

INTEGRATION OF BANANA (*tanduk* variety) WITH OIL PALM PLANTED IN DOUBLE AVENUE PLANTING SYSTEM

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P*isang tanduk* (*Musa paradisiaca*) is one of the popular banana varieties for cooking in Malaysia. It is widely cultivated by smallholders for production of banana chips, a popular snack among Malaysians. The ripened banana is usually deep fried and the under-ripe boiled for breakfast or evening tea. It is the largest variety of banana. Its length ranges from 25 to 40 cm and width 6 to 12 cm. The banana generally has one or two hands in a bunch and a hand comprises of 6-10 fingers (fruits). The skin of the fingers is light green at the unripe stage and turns yellow on ripening. The ripe banana has a light creamy orange pulp with fine texture. It is non-seasonal and is available at the market throughout the year.



Figure 1.

Pisang tanduk (Figure 1) can be grown on a wide range of soils, especially on well-drained alluvial soils and shallow peat. It requires flat to gentle slopes and is quite susceptible to wind damage when planted on a hilly area. Unlike other banana varieties, *pisang tanduk* can only be harvested once during one planting season. This is because most of the suckers grow above the soil surface around the base of the banana plant and will normally lodge as they grow bigger. Replanting has to be carried out for the next harvest.

Under the conventional triangular oil palm planting system, the banana can be integrated for a period of 1.5 – 2.0 years (two planting seasons) after planting of the oil palm (Figure 2). However, under double avenue planting system for oil palm, the banana integration can be extended. In this planting system, the area between the two double avenues can be widened and the light penetration will be increased thus the growth of banana could be enhanced for another two to three years.

METHODOLOGY

Oil palm is planted in double avenues at a distance of 6.1 m x 9.1 m x 9.1 m with planting density of 136 palms ha⁻¹. As shown in Figure 3, the planting distance between the palms in a row is 6.1 m, between rows is 9.1 m and between two double avenues is 15.2 m.

The banana plant is planted either after the completion of oil palm lining or planting. The area for banana planting has to be cleared from shrubs and weeds. The land is ploughed at three rounds to a depth of 20 to 30 cm, *i.e.* two rounds of disc ploughing and one round of rotovation. The period between ploughing rounds is 7 to 10 days. On coastal alluvial soils or areas prone to flooding, field drains have to be constructed between the second and third row of banana plant in each area between two oil palm double avenues. The planting distance and the planting density of the banana will depend on the planting technique of the oil palm, *i.e.* zero burning or clean clearing techniques.

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Zero Burning Technique of Oil Palm Planting

The banana plants can be planted in five rows in the area between the two double oil palm avenues at a distance of 2.4 m between plants and 2.4 m between the rows as shown in *Figure 3*. The planting density will give 880 banana plants ha⁻¹.



Figure 2. Twelve-month-old banana plants growing vigourously in between oil palm avenues.

plant. The planting hole is 0.45 m x 0.45 m x 0.45 m, some 100 g of phosphate rock fertilizer is applied during planting. For early growth vigour and high survival rate, planting has to be carried out at the onset of the rainy season.

The fertilizer programme for banana planting is in *Table 1*.

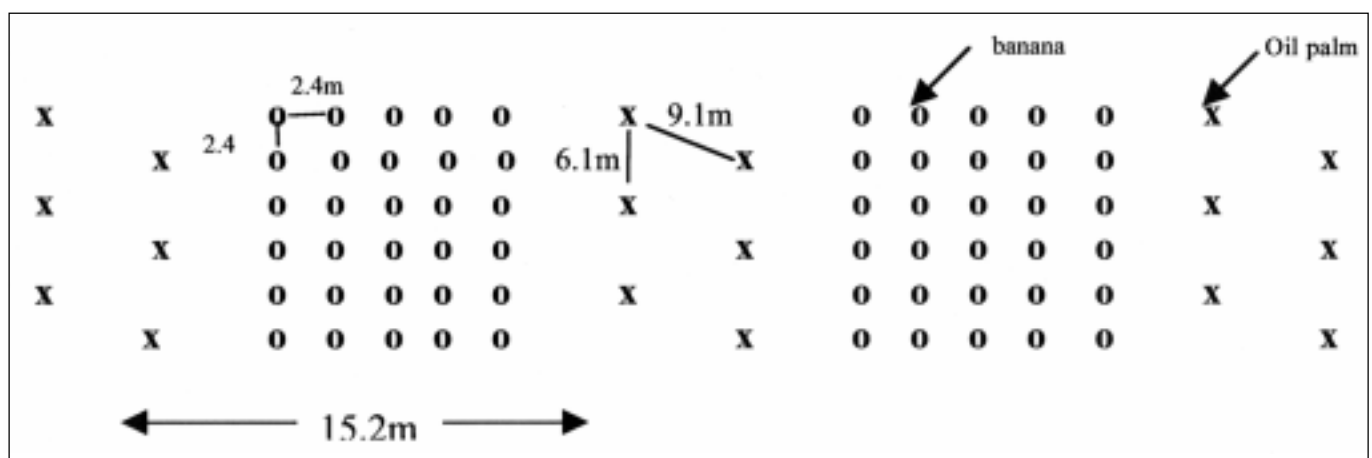


Figure 3. Arrangement of banana plants in double avenue planting system of oil palm.

