FRESH FRUIT BUNCH QUALITY AND OIL LOSSES IN MILLING PROCESSES AS FACTORS THAT AFFECT THE EXTRACTION RATE OF PALM OIL

Farahida Zulkefli
Faculty of Plantation and Agrotechnology
Universiti Teknologi MARA (Melaka)
Email : farahida@melaka.uitm.edu.my

Nasuddin Othman
Faculty of Plantation and Agrotechnology
Universiti Teknologi MARA (Melaka)

Syahrizan Syahlan
Faculty of Plantation and Agrotechnology
Universiti Teknologi MARA (Melaka)
Email : rizan@melaka.uitm.edu.my

Mohd Rasdi Zaini
Faculty of Plantation and Agrotechnology
Universiti Teknologi MARA (Melaka)
Email : ddpim@melaka.uitm.edu.my

Muhammad Aliuddin Bakar
Faculty of Plantation and Agrotechnology
Universiti Teknologi MARA (Melaka)
Email : aliuddin@melaka.uitm.edu.my

ABSTRACT (FONT 9)

*Oil palm **(Elaeis guineensis Jacq.)** industry is one of the fastest growing sectors in Malaysia, where currently Malaysia is the second largest producer of palm oil in the world. Through the milling processes, Crude Palm Oil (CPO) was extracted from Fresh Fruit Bunches (FFB) and the percentage was also known as Oil Extraction Rate (OER).The OER was commonly used as the key factors in determining the performance of the producers. The study were conducted to determine the nature relationship of fruit ripening levels (as the estate factor) and mill's oil losses (as the mill factor) towards the performance of oil extraction rate (OER). The research methodology which adopted for this study was based on the quantitative data analysis. The available historical data from Oil Mill A was collected and analysed. Results showed that the fruit quality from the contributing estates were significantly affects the OER performance of the mill. These estates were sent the under-ripe, unripe, and over-ripe fruit to the mill which did not comply with the mill fruit quality target. The milling processes were also showed some losses of oil from the certain steps in the processes and lead to the low of OER. However, this study showed that the total oil losses were under control and still did not exceed the standard level. The study concluded that the oil losses in the mill was not the main factors that lead to the low produced of OER compared to the effect of fruit quality sent to the mill, where the fruit quality gave the greater impact to the performance of OER produced.*

Key word: Oil Extraction Rate, Oil Palm, Fresh Fruit Bunch, Crude Palm Oil, fruit ripening level, oil losses

INTRODUCTION

The national average oil extraction rates (OER) in Malaysia since 1980 until 2002, have fluctuated from a low of 18.48% in 1982 to a high of 19.87% in 1987 to 1988, although many individual mills have obtained more than 20% oil extraction rates (OER). In the times of low prices of crude palm oil (CPO) as seen in the recent period of 2000 to 2001 and low yield productivity, producers have been challenged to improve the performance of oil extraction rates (OER) as this measurement is a management tool in assessing the performance of the mill and plantation (Chang *et al*., 2003).

To obtain high OER, the key contributing factor includes good FFB quality and efficient milling practices. The percentage of OER is one of the three key factors in determining the performance of oil palm producer, with the other two being the yield per planted hectare and the total production cost per ton palm product. The OER is also commonly used as a standard benchmark for a Palm Oil Mill's performance (Turner and Gillbanks, 2003). The year 2009 was a challenging one for the Malaysian palm oil industry amid the lingering effects of a weak global economy and issues on sustainability and environment associated with oil palm cultivation.

Significant reduction in OER will result in monetary losses for the company. A gross overview shows that for a 1% reduction in OER is equivalent to a loss of RM 350,000 per month in revenue, based on its average monthly production capacity at the

average market price of Crude Palm Oil at RM 2,500.00 per tonne. The contributing e states will be affected as well, in terms of lower oil per hectare and higher production cost (per ton of palm product). More specifically, the study aims at: (i)To analyze whether the estates comply with the mill targets in terms of quality of fresh fruit bunches (FFB). (ii)To determine the oil losses through the waste by the milling process. (iii)To determine the nature of relationship of fruit ripening levels and mill's oil losses factors towards the oil extraction rate (OER).

