

# INTEGRATION OF SOYABEAN WITH OIL PALM IN DOUBLE AVENUE PLANTING

by: SUBOH ISMAIL and NORKASPI KHASIM



MPOB INFORMATION SERIES • ISSN 1511-7871 • JUNE 2007

MPOB TT No. 350

**S**oyabean (*Glycine max*) (Figure 1) is a major source of protein for human and livestock. The average import of soyabean (broken and not broken) in 2002 to 2005 was 693 968 t yr<sup>-1</sup> worth RM 719 991 178, mostly for livestock feed. The major human food products from soyabean are bean curd, soyabean drink and *tempe*.

The soyabean plant is an annual legume, growing to 75–100 cm height depending on the soil, climatic conditions, variety and management. Its roots bear nodules harbouring nitrogen-fixing bacteria. It needs high moisture (rainfall > 150 mm per month) in its first two months of growth for good early growth and subsequent high yield, and low rainfall in the third month for uniform ripening and to minimize bolting of the seeds. Soyabean can grow in a wide range of soils, especially sandy clays with good drainage. It prefers flat to gentle slopes as it is quite susceptible to damage by erosion in hilly areas.

## METHODOLOGY

Oil palm is planted in double avenues at a spacing of 6.1 m x 9.1 m x 9.1 m (136 palms ha<sup>-1</sup>). As shown

in Figure 2, the distance between palms in a row is 6.1 m, between rows 9.1 m and between two double avenues 15.2 m.

Soyabean is planted in between two double avenues of oil palm (Figure 2). The area is cleared of weeds by working it three times 20 to 30 cm depth, *i.e.* two rounds of disc ploughing and one round of rotovation. The period between the rounds is 7 to 10 days. Ground limestone at 1 t ha<sup>-1</sup> is applied before the rotovation and fertilizer, (60 kg N, 100 kg P<sub>2</sub>O<sub>5</sub> and 100 kg K<sub>2</sub>O), before the rotovation.

The soyabean seeds are planted using a seeder (Figure 3) at the spacing of 40 cm between rows and 10 cm within rows. In general the seeding rate is 35 kg ha<sup>-1</sup>. For good weed control, planting is done immediately after the rotovation. A pre-emergence herbicide such as Alachlor (Lasso) is applied after planting. The available area for planting soyabean is 55%-60% in the first year of the oil palm, reducing as the palms grow bigger (Table 1) and shades off more light from the ground.

The common pests of soyabean are the bean fly which damages the roots, leaf eaters (beetles and grasshoppers) which attack the leaves, and pod



Figure 1. The 75-day (left) and 85-day-old soyabean.

ISSN 1511-7871



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Malaysian Palm Oil Board, Ministry of Plantation Industries and Commodities, Malaysia

P. O. Box 10620, 50720 Kuala Lumpur, Malaysia. Tel: 03-87694400

Website: <http://mpob.gov.my>

Telefax: 03-89259446



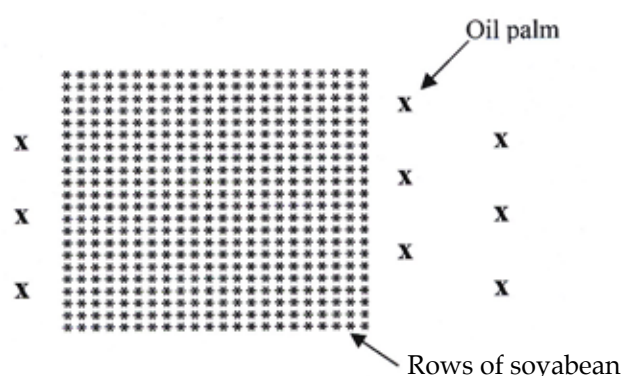
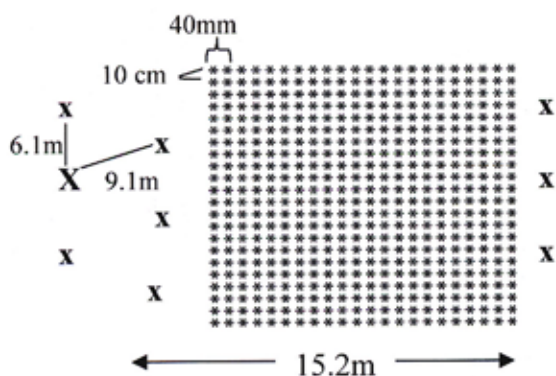


Figure 2. Oil palm planting in double avenues with integration of soyabean.