Clean Clearing Technique of Oil Palm Planting

In addition to the five rows between the two double avenues of oil palm, another two rows of banana are planted in between the palm rows in the avenue of oil palm area. Planting density of banana is increased to 1240 plants ha⁻¹.

For banana planting, it is recommended to use tissue culture planting materials because of its low mortality rate and uniform growth of the

Dried leaves are pruned and spread over the ground between planting rows. Suckers are removed by cutting them at the ground level. Circle weeding up to the radius of about 0.9 m is carried out manually at monthly interval. Chemical weeding at two to three months interval is carried out when the banana plant exceeds four months old.

The banana can be harvested 14 to 18 months after planting (*Figure 4*). After harvesting, all the suckers are cleared and ready for next planting.

The methodology of the next planting is similar to the first planting. The new plants will be planted in between the previous planting points and in the same planting rows. However, two planting rows adjacent to the oil palm rows (and in the avenues area for the clean clearing planting technique) have to be removed to minimize light and space competition with the oil palm. Only three rows will be left and the planting density reduced to 530 plants ha⁻¹.

ECONOMIC EVALUATION

The average banana bunch size that can be obtained when planted on an inland soils is about 6.5 kg. The cost of production for one planting season of the banana is RM 3000 for the zero burning technique and RM 4316 for the clean clearing technique (Table 2). Assuming that

80% of the banana plants produce marketable bunches, the gross income and gross margin per hectare of banana integration in the zero burning technique are RM 5491 and RM 2491 respectively, and for the clean clearing technique RM 7738 and RM 3422 respectively. The return for every RM 1 invested is RM 1.83 for zero burning technique and RM 1.79 for the clean clearing technique.

CONCLUSION

Pisang tanduk has a great potential for integration with oil palm. It maximizes land use, increases land productivity and generates an additional income to oil palm growers especially during the immature phase of oil palm. The banana biomass, such as pruned leaves, suckers and stems during banana harvesting could contribute to improve soil fertility.

TABLE 1. FERTILIZATION PROGRAMME OR *PISANG TANDUK*

Age of banana plant	Types of fertilizer	Rate (g plant ⁻¹)
1 month after planting	Compound 15:15:15	60
3 months after planting	Compound 15:15:15	120
6 months after planting	Compound 12:12:17:2 + TE	240



Figure 4. Fourteen-month-old banana trees

**TABLE 2. ESTIMATED REVENUE AND PRODUCTION COST (ha⁻¹)
OF BANANA (*pisang tanduk*) INTEGRATED WITH OIL PALM**

Items	Zero burning technique		Clean clearing technique	
	Amount of production / input	Value (RM)	Amount of production / input	Value (RM)
Revenue	4 576 kg (704@ 6.5 kg)	5 491 (1.20 kg ⁻¹)	6 448kg (992@ 6.5 kg)	7 738
Input Cost:				
1. Planting material @ RM 1.20	880	1 056	1 240	1 488
2. Fertilizers				
- RP @ 0.45	88 kg	40	124 kg	56
- NPK Green @1.20	160 kg	192	223 kg	149
- NPK Blue @1.20	212 kg	254	298 kg	358
- Borate 40 @1.20	36 kg	44	50 kg	60
3. Weedicides				
- Paraquat	10 lit	140	14 lit	196
4. Insecticides				
- Carbofuran	13.2 kg	60	18.6 kg	84
5. EFB @ 6 t ⁻¹	26	156	36	216
Total Input Cost		1 942		2 607
Labour Cost				
1. Land preparation	contract	218	contract	349
2. Planting @ 0.50	880	440	1240	620
3. Fertilizer application				
4. Weed control	4 m.d	80	5 m.d	100
5. Pruning and thinning	6 m.d	120	9 m.d	180
7. Harvesting	2 m.d	40	3 m.d	60
	14 m.d	280	20 m.d	400
Total labour cost (RM)		1 058		1 709
Total production cost (RM)		3 000		4 316
Gross margin (RM)		2 491		3 422
Return on investment (RM)		1.83		1.79

Notes:

Planting density of banana:

In clean clearing technique – 1240 plants ha⁻¹ (70% of total area).

In zero burning technique – 880 plants ha⁻¹ (50% of total area).

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