

INTEGRATION OF TONGKAT ALI WITH OIL PALM

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Tongkat Ali, *Eurycoma longifolia* (Figure 1), is a shrub or small tree found growing wild along the hill slopes of the rain forests of Malaysia and in other parts of Southeast Asia. It is a medium-sized slender shrub growing up to 10 m in height, often unbranched, with reddish brown petioles and compound pinnate leaves, which may reach 1 m in length. Each compound leaf consists of 30-40 leaflets, lanceolate to obovate-lanceolate. Flowers are hermaphrodite with small petals and are very finely pubescent.



Figure 1. Four-year-old tongkat Ali integrated in the double avenue oil palm planting system.

The root is the main commercial product of tongkat Ali (Figure 2). It is yellowish in colour, has a bitter taste and is normally used as herbal medicine to enhance energy, having aphrodisiac properties, inhibit cancer and improve the immune system. Tongkat Ali root-based products such as canned beverages, ready-mix coffee and tongkat Ali capsules have great demand in Malaysia.



Figure 2. Tongkat Ali roots.

Tongkat Ali roots are normally harvested from the wild habitat of the species, *i.e.* in the rain forest, where it is becoming depleted. Therefore, tongkat Ali cultivation in oil palm plantations appears feasible for the commercial production of tongkat Ali roots. A trial on tongkat Ali integration with oil palm was conducted in 2003 on a mineral soil at the MPOB Research Plot in KLIA Sepang.

METHODOLOGY

Oil palm was planted using the double avenue planting system in 2002 at a spacing of 6.1 m x 9.1 m x 15.2 m, which gave 136 palms ha⁻¹ (Figure 3). The planting and management of oil palm followed the normal estate practices.

The 15.2 m wide avenues were cleared from undergrowth and weeds. Then, the land was worked by two rounds of disc ploughing and one round of rotor tilling to a depth of 20 to 30 cm. The lag time between the two rounds of tilling was 7 to 10 days. Tongkat Ali seedlings were planted at a spacing of 2 m x 1 m, *i.e.* at a population of 1900 plants ha⁻¹ (Figure 3).

The tongkat Ali seedlings had been raised in polybags with the dimensions 20 cm x 12 cm (Figure 4), and were transplanted to the field at the age of 8 to 10 months. Planting was carried out at the onset of the rainy season to ensure good growth and survival of the seedlings.

Rock phosphate at the rate of 200 to 250 g per plant was put into the planting hole during planting. The recommended fertilizer programme for tongkat Ali is shown in Table 1.

The mortality rate was 10% to 20% in the first six to 12 months after planting. Based on observations, the plants had died because of transplanting shock and scorching due to open planting. Therefore, it appears that tongkat Ali needs some shade (*e.g.* by using black plastic netting) at the early stage of planting for vigorous growth.



