

FronD Pruning Enhanced The Growth and Yield of Eight-Year-Old Oil Palm (*Elaeis guineensis* Jacq.)

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ABSTRACT

Pruning of fronds in oil palms is the subject of interest in oil palm farming that is often based on individual experience and casual observation rather than experimental evidence. Frond pruning in a scientific approach pose useful information in oil palm industry. This study was conducted to find out if frond pruning affects growth and yield of eight-year-old oil palm plantation owned by Kenram Industrial Development Incorporated (KIDI), Isulan, Sultan Kudarat, Philippines from 2011-12. This experiment was laid out in Randomized Complete Block Design with four treatments replicated three times. Standard guide on fertilization, cultural management practices, control of insect pest and diseases, and harvesting of bunches for oil palms were followed. Fronds were pruned according to the number of fronds retained per treatment except for those without pruning. Agronomic and yield parameters were gathered, statistically analyzed while variances among treatments were subjected to DMRT. Frond pruning in oil palm plants significantly affected fruit bunch production specifically on the number and weight of harvested bunches. However, no significant effect was observed on its agronomic characteristics. The retention of 32 - 40 fronds per tree produced more and heavier bunch compared to plants with 24 fronds and plants without frond pruning. Optimum fronds are required to obtained better yield. Palms without frond pruning and those with excessive pruning below 32 fronds produced lesser and lighter bunches.

Keywords: bunches, fronds, frond pruning, oil palm, rainfall

INTRODUCTION

Oil palm is a high-value industrial crop in the region. It grows best in Sultan Kudarat, nearby provinces, some areas of Mindanao, and even in other parts of the country. Like any other crop, oil palm culture aims at optimizing productivity, which provides additional income to large as well as small-hold growers.

Pruning some parts of plant aims at improving structural integrity,

influence flowering and fruiting (Penton Media, 2008). Pruning of excessive fronds in oil palm is carried out once a year while it also depends on the age of matured oil palm. On the immature stage, sanitation pruning is undertaken at least six months before mature phase. This procedure is carried out for the palms to bear fruits (Sampoerna Agro, 2007). The only pruning that most palms need is the occasional removal of dead and unnecessary fronds. Excessive pruning of fronds results to poor palm growth and reduces yield (Southeastern Palm Society, 1994).

Legros, *et al.* (2006) pointed out that leaf pruning decreases carbohydrates reserves in nine-year-old oil palm; however, no significant effect was observed on fruit bunch production. Results indicated that oil palm uses glucose as transitory reserve sugar for physiological growth.

FronD pruning has significant economic importance in oil palm production. Experimental evidence indicated that degree of frond removal influenced yield. However, excessive frond pruning decreases yield. In Nigerian trials, the removal of green fronds reduced in the yield although the intended effect was to increase yield (Turner and Gilbanks, 1980).

Foreign and local growers practice frond pruning in oil palms. However, there had been no data on how many fronds are to be left per palm plant to maximize bunch production. The objective of the study was to find out if frond pruning affects growth and yield of eight-year-old oil palm. This experiment was conducted in Kenram Industrial Development Incorporated (KIDI), Isulan, Sultan Kudarat, Philippines from October 2011-December 2012.

