
Revitalise Coconut as a Plantation Crop*

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Coconut, Cocos nucifera in Malaysia is generally a smallholder's crop with 98 per cent under smallholder cultivation and 2 per cent under estate management. The largest coconut area was attained in 1982 at 363,000 hectares and the area has declined to 84,608 hectares in 2016 due to massive conversion of coconut lands to oil palm plantation and other more profitable crops. The demand for coconuts has grown exponentially in the last decade, a total of 700 million fresh nuts are required yearly but Malaysia is short of the demand by 150 million nuts. More than 17 companies in Malaysia are involved in processing coconut-based products for domestic and overseas markets. Planting of coconut in Malaysia only occupies about 1.1 per cent of agricultural lands in the country, compared with oil palm at 75.5 per cent. At present, MATAG and Pandan are the most common varieties planted in Malaysia. The Department of Agriculture (DOA) Sabah has launched variety Tacunan Green Dwarf for planting in 2012. The DOA Peninsular Malaysia also recommends varieties MYD and MRD for planting. Coconut clonal material is not available for planting. Malaysia needs to plant coconut on a large scale to meet the rising demand for domestic consumption and local downstream processing. It was estimated that a total of 6,763 ha of additional coconut area and rehabilitation of the existing coconut area will be able to fulfil the requirement of 700 million coconut fruits in the country by 2021. It is suggested that all the old coconut farms as well as some of the old oil palm should be replanted with coconut in the long-term. Planting technology recommended for oil palm can be applied for development of coconut plantations. Cost of planting depends on type of land developed, planting materials, products targetted, farm input, labour cost and mechanisation. Investment for replanting is less compared with new land development as the existing infrastructure, machinery, labour could be adopted from ex-farm. The income gained from coconut has been improved due to higher production and farm gate price. With careful planning for sustainable production, technology adoption, investment in the coconut plantation should give viable returns.

Keywords: Coconut, *Cocos nucifera*, plantation crop, management, production.

Coconut, *Cocos nucifera* is widely known as the 'tree of life', a long-term crop with various food and non-food uses. It is of the same family, *Arecaceae* as oil palm (*Elaeis guinensis*). Botanically, coconut fruit is a drupe, and is unique compared to other fruits as it contains large amount of water in the centre of the fruit apart from the edible kernel. Its kernel is soft when young and gradually turns hard when

matured. Mature coconut kernel can be made into coconut milk, coconut oil and desiccated coconut.

Coconut cultivation is one of the oldest industries in Malaysia and recorded as early as in 1880 (Ramanathan & Ng, 1971). The largest coconut area was attained in 1982 at 363,000 hectares. The area has declined to 84,608 hectares in 2016 (Anon, 2017).

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However the demand for coconut has grown exponentially in the last decade due to health benefits and wide application of coconut products in downstream activities.

It is observed that the downstream processing manufacturers are facing shortage of coconut in the country. This is mainly due to land use change with coconut being replaced by higher income crops like oil palm, vegetables as well as urbanisation. Further, growers harvest tender coconuts rather than mature coconut for better price and higher demand thus contributing to the problem. Despite the decreasing area, the coconut industry still plays an important role in the country's economy providing livelihood to some 80,000 farm families (Anon, 2011).

Indonesia is the largest coconut fruit exporter in the world. It is the nearest country for Malaysia to import coconut in terms of logistic. A total of 700 million fresh nuts are required yearly in Malaysia, and 150 million nuts need to be imported (Anon, 2018a). The annual coconut consumption per capita is 22 fruits in Malaysia. It is critical that Malaysia needs to expand the coconut area in order to fulfil the nut requirement in the long- term.

This paper discusses the scenario faced by the coconut industry in Malaysia and highlights the opportunities of growing coconut as a plantation crop.