Figure 3. Planting of soyabean by seeder.

borers which feed on the pods. The main soyabean pod borer is *Etiela zinckenella* which attacks the pods at all stages. The pests are controlled by spraying insecticides (Table 2).

Soyabean is vigorous and fast growing (Figure 4). After five to six weeks of planting, the plants are already well established with complete ground cover, preventing the emergence of weeds. Normally, after this stage, no weeding is required.



Figure 4. Soyabean growing vigorously in between oil palm avenues.

TABLE 1. AVAILABLE AREA (%) FOR SOYABEAN INTEGRATED WITH OIL PALM IN DOUBLE AVENUE PLANTING

Palm age (yr)	Available area (%)
0 - 1	55 - 60
1 - 2	45 - 50
2 - 3	40 - 45
3 - 4	35 - 40
4 - 5	25 - 35
> 5	20 - 25

In Malaysia, the crop matures in 85 to 100 days when the leaves turn yellow and drop progressively. The time to harvest is when the pods turn yellowish brown and dry (Figures 1 and 5). Harvesting is by a medium size combine harvester.

### ECONOMIC EVALUATION

The average yield of soyabean integrated with oil palm is about 2.5 t ha<sup>-1</sup>. At the price of RM 1.50



Figure 5. Mature soyabean ready for harvesting.

kg<sup>-1</sup>, the gross income and cost of production are RM 3750 and RM 2545, respectively (Table 3). The gross margin is therefore RM 1025. The return for

every RM1 invested is RM1.47. The actual revenue and cost of production would depend on the actual area available with the oil palm as shown in Table 4.

**TABLE 2. COMMON PESTS OF SOYABEAN AND THEIR CONTROL**

Pests	Time of spraying (days after planting)	Recommended insecticides
Bean fly	5 - 7	Dimethoate, trichlorphon and diazinon
Leave eaters	16 - 24	Carbaryl, trichlorphon, fenvalerate and deltamethrin
Pod borers	40 - 50	Cyfluthrin, lambda cyhalothrin and trichlorphon
Pod borers	60 - 70	Cyfluthrin, lambda cyhalothrin and trichlorphon

**TABLE 3. REVENUE AND COST OF PRODUCTION PER HECTARE OF SOYABEAN INTEGRATED WITH OIL PALM IN DOUBLE AVENUE PLANTING**

Item	Quantity / price (RM)	Value (RM)
a) Revenue		
Sale of soyabean	2 500 kg @ 1.50	3 750
<b>Total Gross Income</b>		<b>3 750</b>
b) Cost		
<b>Input Cost:</b>		
1. Planting material (seed)	35kg @ 2.50	88
2. Fertilizer		
a. NPK 15:15:15	8 (50 kg bag) @ 60	480
b. MOP	67 kg @ 1.18	79
c. TSP	87 kg @ 1.08	94
d. GML	1 t @ 180	180
3. Weedicide	4 lit @ 36	144
4. Pesticide	3 lit @ 60	180
<b>Total Input Cost</b>		<b>1 245</b>
<b>Labour Cost:</b>		
1. Land preparation, ploughing	contract	600
2. Planting	by machine	250
3. Fertilizer application	2 m.d @ 25	50
4. Weed control	2 m.d @ 25	50
5. Pest control	4 m.d @ 25	100
6. Harvesting	by machine	250
<b>Total Labour Cost</b>		<b>1 300</b>
<b>Total Cost of Production</b>		<b>2 545</b>
<b>Gross Margin</b>		<b>1 205</b>
<b>Return on Investment (per RM)</b>		<b>1.47</b>

**TABLE 4. COST OF PRODUCTION AND GROSS MARGIN FROM SOYABEAN INTEGRATED WITH OIL PALM IN DOUBLE AVENUE PLANTING**

<b>Oil palm age (yr)</b>	<b>Available area (%)</b>	<b>Average cost of production (RM)</b>	<b>Average gross margin (RM)</b>
0 – 1	55 - 60	1 463	589
1 – 2	45 - 50	1 209	572
2 – 3	40 - 45	1 069	506
3 – 4	35 - 40	954	452
4 – 5	25- 35	764	362
>5	20 - 25	573	271

### **CONCLUSION**

Soyabean has great potential for integration with oil palm. It maximizes the land use, increases land productivity and generates additional income to the oil palm grower, especially during the immature phase of oil palm. The root nodules fix nitrogen and improve the soil fertility. In addition, the crop residues can be worked into the soil to improve its properties.

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For more information kindly contact:

Director-General  
MPOB  
P. O. Box 10620  
50720 Kuala Lumpur, Malaysia.  
Tel: 03-87694400  
Website: <http://mpob.gov.my>  
Telefax: 03-89259446