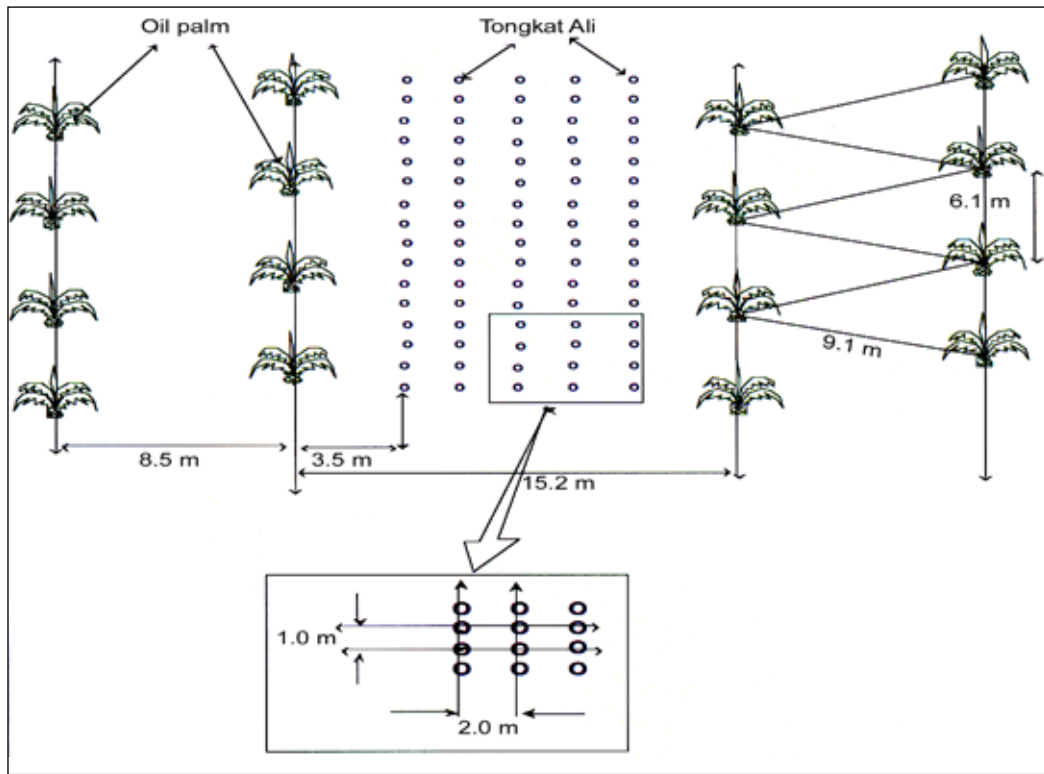


Figure 3. The layout of tongkat Ali integration in the double avenue oil palm planting system.



Figure 4. Tongkat Ali seedlings at seven months of age.

TABLE 1. RECOMMENDED FERTILIZER PROGRAMME FOR TONGKAT ALI (*Eurycoma longifolia*)

Age of Tongkat Ali (year)	Type of fertilizer	Application rate (g per plant)	Frequency
1	Rock phosphate	200	At planting
	Compound 15:15:6:4	250	4
2	Compound 15:15:6:4	300	3
	Rock phosphate	150	1
3	Compound 15:15:6:4	480	3
	Rock phosphate	200	1
4	Compound 15:15:6:4	300	2

Weeding was carried out manually once a month in the first year and at every two months thereafter. Periodic spraying with cypermethrin at the rate

of 10 ml in 10 litres of water was carried out to control the pest, tiger moth (*Etteva sciodoxa*), which attacked the young shoots.

Generally, the plants start to flower and bear fruits at the age of two to three years (Figure 5), and the roots can be harvested when the plants reach the age of four years after planting (Table 2). Harvesting can be carried out by using a 'chain-lock' tool (Figure 6).



Figure 5. Tongkat Ali starts flowering and bear fruits at two years after planting.



Figure 6. Harvesting tongkat Ali roots using a 'chain-lock' tool.

RESULTS

Table 2 shows the vegetative performance and root production of four-year-old tongkat Ali integrated in the double avenue oil palm planting system. Preliminary results show that tongkat Ali plants can be harvested at the age of four years after planting. It was estimated that the dry root yield of four-year-old plants (at a density of 1900 plants ha⁻¹) is 1003 kg ha⁻¹.

TABLE 2. MEASUREMENTS ON VEGETATIVE CHARACTERISTICS AND ROOT YIELD OF FOUR-YEAR-OLD TONGKAT ALI INTEGRATED WITH OIL PALM

Characteristic	Average
Plant height (m)	5.50
Stem diameter measured at 20 cm from ground (cm)	7.4
Fresh root weight (kg)	1.6
Dry root weight (chipped) (kg)	0.66
Extractant from dry roots (powdered) (g)	30
<i>Eurycomanone</i> content/root (µg ml ⁻¹)	163.1

Extraction rate of the bio-active compound *eurycomanone* from the roots was 4.5% which is higher than from the stem which was only 2.9%. Extraction was carried out on the dry roots and dry stems. The *eurycomanone* content in the roots was analysed using high performance liquid chromatography (HPLC). The average *eurycomanone* content in a root was 163.1 µg ml⁻¹. It is believed that the amount of *eurycomanone* in the root will increase with the age of tongkat Ali in the field.

