

INNOVATIVE TECHNIQUE FOR OIL PALM REPLANTING: SAVINGS IN FERTILIZER INPUTS

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In June 2001, MPOB introduced an innovative technique for planting oil palm during replanting (Khalid *et al.*, 2001). The technique is to plant oil palm seedlings into the rows of the old palm biomass residues (Figure 1).



Figure 1. Innovative replanting technique – young palms are planted into rows of old palm biomass residues.

The large amount of biomass available during replanting contains significant amounts of nutrients which can be recycled for the succeeding young palms (Khalid *et al.*, 1999). In terms of monetary value, the fertilizer equivalent of the nutrients available in the biomass is currently (2009) about RM 10 500 ha⁻¹ (Table 1).

FIELD EVALUATION

A field trial on nutrient recycling was conducted over a five-year period in Rengam Estate, Kluang, Johor. The soil type is *typic paleudult* and is known as the Rengam Series, an inland sedentary soil from granitic parent materials. Several rates of fertilizer were tested to fine-tune the fertilizer recommendation for the innovative replanting technique. Table 2 shows the standard estate practice for applying fertilizer at full (100%) rate to the palms.

RESULTS

The leaf nutrient contents of five-year-old palms under two different rates of fertilizer, *i.e.* 100% and 50% rates, are shown in Table 3. The vegetative growth and mean fresh fruit bunch (FFB) yields of the palms under the two rates are shown in Tables 4 and 5, respectively.

The leaf nutrient contents of the palms under the 50% fertilizer rate as shown by the least significant difference (LSD) in Table 3 were not significantly different from those of the palms under the 100% (full) rate of fertilizer application. Similarly, the growth of palms receiving the 50% rate of fertilizer was as vigorous as the palms receiving the full rate

TABLE 1. FERTILIZER EQUIVALENT AND MONETARY VALUE OF OIL PALM BIOMASS AT REPLANTING

	SOA	PR	MOP	Kieserite	Total
Fertilizer equivalent (t ha ⁻¹)	3.06	0.37	2.77	1.0	-
Monetary value (RM)*	1 989	370	7 202	900	10 461

Note: *Estimated monetary value is based on the prices of fertilizers in January 2009: sulphate of ammonia (SOA) = RM 650 t⁻¹, phosphate rock (PR) = RM 1000 t⁻¹, muriate of potash (MOP) = RM 2600 t⁻¹ and kieserite = RM 900 t⁻¹.



TABLE 2. QUANTITY OF FERTILIZER AT FULL (100%) RATE

Fertilizer	Year (kg palm ⁻¹)				
	1	2	3	4	5
SOA	1.00	1.50	2.00	3.00	4.00
PR	1.00	1.50	2.00	2.50	2.50
MOP	0.50	1.00	1.50	3.00	3.50
Kieserite	0.50	1.00	1.50	1.50	2.00

TABLE 3. LEAF NUTRIENT CONTENTS OF FIVE-YEAR-OLD PALMS AT DIFFERENT RATES OF FERTILIZER

Fertilizer rate*	Nutrient content (%)				
	N	P	K	Ca	Mg
100%	2.89	0.160	1.25	0.68	0.42
50%	2.85	0.159	1.30	0.62	0.41
LSD (<i>p</i> = 0.05)	0.34	0.014	0.16	0.09	0.06

Note: *Fertilizer rates with respect to *Table 2*.

TABLE 4. VEGETATIVE GROWTH OF FIVE-YEAR-OLD PALMS AT DIFFERENT RATES OF FERTILIZER

Fertilizer rate*	Fronde length (cm)	Total leaf area (m ²)	Fronde dry weight (kg)	Palm height (cm)
100%	474.33	6.33	2.50	76.55
50%	479.13	5.95	2.71	75.68
LSD (<i>p</i> = 0.05)	37.21	0.92	0.56	24.67

Note: *Fertilizer rates with respect to *Table 2*.

TABLE 5. FFB YIELDS OVER THREE YEARS' HARVESTS UNDER TWO DIFFERENT RATES OF FERTILIZER**

Fertilizer rate*	FFB (t ha ⁻¹ yr ⁻¹)			Bunch number (palm ⁻¹ yr ⁻¹)			Bunch weight (kg)		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
100%	4.51	7.58	16.82	8.97	12.08	15.58	3.38	5.68	9.74
50%	5.30	8.45	20.29	9.21	11.90	16.86	3.92	6.40	10.71
LSD (<i>p</i> = 0.05)	1.89	2.89	4.29	2.39	3.80	4.13	0.70	1.47	1.62

Notes: * Fertilizer rates with respect to *Table 2*.

** Yield records started at 30 months after field planting.

of fertilizer. *Figure 2* shows the growth of five-year-old palms planted using the innovative replanting technique. The statistics in *Table 5* suggest that reduction of fertilizer by 50% did not affect oil palm yields.



Figure 2. Five-year-old palms planted using the innovative replanting technique perform as well as palms planted by the standard estate practice.

BENEFITS

Oil palm growth and FFB production were not affected by a 50% reduction in the fertilizer rate normally practised by estates. Based on the prices of fertilizers in January 2009, it was calculated that a savings of RM 3300 ha⁻¹ over a five-year period can be realized by adopting the proposed replanting technique (*Table 6*). The oil palm fertilizer recommendation for the innovative technique is given in *Table 7*. Besides the reduction in cost of production, less fertilizer application will at the same time minimize the impact of chemicals on the environment (Khalid *et al.*, 2002).

CONCLUSION

Oil palm biomass available during replanting contains significant amounts of nutrients which can be recycled for the succeeding young palms. Over five years of oil palm planting, the innovative replanting technique for oil palm can reduce chemical fertilizer inputs by 50% without affecting the growth and yield of the succeeding oil palms.

TABLE 6. TOTAL COST OF FERTILIZER AT FULL ESTATE RATE OVER FIVE YEARS*

Fertilizer	Year					Total
	1	2	3	4	5	
RM ha ⁻¹						
SOA	91	136	182	273	364	1 046
PR	140	210	280	350	350	1 330
MOP	182	364	546	1 092	1 274	3 458
Kieserite	63	126	189	189	252	819
Total	476	836	1 197	1 904	2 240	6 653

Notes: *Total cost of fertilizer is RM 6653. Halving rate reduced cost by 50%, *i.e.* a savings of RM 3327 ha⁻¹ over the five-year period of oil palm planting.

TABLE 7. RECOMMENDED FERTILIZER RATE FOR OIL PALM WHEN ADOPTING THE INNOVATIVE REPLANTING TECHNIQUE

Fertilizer	Year (kg palm ⁻¹)				
	1	2	3	4	5
SOA	0.50	0.75	1.00	1.50	2.0
PR	0.50	0.75	1.00	1.25	1.25
MOP	0.25	0.50	0.75	1.50	1.75
Kieserite	0.25	0.50	0.75	0.75	1.00

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