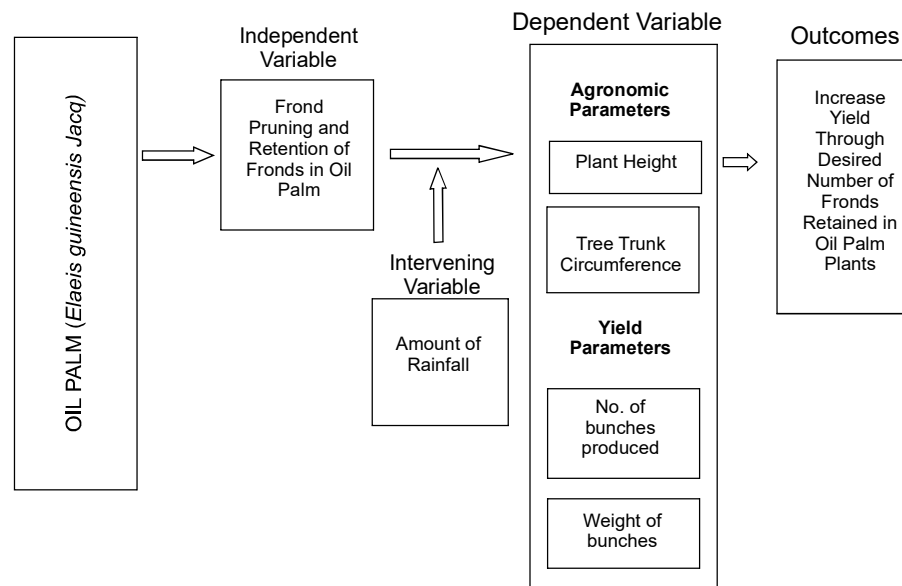


Figure 1. Conceptual Framework

The Conceptual Framework of the Study

Oil palm (*Elaeis guineensis* Jacq) is an industrial crop grown for its oil as raw material in the manufacture of various industrial products. Research and development activities in oil palm had boosted the economy of oil palm producing countries. However, to further improve and advance the industry, some aspects of oil palm production must be investigated. Pruning of fronds in oil palm is the subject of interest in oil palm farming based on individual experience and casual observation rather than experimental evidence. Frond pruning in a scientific approach pose useful information in oil palm industry. Foreign and local growers practice frond pruning in oil palms. However, there had been no data on how many fronds to be left per palm plant to maximize bunch production. This study focuses on finding out the desired number of fronds in a plant that would affect palms in terms of its agronomic and yield parameters. At the end of an investigation, the desired number of fronds is known.

METHODOLOGY

Study Site, Experimental Palms, Statistical Design and Treatments

The study was conducted in oil palm plantation of Kenram Industrial Development Incorporated (KIDI), Isulan, Sultan Kudarat, Philippines from October 2011- December 2012. Eight-year-old oil palm plants with 12 sample plants per treatment or a total of 144 sample plants in a one-hectare experimental area were used. Treatments were no frond pruning (control), 40, 32, and 24 fronds retained , laid out in a Randomized Complete Block Design replicated three times.

Frond Pruning

Frond pruning of experimental plants was maintained every quarter. Lifting of fronds using a scythe to detached fronds was used. Fronds with subtending fruit bunch were retained. Fronds having no bunch were pruned according to the number of retained fronds as specified in the treatments except for palm plants without frond pruning (control).

Cultural Management of Oil Palms

The experimental plants were applied with a fertilizer grade 12-12-17-2 (N, P₂O₅K₂O,B) once a month at the rate of 2.5 kg/tree. A follow-up application of 0-0-60 (Potash) at the rate of 1.10 kg per tree was made every month thereafter. Grasses were cut and ferns attached to the trunk were removed while pruned fronds were piled in the center rows of the palm plants to maintain sanitation. Pests were controlled as they occurred.

Harvesting of Bunches

As a standard practice, fruit bunches were harvested twice a month as fruits turned golden yellow. This was done to prevent overripe fruitlets from falling to the ground. Scythe was used to detach fruit bunches from the palm plant.

Data Gathered and Statistical Analysis

Average plant height (m) increment per treatment. Plants were measured by lifting an improvised calibrated measuring tape tied at the tip of the pole pointing out vertically at the tip of the youngest leaf down the base of the trunk. Initial height was taken prior to frond pruning while height increment was taken seven and 14 months after pruning.

Average trunk circumference (m) increment per treatment. Initial trunk diameter was measured prior to frond pruning while its increment (m) was taken seven and 14 months after pruning.

Average number of harvested bunches per treatment. Harvested fruit bunches were counted per palm plant while the average number of bunches was computed every two months thereafter.

Average weight (kg) of harvested bunches per treatment. Harvested fresh fruit bunches were individually weighed. Average weight was taken every two months thereafter.

Amount (mm) of rainfall. Rainfall data were retrieved right at Kenram Industrial Development Incorporated Agro-meteorological Station from the start until the study ended.

Data gathered were analyzed using the ANOVA in Randomized Complete Block Design while mean separation was subjected to DMRT (Gomez and Gomez, 1984). Relationships between the two variables were analyzed using the Regression Correlation Analysis.