In the trial, the recorded fresh fruit bunch yield of oil palm for the first, second and third year harvests were 3.5 t ha⁻¹, 9.1 t ha⁻¹ and 22.0 t ha⁻¹ compared to the control 3.5 t ha⁻¹, 9.0 t ha⁻¹ and 24.6 t ha⁻¹ respectively. There are not much differences in terms of oil palm yield that was observed compared with the control.

ESTIMATED COST AND REVENUE

The total production cost of tongkat Ali integration in the double avenue oil palm system for one planting season (four years) was RM 18 740 ha⁻¹. Assuming that only 80% of the tongkat Ali plants produced marketable roots, the average dry root yield was estimated at 1003 kg ha⁻¹ (Table 3). The dried root is expected to be sold at RM 28 kg⁻¹. Thus, the gross revenue and net revenue per hectare will be RM 28 084 and RM 9344, respectively. The return for every RM 1 invested will be RM 1.50.

TABLE 3. ESTIMATED COST AND REVENUE FOR TONGKAT ALI INTEGRATION IN DOUBLE AVENUE OIL PALM (RM ha⁻¹)

No.	Item	Quantity/price (RM)	Value (RM)
1	Capital expenditure		
	a) Land preparation	1 ha @ 650	650
	b) Seedling cost (+10% additional seedlings)	2 090 seedlings @ RM 1.50 seedling ⁻¹	1 815
	c) Cost of transplanting (from polybags to field)	1 900 seedlings @ RM 1.50 polybag ⁻¹	2 850
2	Operational costs		
	a) Weeding	28 man-days @ RM 28 man-day ⁻¹	784
	b) Pest and disease control	10 man-days @ RM 28 man-day ⁻¹	280
	c) Fertilizer application	7 man-days @ RM 28 man-day ⁻¹	196
3	Input costs		
	i) Fertilizers:		
	Yr 1: Rock phosphate	7 bags @ RM 65 bag ⁻¹	455
	Compound 15:15:6:4	11 bags @ RM 125 bag ⁻¹	1 375
	Yr 2: Compound 15:15:6:4	12 bags @ RM 125 bag ⁻¹	1 500
	Rock phosphate	7 bags @ RM 65 bag ⁻¹	455
	Yr 3: Compound 15:15:6:4	18 bags @ RM 125 bag ⁻¹	2 250
	Rock phosphate	7 bags @ RM 65 bag ⁻¹	455
	Yr 4: Compound 15:15:6:4	11 bags @ RM 125 bag ⁻¹	1 375
	ii) Pest control:		
	Dipterex: Yr 1 and 2	2 kg @ RM 45 kg ⁻¹	90
	Albarol, decis: Yr 3-4	2 litres @ RM 45 litre ⁻¹	90
	iii) Weed control:		
	Yr 1: Round-up/Paraquat	4 litres @ RM 20 litre ⁻¹	80
	Yr 2: Round-up/Paraquat	4 litres @ RM 20 litre ⁻¹	80
	Yr 3: Round-up/Paraquat	4 litres @ RM 20 litre ⁻¹	80
	Yr 4: Round-up/Paraquat	4 litres @ RM 20 litre ⁻¹	80
4	Harvesting cost (Including chipping and drying)	1 900 trees @ RM 2 tree ⁻¹	3 800
5	Total production cost		18 740
6	Gross revenue	0.66 kg x 1 520 plants (80% harvested) 1 003 kg @ RM 28 kg ⁻¹	28 084
	Net income		9 344
	Return on investment (RM)		1.50

CONCLUSION

Tongkat Ali (*Eurycoma longifolia*) has great potential for integration with oil palm. Integration maximizes land use, increases land productivity and generates additional income for oil palm growers, especially during the immature phase of oil palm. Besides increasing the farmer's income, planting tongkat Ali will also contribute to the sustainability of the local herbal industry and to the national economy.

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