98	0	3	46
	2011	90	10	0	100	0	0	52
L2	1997	95	4	1	91	7	2	46
	1998	88	5	8	85	8	8	50
	2006	100	0	0	83	8	10	40
	2008	100	0	0	100	0	0	46
	2009	90	2	5	88	7	5	53
L3	2007	87	13	0	88	12	0	47
	2008	55	43	3	38	63	0	43
	2009	76	21	3	33	61	6	38
	2010	75	25	0	75	25	0	57
L4	2008	78	12	10	78	20	2	48
	2009	90	10	0	92	8	0	51
L5	2007	80	13	7	73	25	2	48
	2008	87	11	2	81	18	1	46
	2010	75	25	0	85	15	0	41
	2011	86	11	3	71	27	1	46
L6	2012	67	30	3	72	25	0	47

Description : LS : Location Sampling, N : Normal, A : Abnormal, D : Dead Plants, G : Green, G-Y: Green-Yellow, Y : Yellow, NM : Number of Midribs

The results showed that the normal condition of the plant was good enough, that is an average of 75-85%, although there are locations with normal plant values below 75%, namely L6 locations with an average value of 66.7%. This can be seen from the various points of the observed planting year. Although the age of the planting year is different, the average crop condition is quite good. In visual leaf color observations, the condition is good that is 80% green, although some are yellowish green and yellow, but only found in a few years of planting, such as locations L3 and L5 which have a yellowish green color> 50% while the leaves are yellow found in some L2 planting block years but not significant because around 10% of the population. Color provides valuable information in estimating the maturity and examining plantation moreover it is good indicator for healthy plantation and ripeness [1]. This shows the effect of fertilizer doses (N and K elements) is quite important to the condition of the plant. Because the effect is directly related to the plant either quickly or slowly in fulfilling the growth and development of the principal of the plant. The number of midribs generally looks normal or is often prooned and cleaned so that the plants look neat in various planting years.

IV. CONCLUSION

The results between FFB and ABW do not have a real effect in regression and have a contrasting correlation value of -0.418. The results of regression value analysis of elements N and K to the FFB and ABW values show the same value that is not significant or p-value> 0.05 so that the observed sample of N and K elements cannot estimate the number of FFB (units) and weight of FFB (Kg) In observing the correlation values between elements N and K to FFB, the result is a weak relationship. While the correlation of elements N and K to ABW shows a significant value (p-value <0.05) both elements N and element K but the value is opposite. Based on this, it can be explained if a high dose of N and K is given, the ABW (average bunch weight) value will be low. Plant conditions indicate that various plants that have different ages at the plantation site. Landscape Sembilang Dangku generally have a fairly high plant normality and the leaves are relatively green although there are several abnormal planting locations and yellow leaf color, this number is quite small. when compared to normal plants and green plant leaves. Based on this, the dosage of fertilizer given to plants generally affects the plant staple/year and has an effect on plant growth either sooner or later.

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