

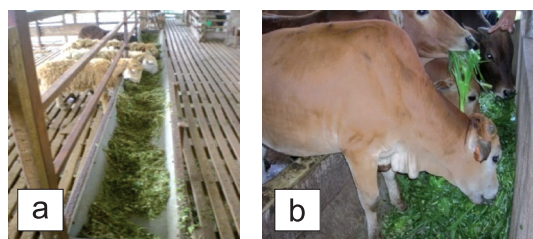
Sorghum (*Sorghum vulgare*) (Figure 1) originated from Ethiopia and Sudan. It was introduced into Malaysia in 1969, and has been cultivated at the Agriculture Station, Sungai Udang, Melaka, during the paddy off-season. Sorghum belongs to the family *Graminineae*, similar to wheat, rice and maize. It can reach up to 4 m in height, and grows well in warm climate with temperatures ranging from 26°C to 37°C. Sorghum can be cultivated at 1200 m above sea level, and can tolerate high temperature, drought conditions and withstand water-logging for short periods.



Figure 1. Forage sorghum (55-day old) integrated in the double avenue oil palm planting system.

Forage sorghum is used for animal feed (Figure 2a-b). It can be grazed, or turned into silage or hay. It has great potential to be integrated with oil palm as a fodder source because of its wide adaptation, rapid growth, high green and dry fodder yields, with high ratoonability and drought tolerance.

A trial on integrating forage sorghum with oil palm cultivation was conducted from 2008 to 2010 on mineral soils at the MPOB Research Plot in KLIA Sepang, Selangor and at the MPOB Research Stations in Kluang (Johor), Keratong (Pahang) and Lahad Datu (Sabah).



Figures 2a-b. Green chopped forage sorghum is fed to goats and cattle.

METHODOLOGY

Oil palm was planted using the double-avenue planting system with spacings of 6.1 m x 9.1 m x 15.2 m, giving a planting density of 136 palms ha⁻¹ (Figure 3). The palms were managed according to normal estate practices. The 15.2 m wide avenue space between two rows oil palm was cleared from shrubs and weeds, and ploughed twice using disc and rotor attachments to a depth of 20 to 30 cm. The lag time between ploughings was 7 to 10 days. Forage sorghum seeds were obtained from Australia.

Planting was carried out in the double-avenue space at the onset of the rainy season to ensure good growth and survival rate. Forage sorghum seeds were planted at a spacing of 70 cm x 20 cm at the rate of 7 kg ha⁻¹, giving 71 428 plants ha⁻¹ (Figure 3). Basal dressing and top dressing were practiced in the planting programme. The fertiliser programme for forage sorghum is shown in Table 1. Weeding was carried out at 25- to 30-day intervals which is equivalent to about two to three rounds per season.

Generally, the plants can be harvested at the age of 50 to 55 days after planting (Figure 4), and the harvesting was carried out by cutting the plants at 25 to 30 cm above ground (Figure 5).

The sorghum can be harvested four times for each planting season at intervals of 35 to 40 days (Figure 6).