RESULTS AND DISCUSSION

Plant height and trunk circumference increment (m)

Pruning of fronds did not significantly affect the height (m) and trunk circumference (m) increments of oil palm plants seven and 14 months after frond pruning (Table 1). Height and trunk circumference were almost similar in all palm plants with 24, 32, and 40 fronds left per plant and plants without pruning. Means for height increment ranged from 10.36-10.96m and 10.84-11.53m while trunk circumference increment ranged from 1.90m-2.70 and 1.70-2.0m seven and 14 months after pruning. The results indicated that pruning of fronds had no direct effect on plant height and trunk circumference of oil palm plants. Pruning and retention of fronds in oil palms basically point out that pruning some parts of the plant improves the structural integrity and influences flowering and fruiting (Penton Media, 2008).

Table 1. Plant height and trunk circumference increment (m) of oil palm 7 and 14 months after frond pruning

Number of fronds retained	Initial plant height (m)	Plant height increment (m) (months)		Initial trunk Circumference (m)	Trunk circumference increment (m) (months)	
		7	14		7	14
All fronds retained	9.97	10.47	10.97	1.10	1.90	2.00
40	10.37	10.90	11.37	1.11	2.70	1.70
32	9.83	10.36	10.84	1.13	1.90	1.93
24	10.35	10.96	11.53	1.12	1.97	1.97
Coefficient of variation (cv) ¹	7.90	14.93	2.67	2.30	6.66	4.04
Level of significance	ns	ns	ns	ns	ns	ns

¹cv- coefficient of variation

ns not significant

Number of Harvested Bunches

The number of harvested bunches in oil palm plants two, four and six successive months after pruning had no significant effect (Table 2 & Fig.1). Number of bunches was 13.33-18.33 after 2 months, 7.67-10.0 after 4 months while 9.67-11.67 after 6 months. However, a significant number was observed in oil palms 8, 10, 12 and 14 months after pruning. Plants with 40 fronds (Fig. 3 and 4) produced 5.33 while plants with 32 and 24 fronds had 3.67. Those without pruning had 1.67 eight months after pruning (Fig. 5, 6 & 7). Ten months after pruning, plants with 40 fronds obtained 28.0. Plants with 32 and 24 fronds had 25.33, and 20.0 bunches while plants without pruning had 17.67 (Fig. 3,4,5,6 &7). On the other hand, plants with 32 fronds 12 months after pruning had 23.0 bunches. Plants with 40 and 24 fronds had 17.0 and 13.0 while only 10.33 were obtained in plants without pruning (Fig. 3,4,5,6 & 7). Plants bearing 40 and 32 fronds obtained 22.33 and 20.33 bunches 14 months after pruning. Plants with 24 fronds had 17.0 while only 14.33 in plants without pruning (Fig. 3, 4, 5, 6&7).

These results indicated that pruning some parts of the plant aimed at improving structural integrity and influencing flowering and fruiting (Penton Media, 2008). Pruning of excessive fronds is carried out once a year depending on the age of mature palms (Sampoerna, 2007). Southeastern Palm Society (1994) further pointed out that excessive pruning of fronds resulted to poor growth and reduced the yield of oil palms.

Weight (kg) of Harvested Bunches

Pruning of fronds significantly affect the weight of harvested bunches of oil palm plants across the duration of the experiment (Table 3 and Fig. 3,4,5,6 &7). Pruning of fronds in plants with 32 fronds obtained a weight of 335.33 kg while 40 fronds had 286.50 kg two months after pruning.

Lighter harvested bunches of 224.33 and 215 kg in plants without pruning and those with 24 fronds was obtained. Four months after pruning, plants with 32 fronds had the heaviest weight with 132.0 kg followed by 112 kg in plants with 40 fronds. Significantly lower weight of 107.0 and 85.33 kg was obtained in plants without pruning and those with 24 fronds. Six months after pruning, plants with 40 fronds had 71.67 kg and 55.33 kg in plants with 32 fronds. Lowest weight of 39.33 and 22.67 kg were in plants with 24 fronds and plants without pruning. Weight of bunches was significantly high in plants with 32 fronds (143.0 kg) 8 months after pruning while 136.83kg in plants with 40 fronds. Plants without pruning had 134.0 kg while 104.0 kg in plants with 24 fronds. Ten months after pruning, plants with 40 fronds significantly obtained 447.0 kg, and 424.33 kg in plants with 32 fronds. Plants with 24 fronds and plants without pruning had 320.33 and 309.33 kg, respectively. Frond pruning of plants 12 months after had 283.33 kg in plants with 32 fronds, and 276.67 kg in plants with 40 fronds. Plants with 24 fronds and those without frond pruning had 221.33 and 190.0 kg. After 14 months, plants with 32 fronds had 395.0 kg and 347.0 kg in plants with 40 fronds. Those with 24 fronds and plants without pruning had 303.33 and 211.67kg.