REVIEW OF CURRENT SITUATION

Economic products from coconut

Matured coconut fruits are used in cooking or as confectionery. Tender coconuts are harvested for drink, and vital in the tourist market. The main traditional economic products of coconut are copra and copra oil. However, new products have been developed, i.e. coconut milk powder, coconut milk,

desiccated coconut, coconut water, tender coconut, coconut shell charcoal, activated carbon, coconut husk fibre, and lately virgin coconut oil (VCO) has the highest value in the market. The health benefits of virgin coconut oil as a source of lauric oils and coconut water as a isotonic or health drink have increased the value of coconut fruits significantly.

At present, the farm gate price for a mature coconut ranges from of RM1.00 to RM1.90 depending on fruit size. The wholesale price of tender coconut is RM2 to RM3 per fruit depending on the supply and demand within the market, and other factors like supply disruptions, climate and the emergence of substitute commodities

Coconut cultivated area

More than 93 countries in the regions of Asia, East Africa and America grow coconuts (Sivapragasam, 2008). Total coconut area in the world is 12 million hectares. Indonesia, Philippine and India are the three top major coconut growing countries, and Malaysia ranks fourteenth (*Table 1*).

Malaysia has 84,609 hectares of coconut area in 2016. Sabah has the largest coconut planted area in Malaysia followed by Sarawak and Johor (*Table 2*).

Coconut was the third major crop after rubber and paddy in 1947 (McConnell, 1964). At present coconut is the fourth major crop in Malaysia after oil palm, rubber and paddy (*Table 3*). Planting of coconut in Malaysia only occupies about 1.1 per cent of agriculture lands in the country, compared with oil palm at 75.5 per cent. A 20 per cent decline in cultivated area and farm productivity from 2010-2016 is observed in Malaysia. However, this trend of declining of the coconut industry also occurs in other coconut growing countries as shown in *Table 1*.

TABLE 1
AREA OF COCONUT (IN 1000 HA), 2010–2014

Rank	Country	Year				
		2010	2011	2012	2013	2014
1	Indonesia	3,739	3,768	3,782	3,654	3,610
2	Philippines	3,576	3,562	3,574	3,551	3,502
3	India	1,895	1,896	2,071	2,137	2,141
4	Sri Lanka	395	395	395	395	440
5	Brazil	273	273	279	279	251
6	Papua New Guinea	221	221	221	221	221
7	Thailand	232	216	214	209	206
8	Kenya	78	82	86	177	177
9	Mexico	179	179	176	176	169
10	Vietnam	147	155	157	158	159
11	Tanzania	134	134	134	131	128
12	Samoa	102	104	97	99	99
13	Vanuatu	96	96	92	92	92
14	Malaysia	106	106	101	88	88
15	Others	848	848	862	857	913
	Total	12,021	12,035	12,241	12,224	12,196

Source: Anon (2018). Asian and Pacific Coconut Community

TABLE 2
PLANTED AREA OF COCONUT BY STATE, MALAYSIA, 2010–2016

State	Planted area (ha) by year						
	2010	2011	2012	2013	2014	2015	2016
Johor	21,099	21,124	20,068	13,198	17,570	11,550	11,751
Kedah	1,750	1,651	1,568	1,094	1,297	1,931	2,273
Kelantan	5,728	5,587	5,308	5,420	6,403	8,078	9,327
Melaka	2,974	2,990	2,841	2,547	2,421	2,451	2,254
Negeri Sembilan	1,366	1,273	1,210	1,539	1,319	1,576	1,398
Pahang	1,722	1,772	1,683	3,772	4,014	3,988	6,135
Perak	15,042	15,064	14,311	9,430	9,655	9,446	9,266
Perlis	546	560	532	532	366	370	183
Pulau Pinang	1,992	1,942	1,844	1,819	33	51	40
Selangor	10,624	10,521	9,995	9,565	10,500	9,721	9,281
Trengganu	2,289	4,335	4,119	4,533	3,329	1,964	3,345
Sabah	18,083	17,998	17,098	17,286	16,785	16,481	16,600
Sarawak	21,817	20,912	19,866	17,065	14,227	14,222	12,616
WP Labuan	627	583	554	175	172	172	141
Total (ha)	105,659	106,313	100,996	87,974	88,093	82,001	84,609