MATERIALS AND PREPARATION METHODS

Study area

This case study was focused on Oil Mill A that is located in Lepar, Pahang.

Data collection

The data include the oil extraction rate (OER) percentages from 2007 to 2009, fruits received by the mill and the data of oil loss from the milling process. The data collected are: Monthly FFB Grading Analyze, OER percentage, monthly FFB processed, and monthly oil losses from milling processing. The data were imported to Microsoft Excel and SPSS for statistical analysis. Using the Microsoft Excel the graphs were built to achieve the case study objectives. The statistical tests used were in accordance with the objectives of the study.

RESULT AND DISCUSSION

To analyse whether the estates comply with the mill targets in terms of quality of fresh fruit bunches (FFB).

Based on the Table 1, the analysis for fruit ripeness level received by the mill shows that the percentage mean of unripe, under-ripe, ripe and over-ripe fresh fruit bunches are 0.56, 5.73, 88.50 and 5.16 percent respectively. The highest mean is the ripe fruit that has a high oil content which can contribute to high oil extraction rate.

Table 1: Descriptive Analysis for Fruit Ripening Level

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Unripe	36	.5931	.23508	.03918	.5135	.6726	.19	1.31
Under ripe	36	5.7350	.83066	.13844	5.4539	6.0161	3.71	7.42
Ripe	36	88.5089	.94966	.15828	88.1876	88.8302	85.76	90.59
Over ripe	36	5.1631	.78921	.13153	4.8960	5.4301	4.02	7.02
Total	144	25.0000	36.85669	3.07139	18.9288	31.0712	.19	90.59

From Table 2, the ANOVA shows there is a significant difference among the groups of fruit ripening level. All the four ripening levels give different effect among each other.

Table 2: The One-Way Anova Table Testing Difference between Fruit Ripening Level.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	194174.010	3	64724.670	114054.603	.000
Within Groups	79.448	140	.567		
Total	194253.458	143			

Table 3, shows that from the Post Hoc Test, all the four ripening levels are not homogeneous subsets.

Table 3: Post Hoc Tests Homogeneous Subsets' Turkey B[a]

treatment	N	Subset for alpha = 0.05			
		1	2	3	4
unripe	36	.5931			
overripe	36		5.1631		
underripe	36			5.7350	
ripe	36				88.5089

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 36.000.

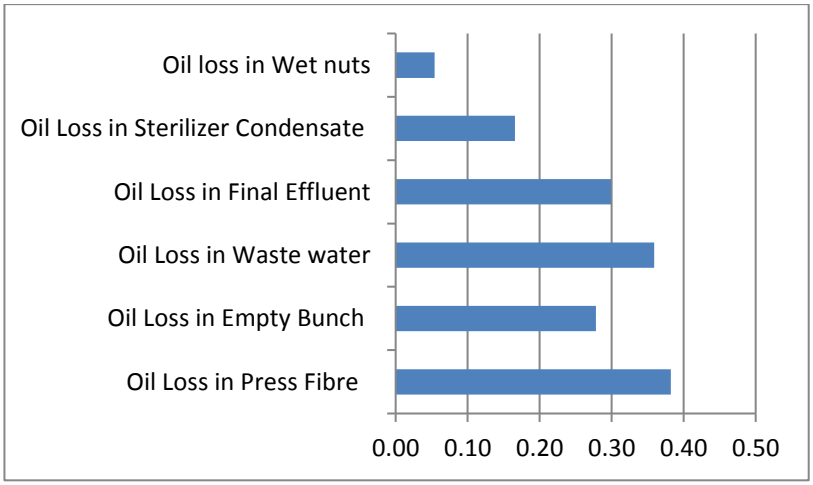
The oil losses through waste.

