

# INTERGRATION OF HILL PADDY WITH OIL PALM IN DOUBLE AVENUE PLANTING

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**H**ill paddy (*Oryza sativa* L.) (Figure 1) can be grown on wide range of soils, especially on sandy clay loam to clay loam. In general, it is grown in rain-fed areas, either on flat or sloping land. Although grown on dry land, it requires high moisture (rainfall of 250–200 mm per month) during its first four months of growth. The crop takes 140 to 166 days to mature, depending on the variety and climatic conditions. Currently, hill paddy is grown in the traditional way without proper manuring with poor yields obtained - as low as 1 t ha<sup>-1</sup> season<sup>-1</sup>. However, with good management and fertilization, the yield can be more than 3 t ha<sup>-1</sup> season<sup>-1</sup>. Based on this production, and as its good aroma and taste command a higher price (niche market), hill paddy has great potential to be inter-planted with oil palm to generate additional income for the oil palm grower.

## METHODOLOGY

Oil palm is planted in double avenues at 6.1 m x 9.1 m x 9.1 m spacing (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.



Figure 1. Hill paddy planted between oil palm rows.

The paddy is planted in between two double avenues of oil palm (Figure 2). In the land preparation, chemical weeding is carried out 10-14 days before the first ploughing. It is very important to clear off all weeds. The land is worked three times to 20–30 cm depth (Figure 3), i.e. two rounds of disc ploughing and one round of rotoovation. The period between the working rounds is 7 to 10 days. The crop is planted using a seeder (Figure 4) at the spacing of 30 cm between rows and 4–6 cm within rows. The seeding rate is 35–40 kg ha<sup>-1</sup>, with the actual amount dependent on the available area for planting in between the oil palms. For good weed control, planting should be done immediately after the rotoovation.

The available land for planting hill paddy in between oil palm is 55%-60% in the first year. Decreasing as the oil palm canopy closes over to increasingly shade the under-crop. The available planting area for hill paddy at different oil palm ages is shown in Table 3.

The fertilization of hill paddy is as follows:

- Basal dressing - 200 kg ha<sup>-1</sup> of 15:15:15
- 1<sup>st</sup> dressing - 143 kg ha<sup>-1</sup> ammonium sulphate
- 2<sup>nd</sup> dressing - 143 kg ha<sup>-1</sup> ammonium sulphate

The basal dressing is applied one or two days after the rotoovation. The first top dressing is at 35–40 days after planting, i.e. at tillering, to maximize the number of tillers produced. The second top dressing is at 100–110 days when the plants start flowering to obtain maximum grain filling. Both applications are broadcast.

The common pests of hill paddy are the leaf folder (*Cnaphalocrosis medinalis*), stem borer (*Chilo polychrysa*) and grain suckers (*Leptocorisa* spp.) They can be controlled by the chemicals in Table 1.



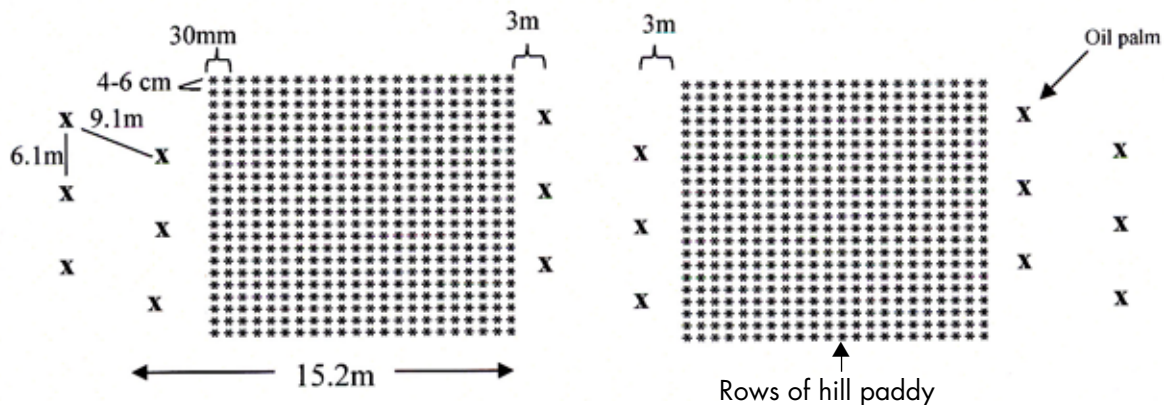


Figure 2. Oil palm planting in double avenues with hill paddy in between.



Figure 3. Land preparation for hill paddy.