Source: Anon (2014, 2017)

TABLE 3
TOTAL PLANTED AREA (HECTARE) OF MAIN INDUSTRIAL CROPS IN MALAYSIA, 2010 - 2016

Crop	Planted area (ha) by year							% over total land	% Land use change 2010 to 2016
	2010	2011	2012	2013	2014	2015	2016		
Oil palm ¹	4,853,766	5,000,109	50,76,929	5,229,739	5,392,235	5,642,943	5,737,985	75.5	18
Rubber ²	1,020,380	1,027,040	1,041,190	1,057,270	1,065,630	1,078,630	1,072,920	14.1	5
Paddy ³	677,884	687,940	684,545	671,679	679,239	681,559	688,770	9.1	2
Coconut ⁴	105,659	106,312	100,996	87,974	88,093	82,001	84,609	1.1	-20
Cocoa ⁵	20,083	20,848	11,748	13,826	16,102	18,122	17,421	0.2	-13
Total	6,677,772	6,842,249	6,915,408	7,060,488	7,241,299	7,503,255	7,601,705	100.0	-

Source: ¹ Anon (2018b), ² Anon (2016), ³Anon (2014), ⁴ Anon (2017), and ⁵Anon (2018c).

Coconut management by sector

Coconut in Malaysia is generally a smallholder's crop with 98 per cent of the area being under smallholder cultivation and 2 per cent under estate management (Anon, 2011). Average farm size of the smallholder is 2.8 hectares (Fong *et al.*, 2005). In Malaysia a smallholding is a farm with less than 40.47 hectares (100 acres) of land; while estates encompass 40.47 hectares (100 acres) or more (McConnell, 1964). There are few plantations engaged in coconut planting. One of them United Plantations Bhd (UP) has maintained coconut planting since 1912. United Plantation has the largest coconut plantation in Malaysia covering 3,519 hectares with a capacity to produce 76 million nuts a year (Gurmit & Mukesh, 2005).

Milling technologies

The main commercial products for export are coconut milk, coconut water, desiccated coconut and coconut cream powder which need to be manufactured in a processing plant. At present, Sabah has one coconut milk powder factory. There is one in Sarawak but it does not run on full capacity due to shortage of

coconut fruits. There are 17 manufacturers in Peninsular Malaysia producing coconut milk, desiccated coconut and other products for export and local consumption (Sivapragasam, 2008). Other small or medium industries to process VCO, coconut soap, tender coconut etc. are many, but data is not readily available.

Supporting services, research and development (R&D)

In the past few decades, little R & D has been given to coconut by the government and private sector compared to other economic crops like oil palm, rubber, paddy and cocoa. However, extension programme for new planting, replanting or rehabilitating the coconut farm has been carried out by the Department of Agriculture (DOA) in Peninsular Malaysia and the DOA Sabah and Sarawak with limited fund and resources.

In Malaysia, coconut breeding work is mainly carried out by MARDI, the Department of Agriculture Sabah and United Plantations. A gene pool is maintained by these agencies for long-term breeding purpose. Today, at least 14 tall and 9 dwarf varieties are conserved for variety improvement (Table 4). Various hybrids were crossed and evaluated in the country

since 1980s (Gurmit & Mukesh, 2005; Fong *et. al.*, 2005; Fong, 2011). Most of them produced high number of fruits but fruit size varied depending on the parental material (Table 5). MAWA and MATAG were promising and released for planting.

Federal Agricultural Marketing Authority (FAMA) plays a role in collecting data on farm gate price of dehusked nut. FAMA corporation Sdn. Bhd. is the only government link company (GLC) appointed by the government to import mature coconut for fresh market in Malaysia.

Manufacturers with handling capacity exceeding 500,000 fresh fruit per year are allowed to apply for permit to import mature coconut fruit for processing.