Based on the Table 4 the descriptive analysis for oil losses from the milling process shows that the means of oil loss through press fiber, empty bunch, and waste water, final effluent, sterilizer condensate and wet nut are 0.38, 0.28, 0.36, 0.30, 0.17 and 0.05 percent respectively. The highest mean is the oil loss in the press fiber and the lowest mean is the oil loss in the wet nut. The means of oil losses is illustrated in the Figure 1 below.

Table 4: Descriptive Analysis for Oil Losses Level

	N	Mean (% of oil losses)	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Press fiber	36	.3822	.08322	.01387	.3541	.4104	.26	.55
Empty bunch	36	.2781	.05913	.00985	.2580	.2981	.12	.46
Waste water	36	.3589	.04683	.00780	.3430	.3747	.28	.44
Final effluent	36	.2992	.05699	.00950	.2799	.3184	.19	.45
Sterilizer condensate	36	.1656	.03121	.00520	.1550	.1761	.10	.25
Wet nut	36	.0542	.03508	.00585	.0423	.0660	.02	.17
Total	216	.2563	.12636	.00860	.2394	.2733	.02	.55

Figure 1: The Three Years Percentage Means of Oil Losses in 6 Sample of Waste



From the One-way ANOVA as shown in Table 5, there is a significant difference among the oil losses from the mill process.

Table 5: The One-Way ANOVA Table Testing Difference Between Oil Losses

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.800	5	.560	185.979	.000
Within Groups	.632	210	.003		
Total	3.433	215			

From the Table 6, the Post Hoc Test shows that the oil loss in press fibre and the waste water is relatively high among the groups.

Table 6: Post Hoc Tests Homogeneous Subsets' Turkey B[a]

Oil loss	N	Subset for alpha = 0.05			
		1	2	3	4
Wet nut	36	.0542			

Sterilizer	36		.1656		
Empty bunch	36			.2781	
Final effluent	36			.2992	
Waste water	36				.3589
Press fibre	36				.3822

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 36.000.

Figure 2: Total Oil Loss in Different Sample of Waste (2007 to 2009)

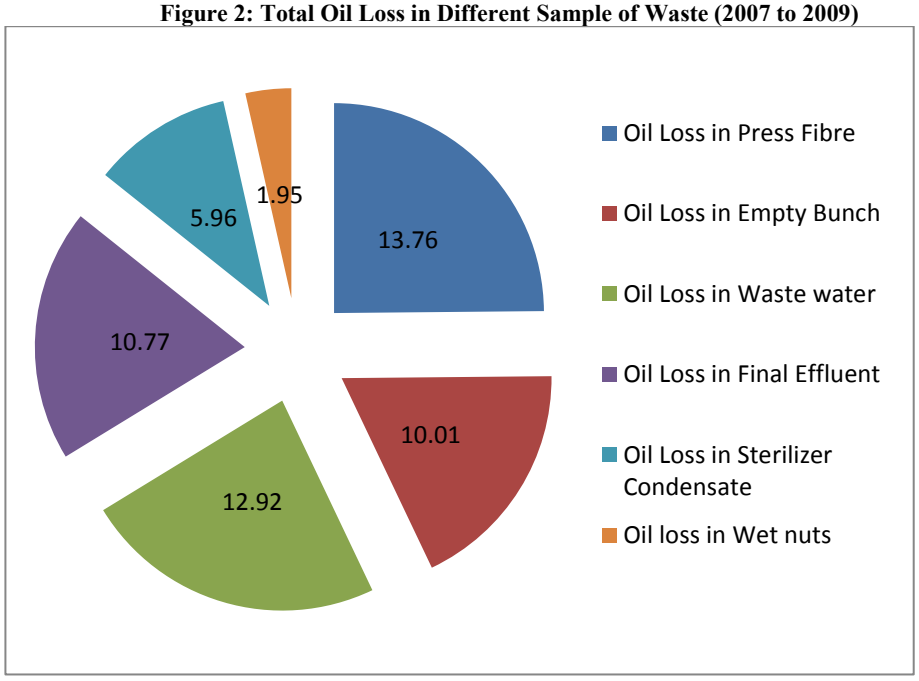


Figure 2, shows the total of oil losses within three years. The total for oil loss in press fibre is the highest with 13.76 percent followed by 12.92 percent of oil loss in the waste water. This performance shows that the mill is still not exceed the standards limit set by the company. In conclusion the mill is still running efficiently. However for the long term, the mill still needs to have a strategy on reducing the oil loss from the milling processes.