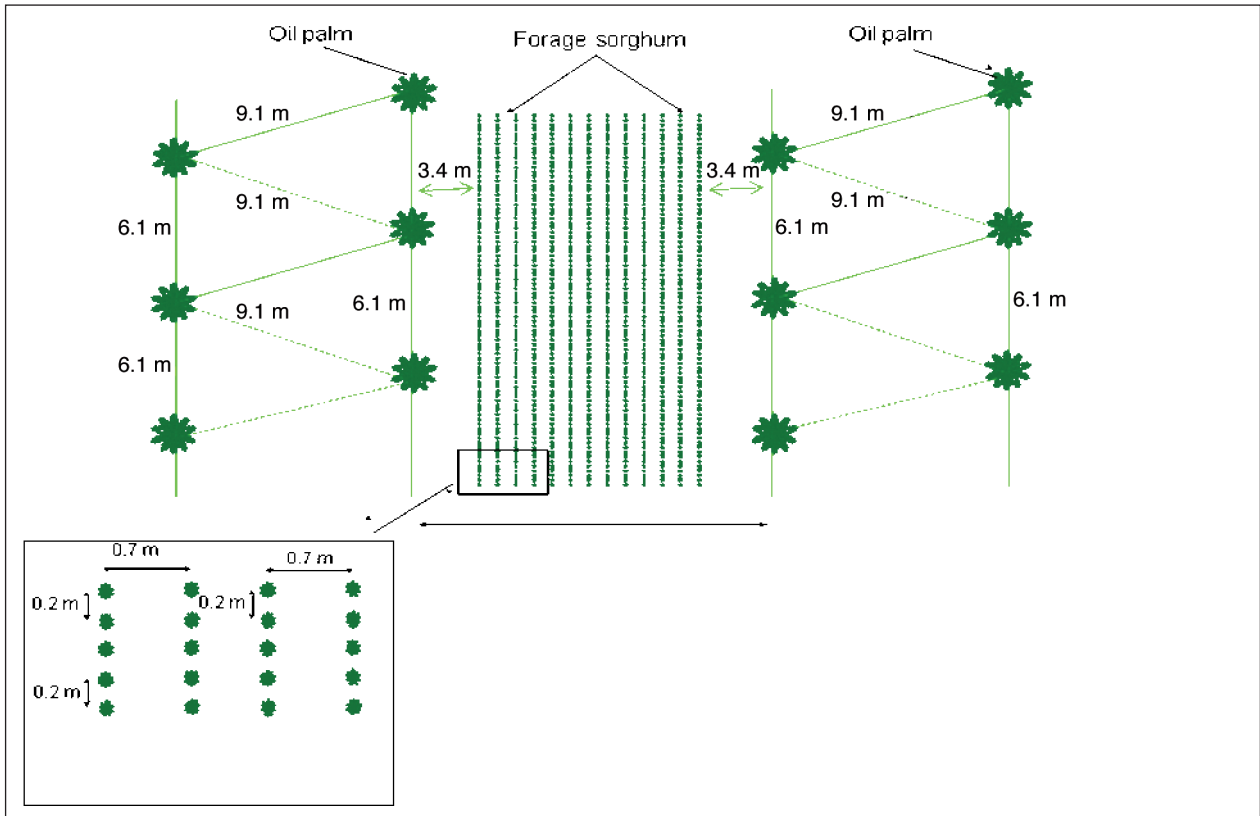


Figure 3. Layout of forage sorghum rows integrated into the double-avenue oil palm planting system.



Figure 4. Forage sorghum can be harvested at the age of 55 days after planting.

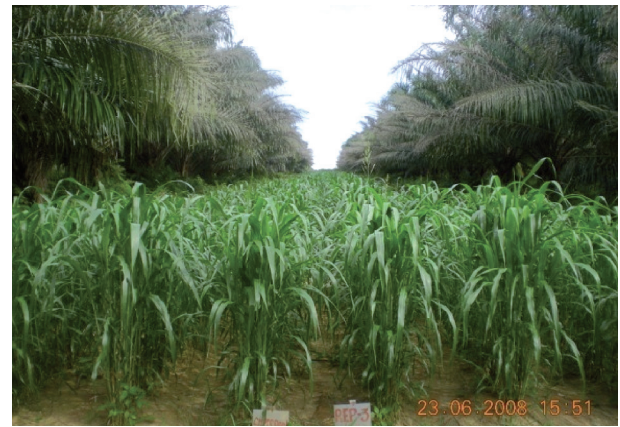


Figure 6. New tillers at 20 days after the first harvest in KLIA, Sepang.



Figure 5. Harvesting forage sorghum using a sickle.

The Standard Method of Testing Animal Feed-stuffs (1982) was followed for analysing the nutrient composition of forage sorghum using the method of Goering and van Soest (1970) and the Gas Test of Menke (1975).

RESULTS

Forage sorghum has better production and nutritional value compared with Napier grass (Table 2).

No significant reduction in oil palm yield was observed during the three-year studies. The respective average fresh fruit bunch (FFB) yields for the

TABLE 1. INTEGRATED FORAGE SORGHUM FERTILISER PROGRAMME

Type of fertiliser	Basal dressing (kg ha ⁻¹ season ⁻¹)	Top dressing (kg ha ⁻¹ season ⁻¹)
Compound 15:15:15	500	-
Triple superphosphate	98	-
Muriate of potash	75	-
Urea*	-	150

Note: * Applied after first to third harvests.