Figure 4. Planting hill paddy using a seeder.

TABLE 1. COMMON PESTS OF HILL PADDY AND THEIR CONTROL

Pest	Time of treatment (days after planting)	Some recommended insecticides/rat bait
Leaf folder and grasshoppers	30 - 40	Dimethoate, trichlorphon and diazinon
(1) Leaf folder and grasshoppers (2) Stem borer	60 - 70	(1) Carbaryl, trichlorphon, and phenthoate (2) Furadan, isoprothione
Rat	90 - 100	Floeoumafen 0.05%
<i>Leptocorisa</i> spp.	100 - 120	Carbaryl and trichlorphon
Rat	110 - 120	Flocoumafen 0.05%
Rat	130 - 140	Flocoumafen 0.05%

Hill paddy is very susceptible to rat damage. Three rounds of rat baiting using Flocoumafen 0.05% at the rate of 4 kg per application are needed for good control. The times of application are as shown in *Table 2*. Ten pieces of Flocoumafen are put in a plastic container (called acorat). The acorats are placed in zig-zag positions at both sides of the hill paddy rows with a distance of 20 m (*Figure 5*). In zero-burning new planting or replanting of oil palm, rat damage is very severe (50%-80%). The clumps of debris from the previous jungle/crop are very good breeding sites for rats. The cost for controlling rats is therefore very high and may not be economic. Hence, planting hill paddy in such areas is not recommended.

The hill paddy matures in 135-166 days, and is harvested by a mini combine harvester when the grains turn yellow, indicating their moisture content to be 15%-18%.

## ECONOMIC EVALUATION

The average yield of hill paddy integrated with oil palm is about 3 t ha<sup>-1</sup>. Assuming a price of RM 1.20 kg<sup>-1</sup>, the gross income and cost of production are RM 3600 and RM 2704 respectively (*Table 2*), leaving a gross margin of RM 895. The return for RM 1 invested is RM 1.33. The actual revenue and cost will depend on how much of the oil palm can be planted (*Table 3*).

**TABLE 2. REVENUE AND COST OF PRODUCTION PER HECTARE OF HILL PADDY INTEGRATED WITH OIL PALM IN DOUBLE AVENUE PLANTING**

Item	Quantity/price (RM)	Value (RM)
<b>A) Revenue</b>		
Sale of paddy	3 000 kg @ 1.20	3 600
<b>Total Gross Income</b>		<b>3 600</b>
<b>B) Cost</b>		
<b>Input Cost:</b>		
1. Planting material (seed)	35 kg @ 2	70
2. Fertilizer		
a. NPK 15:15:15	4 (50 kg bag) @ 60	240
b. Urea	3 (50 kg bag) @ 60	180
3. Weedicide	12 lit @ 15	180
4. Pesticide	8 lit @ 40	320
5. Rat bait	12 kg @ 14.50	174
6. Acorat + stick	100 @ 0.40	40
<b>Total Input Cost</b>		<b>1 204</b>
<b>Labour Cost:</b>		
1. Land preparation, ploughing	contract	600
2. Planting	by machine	250
3. Fertilizer application	3 m.d @ 25	75
4. Weed control	5 m.d @ 25	125
5. Pest control	5 m.d @ 25	125
6. Rat baiting	3 m.d @ 25	75
7. Harvesting	by machine	250
<b>Total Labour Cost</b>		<b>1 500</b>
<b>Total Cost of Production</b>		<b>2 704</b>
<b>Gross Margin</b>		<b>895</b>
<b>Return on Investment (per RM)</b>		<b>1.33</b>



Figure 5. The 70 – 80-day-old hill paddy in between five-year-old oil palm in double avenue planting.

**TABLE 3. AVAILABLE LAND AREA (%), COST OF INTEGRATED PRODUCTION AND GROSS MARGIN OF HILL PADDY OIL PALM PLANTED IN DOUBLE AVENUES**

Oil palm age (year)	Available land area (%)	Average cost of production (RM)	Average gross margin (RM)
0 – 1	55 - 60	1 557	513
1 – 2	45 - 50	1 286	424
2 – 3	40 - 45	1 138	375
3 – 4	35 - 40	1 016	335
4 – 5	25- 35	813	268
>5	20 - 25	610	200

### CONCLUSION

Hill paddy has a long maturity period and high potential yield. It can be integrated with oil palm in areas that receive high rainfall (>100 mm per month) for four continuous months. The integration can generate substantial additional income for the oil palm grower, especially during the immature phase of oil palm. However, it is not recommended for areas previously cleared by zero-burning.

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