EFFECTIVE PLACEMENT OF FERTILISERS FOR MATURE OIL PALM PLANTED ON ALLUVIAL SOILS

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Fertiliser is an important input in oil palm plantations, and has to be managed efficiently for maximum returns. Fertiliser efficiency depends on the source and type of fertiliser, method of placement, rate, frequency and timing of application. Previous work shows that application of fertiliser by general broadcast on clean-weeded circles, over the frond stack and outside the edge of the palm circles resulted in maximum yield response. Soon and Hoong (2002) and Zin *et al.*, (2006) reported that the application of fertiliser by subsoil placement was inferior to broadcast application. However, due to a shortage of labour in the oil palm industry, subsoil placement or the burying of fertilisers is preferred by the planters because it provides an option of reducing the number of application rounds. Some planters claim that subsoil placement is a good practice because it is able to reduce run-off losses caused by heavy rainfall, especially in Sabah. However, there are no data to substantiate this claim. In response to this, MPOB carried out a long-term study to compare the effectiveness of fertiliser placement methods on mature oil palm planted on recent terrace alluvial soils in Sabah.

OBJECTIVE

To disseminate the technology for the most effective placement of fertilisers in mature oil palm planted on alluvial soils.

FIELD TRIAL

A field trial was conducted for more than seven years to compare subsoil placement of fertilisers with the conventional broadcast method. The trial was carried out at MPOB Research Station Lahad Datu, Sabah, located at N05^0 07'50" latitude and E118^0 26'34" longitude, having an elevation of 50 m above sea level. The area experienced a dry season between May and September followed by a wet season between October and April. The average annual rainfall was 2522 mm. The lowest rainfall of 95 mm was experienced in August, while February had the highest rainfall of 324 mm *(Figure 1)*.

The trial was carried out on mature palms planted on Bengawat soil families (*USDA; Typic Endoaquepts* or *FAO; Eutric Gleysols*). Soils of Bengawat families are deep, are somewhat poor to poorly drained soils, and developed over recent alluvial deposits. The trial was laid out as a randomised complete block design (RCBD) with three replicates. Palm performance in the experimental plots was evaluated based on fresh fruit bunch (FFB) yields, vegetative growth and leaf nutrient contents. The fertiliser used was a compound fertiliser (10.5:5.4:16.2:2.7:0.5B). Two methods of fertiliser placement and a control were tested:

(i) Fertiliser at 3 kg palm^{-1} round^{-1} was broadcast over the outside edge of the weeded circle with three rounds of application per year *(Figure 2)*.

(ii) One round of fertiliser application at 9 kg palm^{-1} with the fertiliser uniformly buried in four pockets (10-15 cm deep) at approximately 1.5-2.0 m from the palm base *(Figure 3)*.

(iii) There was no fertiliser application in the control plot.

PERFORMANCE OF MATURE OIL PALM AS AFFECTED BY FERTILISER PLACEMENT

The effects of the fertiliser placement methods on FFB yields over the seven years of treatment are summarised in *Figure 4* and *Table 1*. There was no significant difference in the seven-year cumulative FFB yield between the two methods of fertiliser placement. However, the data show that FFB yield from the broadcast method was consistently higher than that of the subsoil fertiliser placement.

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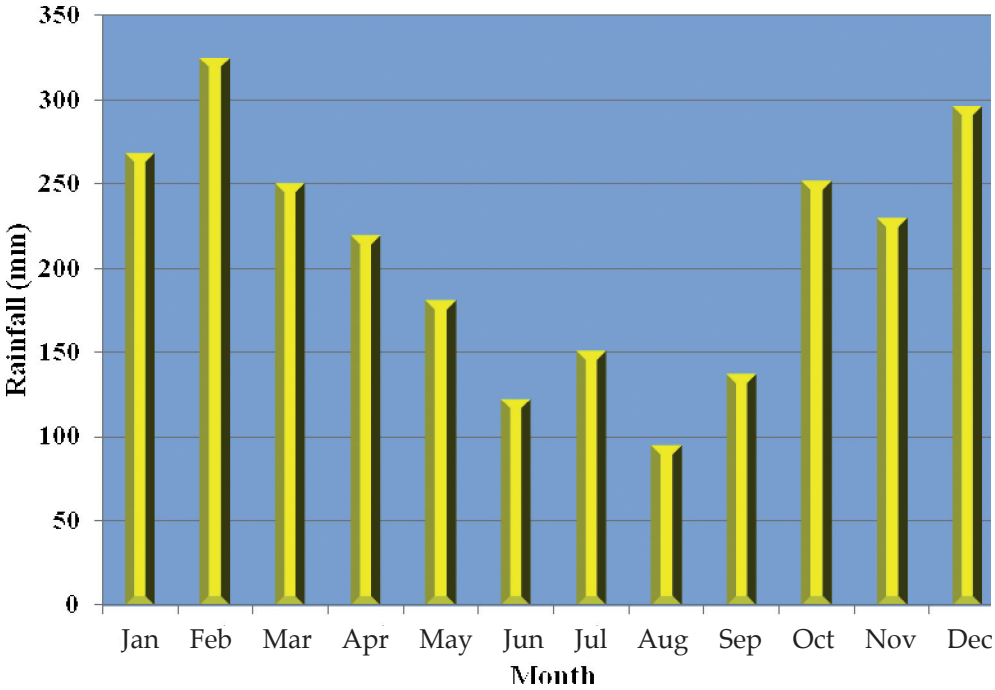


Figure 1. Average monthly rainfall distribution (2003-2009).