Table 2. Number of harvested bunches of oil palm per treatment 2-14 months after frond pruning

No. of fronds retained	Number of harvested bunches of oil palm per treatment after frond pruning (months)						
	2	4	6	8	10	12	14
No frond pruning	17.00	7.67	11.00	1.67 ^c	17.67 ^d	10.33 ^d	14.33 ^c
40	14.00	8.67	11.67	5.33 ^a	28.00 ^a	17.00 ^b	22.33 ^a
32	18.33	10.00	10.33	3.67 ^b	25.33 ^b	23.00 ^a	20.33 ^a
24	13.33	7.67	9.67	3.67 ^b	20.00 ^c	13.00 ^c	17.00 ^b
Coefficient of variation (cv) ¹	26.84	36.74	21.92	33.19	1.73	4.81	8.41
Level of significance	ns	ns	ns	*	*	*	*

¹cv-coefficient of variation

^{ns} not significant, * significant at 5%

Results on the above parameters suggest the importance of high-level solar radiation for the growth and bunch production of oil palm as inferred from several separate observations. Exact requirements in terms of radiation and the sunshine for optimum yield are unknown. Hence, their importance was inferred from the following facts (Hartley, 1980): a) shading palms of all ages reduces growth and net assimilation rate b) shading adult palms decrease the production of female inflorescence c) pruning of the leaves of the adjacent palms increases the production of inflorescence. Excessive frond pruning decreases yield. In Nigerian trials, the removal of green fronds has brought a reduction in the yield although the intended effect was to increase the yield (Turner and Gilbanks, 1980).

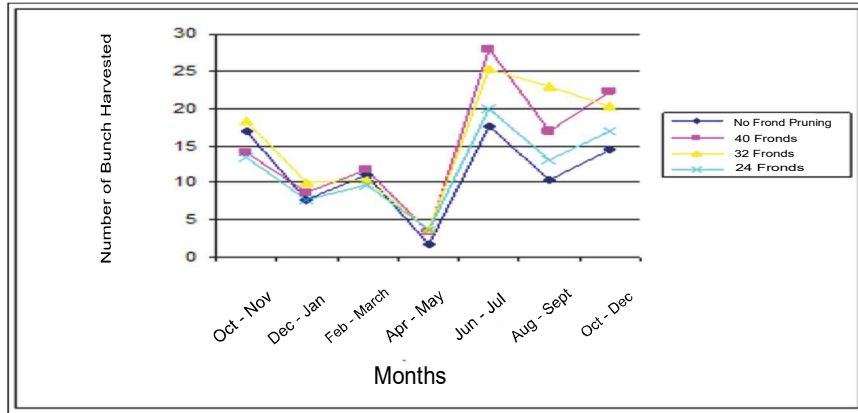


Figure 2. The bi-monthly trend of harvested bunches of oil palm after frond pruning



Figure 3. Oil palm with 40 retained fronds bearing matured fruit bunch



Figure 4. FFB from oil palm with 40 retained fronds



Figure 5. Oil palm with 32 retained fronds bearing matured fruit bunch



Figure 6. Oil palm with 24 retained fronds bearing matured fruit bunch



Figure 7. Oil palm without frond pruning

Table 3. Weight (kg) of harvested bunches of oil palm per treatment 2-14 months after frond pruning

Number of fronds retained	Weight of harvested bunches after frond pruning (months)						
	2	4	6	8	10	12	14
No frond pruning	224.33 ^c	107.00 ^c	22.67 ^d	134.00 ^b	309.33 ^d	190.00 ^d	211.67 ^d
40	286.50 ^b	112.00 ^b	71.67 ^a	136.83 ^b	447.00 ^a	276.67 ^b	395.00 ^a
32	335.33 ^a	132.00 ^a	55.33 ^b	143.00 ^a	424.33 ^b	283.33 ^a	347.00 ^b
24	215.83 ^d	5.33 ^d	39.33 ^c	104.00 ^c	320.33 ^c	221.33 ^c	303.33 ^c
Coefficient of variation(cv) ¹	11.87	3.97	6.06	7.43	1.52	1.34	2.76
Level of significance	*	*	*	*	*	*	*