TABLE 2. PRODUCTION AND NUTRITIONAL VALUE OF FORAGE SORGHUM COMPARED TO NAPIER GRASS

Type of forage	Cumulative yield (t ha ⁻¹ yr ⁻¹)		Forage nutritional value			
	Fresh	Dry	Crude protein (%)	Crude fibre (%)	Total digestible nutrients (%)	Metabolisable energy (MJ kg ⁻¹)
Forage sorghum*	323.76	58.82	16.42	34.19	59.42	8.90
Napier grass**	177.51	30.00	12.70	24.10	55.70	8.27

Note: * Average figure from several field trials conducted.

Source: ** Department of Veterinary Services, 2nd Edition, 2001.

first, second and third year harvests were 4.07, 11.67 and 25.40 t ha⁻¹, which were higher than the control plot yields of 3.52, 9.04 and 24.66 t ha⁻¹, respectively.

PRODUCTION COST AND REVENUE

The total production cost of integrating forage sorghum with the double avenue oil palm planting system for one planting season was RM 5580.00 ha⁻¹ (Table 3).

The average fresh fodder yield was 320 t ha⁻¹ yr⁻¹, and the price of one tonne of fodder was RM 70.00. Thus, the gross revenue and net revenue per hectare were RM 22 400.00 and RM 11 240.00 respectively. The monthly income per hectare from forage sorghum was RM 937.00. The oil palm revenue was calculated based on FFB yields of the trial plots and on the average FFB price per tonne which in 2010 was RM 540.00 t⁻¹. Based on this FFB price and on a production of 25.40 t ha⁻¹

TABLE 3. ESTIMATED PRODUCTION COST FOR FORAGE SORGHUM INTEGRATED WITH DOUBLE AVENUE PLANTING OF OIL PALM (RM ha⁻¹ season⁻¹*)

Input/operation	Input/contract cost (RM)	Labour		Total (RM)
		Man-day	Cost (RM)	
Seeds	400.00**	-	-	400.00
Land preparation	850.00	-	-	850.00
Planting	-	10	300.00	300.00
Liming and fertilisation	2 180.00	13	390.00	2570.00
Weed control	80.00	9	270.00	350.00
Pest and disease control	150.00	2	60.00	210.00
Harvesting	-	30	900.00	900.00
Total	3 660.00	64	1 920.00	5 580.00

Note : * 6 months per season and 4 harvests.

** Ex-farm price.

yr⁻¹, the gross and net revenues per hectare were RM 13 716.00 and RM 8128.00, respectively. The monthly income from oil palm was RM 677.00. The total monthly income from integrating forage sorghum with oil palm was thus RM 1614.00 (Table 4).

REFERENCES

GOERING, H K and VAN SOEST, P J (1970). Forage fibre analyses (*Apparatus, reagent, procedures and some application*). USDA Agriculture Handbook, No. 379.

TABLE 4. ESTIMATED REVENUE FROM INTEGRATION OF FORAGE SORGHUM WITH OIL PALM (RM ha⁻¹ year⁻¹)

Item	Forage sorghum	Oil palm	Total (RM)
	Price: RM 70 t ⁻¹	*Price: RM 540 t ⁻¹	
Fresh yield (t ha ⁻¹ yr ⁻¹)	320	25.40	-
Gross return (RM ha ⁻¹)	22 400.00	13 716.00	36 116.00
Total cost (RM ha ⁻¹)	11 160.00	5 588.00	16 748.00
Net return (RM ha ⁻¹)	11 240.00	8 128.00	19 368.00
Monthly income (RM)	937.00	677.00	1 614.00

Note: *Actual FFB price in 2010.

CONCLUSION

Forage sorghum has great potential to be integrated with oil palm as a fodder source. The integration maximises land use, increases land productivity and generates additional income for oil palm growers. Besides increasing the farmer's income, this practice will also contribute to and support the sustainability of the ruminant livestock industries and the national economy.

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