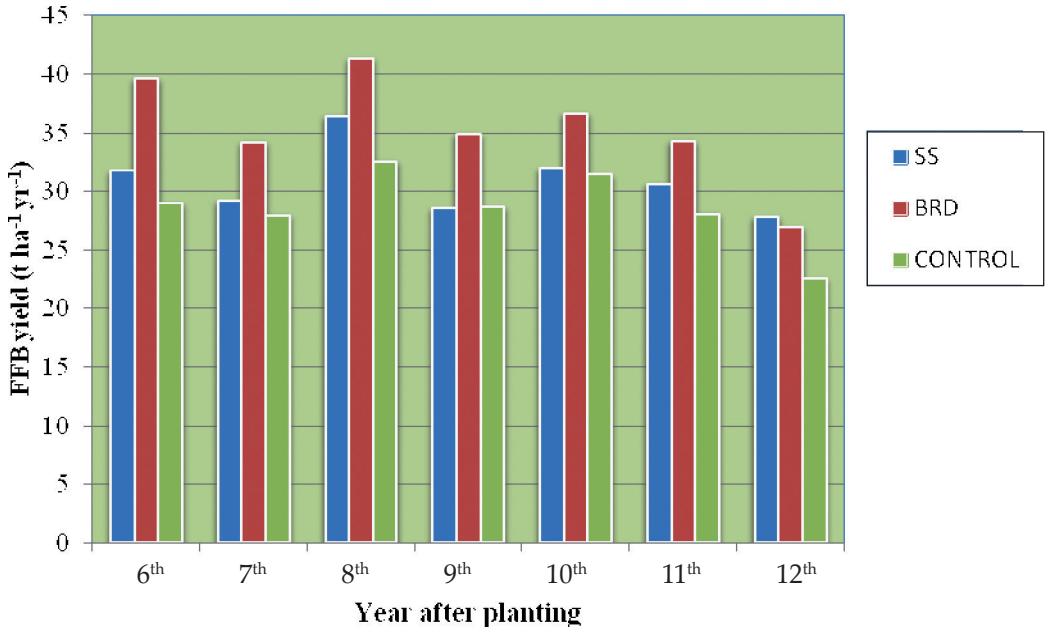
Figure 2. Conventional broadcasting of fertiliser.

Figure 3. Subsoil placement (burying) of fertiliser in four pockets.

TABLE 1. EFFECTS OF FERTILISER PLACEMENT ON FFB YIELD AND OIL PALM BUNCH COMPONENTS (7-year period)

Fertiliser placement	FFB yield ($t\ ha^{-1}\ yr^{-1}$)	Bunch number ($palm^{-1}\ yr^{-1}$)	Average bunch weight (kg)
BRD	35.62a	14.67a	14.68a
SS	31.10ab	12.95b	14.71a
CONTROL	28.63b	12.41b	13.93a
LSD (0.05)	6.23	0.76	3.14
CV (%)	10.71	2.51	9.58

Note: Means with same letter are not significantly different at p = 0.05 (Duncan's multiple range test), BRD = Broadcasting method; SS = Sub-soil placement; and CONTROL = No fertiliser.



Note: SS = Sub-soil placement; BRD = Broadcasting method; and CONTROL = No fertiliser.

Figure 4. FFB yields throughout study period.

FFB yield of the subsoil placement was 13% lower than that of the conventional broadcast method. Fertilisers applied by broadcasting covered a wider area, thus the chances of the feeding roots coming into contact with the fertilisers would be higher, resulting in more efficient nutrient uptake. The lower FFB yield from the subsoil placement method was reflected by a significantly lower bunch production, 12% lower than from the conventional broadcasting method. Economically, the application of fertiliser by broadcasting resulted in a higher revenue of about RM 2034.00 ha^{-1} (assuming the price of FFB is RM 450.00 t^{-1}).

Data on the three-year cumulative leaf analysis and vegetative parameters of samples collected from the fifth to the seventh years after treatment show that there was no significant difference between the two methods (*Table 2*). Although the vegetative parameters were not significantly different, growth

TABLE 2. EFFECTS OF FERTILISER PLACEMENT ON LEAF NUTRIENTS AND VEGETATIVE PARAMETERS (3-year period)

Fertiliser placement	Leaf nutrient (% dry matter)			Vegetative parameter				
	N	P	K	Total frond number	Height (m)	Trunk diameter (m)	Frond area (m^2)	Frond dry weight (kg)
BRD	2.53a	0.13a	0.70a	38a	5.22a	0.64a	19.16a	5.02a
SS	2.62a	0.13a	0.69a	38a	4.60ab	0.63a	18.51a	4.41a
CONTROL	2.50a	0.13a	0.66a	36b	4.19b	0.61a	17.03b	4.05a
LSD (0.05)	0.311	0.008	0.115	1.309	0.765	0.081	1.191	0.956
CV (%)	5.38	2.59	7.40	1.55	7.23	5.71	2.88	9.39

Note: Means with same letter are not significantly different at p = 0.05 (Duncan's multiple range test).
BRD = Broadcasting method; SS = Sub-soil placement; and CONTROL = No fertiliser.

parameters in palms receiving fertiliser by the broadcast method were slightly better compared to those from the subsoil placement.

CONCLUSION

The FFB yield resulting from subsoil placement was 4.52 t ha^{-1} or 13% lower than that from the broadcast method. Although the application of fertiliser by general broadcast was not statistically different, the higher profits that resulted would suggest it to be a more effective method for mature oil palm planted on alluvial soils than subsoil placement.

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