CONCLUSION

The Oil Mill A needs to give more attention to the mill performance in terms of the oil extraction rate. It is because the mill status is currently not showing the positive trends. While the other mill B. can perform better even though it is in the same region. The mill should focus on the main contributed factors of low OER so that they can improve more, yet a better performance can be achieved. The fruit quality from the contributing estates significantly affects the OER performance of the mill. These estates are sending under-ripe, unripe, and over-ripe fruit to the mill which do not comply with the mill set target in terms of fruit quality. The milling process shows that there are some losses of oil from the certain processes discussed in this study, which lead to the low OER. However, from this study, it also shows that the total oil losses are still under control which do not exceed the standard level. Based on this study, oil losses in the mill is not the main factor that leads to low OER compared to the effect of fruit quality sent to the mill from the estates which gives greater impact to the OER performance.

.

REFERENCES

Adzmi, H. and Janatul Amas, M. (2005). Regulations on Quality of Fresh Fruit Bunch. Oil Palm Bulletin 50. p. 31-38.

Arrifin, D. and Jalani, B. S. (1994). Proceedings of the National Seminar on Palm Oil Extraction Rate: Problem and Issues. Palm oil Research Institte of Malaysia.

Caliman, J. P. and Southworth A. (1998). Effect of Drought and Haze on the Performance of Oil Palm.

Chang, L.C., Abdul Rahim, A.S. and Zainon, B. (2003). An Economic Perspective of OER in the Oil Palm Industry of Malaysia. MPOB.

Corley, R. H. V. and Law, I. H. (2001). Ripening, Harvesting and Oil Extraction. The Planter. 507.
Ho, C. Y. (1993). Climate Effects on Oil Extraction Rates.
Jalani, B. S., Chan, K. W., Rajanaidu, N. and Arrifin, D. (2001). Review of the Stagnating Yield in Oil Palm Plantation and its possible remedies. MPOB.
Jalani, B. S., Yusof, B., Chan, K.W., and Rajanaidu, N. (2002). Prospects of Elevating National Oil Palm Productivity: a Malaysian Perspective. MPOB.
Jorgenson, D. and Fraumeni, B. (1981). Substitutuion and Technical Change in Production.
LKPP. (2010). Laman Web Rasmi LKPP Negeri Pahang. Retrieved January 20, 2010 from http://www.lkpp.gov.com.my.
LCSB. (2010). LCSB Portal. Retrieved January 20, 2010 from http://www.lcsb.com.my.
MPOB. (2009). Overview of the Malaysian Oil Palm Industry 2008. MPOB.
Muhamad Rizal, A. R. and Tsan, F. Y. (2008). Rainfall Impact on Oil Palm Production and OER at FELDA Triang 2. UiTM, Shah Alam.
Teoh, C. H. (2002). The Palm Oil Industry in Malaysia: From the Seed to Frying Pan. WWF Malaysia.
Turner, P. D. and Gillbanks, R. A. (2003). Oil Palm Cultivation and Management, The Incorporated Society of Planters, Kuala Lumpur.
Yew, A. T., Kum, W. L., Chak, K. L. , and Kum, S. L. (2010). Imaging Technique for Qualification of Oil Palm Fruit Ripeness and Oil Content.
Zulkifli, A. R. (1995). Report on Case Study of Oil Extraction Ratios in Palm Oil Mills. PORIM Report: PO (264) 95.Teo Leng. (2000). *Mechanisation in oil palm plantations: Achievement and challenges.* Malaysian Oil Science and Technology 70-77.
Veloo, R., & Hitam, M. F. (2011). Plantation labour: Need for management strategy.
Verma, S. R. (2008). Impact of Agricultural Mechanization on Production, Productivity, Cropping Intensity Income Generation and Employment of Labour.