Commercial planting material

The traditional variety is the tall variety, the Malayan Tall planted in Peninsular Malaysia, the Sarawak Tall in Sarawak and the Sabah Tall planted in Sabah. Since 1980s, MAWA (MYD/MRD x WAT) hybrid coconut has been

TABLE 4
COCONUT BREEDING MATERIAL CONSERVED IN MALAYSIA

<i>Tall variety</i>	<i>Dwarf variety</i>
1. Christmas Island Tall (CIT)	1. Aromatic Green Dwarf (AROD)
2. Kakar Tall (KKT)	2. Cameroon Red Dwarf (CRD)
3. Malayan Tall (MLT)	3. Catigan Green Dwarf (CATD)
4. Markham Valley Tall (MVT)	4. Malayan Green Dwarf (MGD)
5. Rangiroa Tall (RGT)	5. Malayan Red Dwarf (MRD)
6. Rennell Island Tall (RIT)	6. Malayan Yellow Dwarf (MYD)
7. Rotuman Tall (RTMT)	7. Sungai Gulang-gulang (SGG)
8. Sabah Tall (SBT)	8. Tacunan Green Dwarf (TACD)
9. Sarawak Tall (SKT)	9. Niu Leka Green Dwarf (NLAD)
10. Tagnanan Tall (TAGT)	
11. Tahitian Tall (TAT)	
12. West African Tall (WAT)	
13. Ceylon Tall	
14. Laguna Tall (LAGT)	

TABLE 5
SOME HYBRIDS COCONUT EVALUATED IN MALAYSIA

1 MYD x CIT	9 CRD x RIT	17 SBT x WAT
2 MYD x SBT	10 MYD x TAGT	18 TACD x WAT
3 MYD x KKT	11 MYD x WAT	19 MRD x WAT
4 MYD x MLT	12 MYD x CATD	20 CRD x MYD
5 MYD x RGT	13 MYD x TAC	21 MYD x NLAD
6 MYD x RIT	14 CATD x WAT	22 MYD x LAGT
7 MYD x RTMT	15 CRD x WAT	23 MRD x NLAD
8 TAGT x WAT	16 MYD x TAT	24 MRD x LAGT

(For identifying variety's full name refer to Table 4)

introduced for commercial planting in Malaysia and was followed by MATAG (MYD x TAGT) in 1990s. Pandan coconut or Aromatic Green Dwarf coconut (AROD) was introduced in 1980s mainly for tender nut production as for its aroma and sweetness of the water. Mature Pandan coconut can be used to produce good quality aromatic VCO as well. At present, MATAG and Pandan are the most common varieties planted in Malaysia. The Department of Agriculture Sabah has launched Tacunan Green Dwarf for planting in 2012. The department is in the progress to expand seed gardens and breeding material which have been given to DOA Peninsular Malaysia and DOA Sarawak for multiplication. DOA Peninsular Malaysia also recommends MYD and MRD for planting.

At present, no commercial coconut clonal material is available in the market. Investment on R & D to produce clonal material is urgently needed to solve the slow reproduction rate of coconut through conventional seed production. Adoption of oil palm cloning technology by the public and private sector in the coconut industry is urgently needed, in order to produce selected quality planting material in the future for this country. The industry needs to plant quality planting materials with slow height increment, precocity and high yielding.

Planting material requirement and production

There are few MATAG and Pandan seed producers in Malaysia established by the Department of Agriculture (DOA) in the Federal government, and in Sabah and Sarawak. United Plantations Berhad has been one of the private companies producing hybrid planting materials since 1974. Lately, National Farmers Organization (NAFAS) and National

Land Finance Co-operative Society (NLFCS) are also in the progress to produce MATAG for planting. It was estimated that about one million coconut seedlings can be produced which can be sufficient to plant about 4,389 hectares of coconut land annually. In year 2021, a total of 17,555 hectares of coconut could be planted to produce 150 million fruits annually (*Table 6*). The low yielding, tall palms need to be replanted with high yielding varieties in the long-term.

At present, it is observed that there is a nation-wide 'rush' to undertake new planting or replanting of coconut which has led to a sudden shortage of seeds and seedlings. Prices of seeds and seedlings have increased to exorbitant levels, and there could even be an influx of low quality planting materials in the market. At present dwarf variety cost RM5 to RM15 per seedling; MATAG costs RM15 to RM50 a seedling.