¹cv-coefficient of variation
 * significant at 5%

Relationship Between the Amount of Rainfall and the Number and Weight of Harvested Bunches

Table 4 shows the significant correlation between rainfall (mm) and the number and weight of harvested bunches of oil palm after frond pruning. Result revealed that rainfall affects the number of the bunch. The obtained correlation coefficient was 0.7683 (high relationship) and the coefficient of determination was 0.5903. This means that rainfall increase the number of bunches by 59.03% while 40.97% was caused by other factors. On the other hand, there was a very high relationship between the amount of rainfall and the weight of harvested fresh fruit bunches after frond pruning. The result pointed out that rainfall affects weight of harvested bunches. The obtained correlation coefficient was 0.8462 while the coefficient of determination was 0.7161. This means that rainfall improved weight of harvested bunches up to 71.61% while 28.39% of which was attributed to other factors. Correlational results between the amount of rainfall and the number and weight of harvested bunches coincide with the rainfall pattern from October 2011 to December 2012 (Figure 2).

Hartley (1977) pointed out that enough rainfall up to 2,000 mm (80 in) or more or evenly distributed is required to attain high bunch production. Lower than the minimum is critical to the yield of oil palm. Enough or evenly distributed rainfall all throughout the year is required to maximize yield of oil palm.

Table 4. Relationship between the amount of rainfall and the number and weight of harvested bunches after frond pruning

Variable	Correlation coefficient (r)	Coefficient of determination (r ²)	Interpretation	t-computed	t(tab.025, df=6)
Amount of rainfall versus number of harvested bunches	0.7683	0.5903	High positive relationship	2.684*	2.447
Amount of rainfall versus weight (kg) of harvested bunches	0.8462	0.7161	Very high positive relationship	3.551*	2.447

* significant at 5%

In the Philippines, oil palm farming is typically conducive in Type IV climate particularly in Mindanao, even in Southeast Asia or in countries located in the tropical belt where rainfall are well distributed.

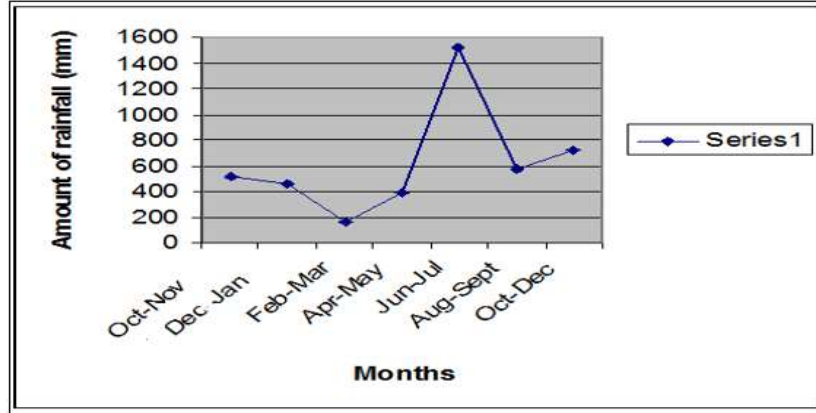


Figure 2. Amount of rainfall (mm) during the entire duration of the experiment

CONCLUSION AND RECOMMENDATION

FronD pruning in oil palm plants significantly affect fruit bunch production specifically on the number and weight of harvested bunches. However, no significant effect was observed on its agronomic characteristics. The retention of 32- 40 fronds per palm plant produced more and heavier bunch than those plants with 24 fronds and plants without frond pruning. To obtain better yield, enough fronds are required. Lesser and lighter weight of bunches are produced in plants without frond pruning and those with excessive pruning below 32 fronds.

Intervening variable further revealed that rainfall had a significant relationship to the number and weight of bunches. Hence, rainfall is one of the indicators in the yield of oil palm due to the high positive relationship between the two variables.

Hence, pruning and retention of 32 – 40 fronds per palm plant is recommended to oil palm growers to obtain more and heavier bunch production.

ACKNOWLEDGMENT

The author of this paper acknowledges the management of Kenram Industrial Development Incorporated (KIDI), Isulan, Sultan Kudarat, Philippines who suggested and allowed him to conduct the study in KIDI's oil palm plantation and to SKSU RD&E Office for funding the study.

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