Those plantations wanting to plant dwarf variety i.e. Pandan or Tacunan are encouraged to establish their own seed garden at the initiation of planting. The existing Pandan coconut and Tacunan coconut farms can be identified and converted to coconut seed producers.

MATAG or hybrid seed production is tedious and time consuming. A technical support team is required to establish maternal palm (MYD/MRD) garden and select paternal palm (TAGT) for pollen source; including a laboratory for pollen processing and viability test, emasculation and assisted pollination. Culling for off-type seedlings in nursery are routine work for hybrid seed production. F2 seeds collected from the MATAG coconut are not supposed to be used as planting materials due to segregation.

Both dwarf and hybrid seed gardens need to be isolated from other coconut with an

TABLE 6
PROJECTED COCONUT SEEDLINGS PRODUCTION IN MALAYSIA, 2018-2021

Variety	Item	By year				Total	Annual mean
		2018	2019	2020	2021		
MATAG	Total seedlings	177,000	177,000	197,000	197,000	748,000	187,000
	Area (ha) developed (180 palm/ha)	983	983	1,094	1,094	4,156	1,039
	Cumulative area (ha)	983	1,967	3,061	4,156		
Pandan	Total seedlings	256,550	264,550	266,550	266,550	1,054,200	263,550
	Area (ha) developed (272 palm/ha)	943	973	980	1,481	4,377	1,094
	Cumulative area (ha)	943	1,916	2,896	4,377		
Tacunan	Total seedlings	15,000	18,000	20,000	20,000	73,000	18,250
	Area (ha) developed (236 palm/ha)	64	76	85	85	309	77
	Cumulative area (ha)	64	140	225	309		
MYD	Total seedlings	510,000	510,000	510,000	510,000	2,040,000	510,000
	Area (ha) developed (272 palm/ha)	1,875	1,875	1,875	1,875	7,500	1,875
	Cumulative area (ha)	1,875	3,750	5,625	7,500		
MRD	Total seedlings	82,500	82,500	82,500	82,500	330,000	82,500
	Area (ha) developed (272 palm/ha)	303	303	303	303	1,213	303
	Cumulative area (ha)	303	607	910	1,213		
Malaysia	Estimated total seedlings	1,041,050	1,052,050	1,076,050	1,076,050	4,245,200	1,061,300
	Total area developed	4,168	4,211	4,337	4,838	17,555	4,389
	Cumulative area developed	4,168	8,379	12,716	17,555		

isolation barrier of 400 meters to avoid contamination.

Out sourcing of planting materials from other countries is not encouraged as there is risk of introduced invasive alien species (IAS) of pests or diseases.

GROWING COCONUT UNDER PLANTATION MANAGEMENT

Malaysia needs to plant coconut on a large scale to meet the rising demand for domestic

consumption and local downstream processing. It was estimated that with a total of 6,763 hectares of new areas developed and rehabilitation of the existing coconut area will enable Malaysia to fulfil the requirement of 700 million coconut fruits in the country by 2021 (Table 7).

Coconut planting, field maintenance and production

New agricultural land for coconut is limited. It

TABLE 7
ESTIMATED ANNUAL COCONUT PRODUCTION IN MALAYSIA IN 2021

<i>Coconut planting</i>	<i>Area (Ha)</i>	<i>Estimated yield (nuts/ha)</i>	<i>Estimated total production</i>
Existing area (various varieties) based on 2016	84,609	6,500	550,000,000
New area (MATAG, Pandan, Tacunan)	6,763	22,180	150,000,000
Total	91,372		700,000,000

was suggested that all the old coconut farms as well as some of the old oil palm areas should be replanted with coconut. The coconut plantation management procedure is very similar to oil palm, i.e. from land clearing to planting, timing of harvesting as well as machineries and equipment used or required. Thus no extra cost is needed for change of land use from oil palm to coconut. However, planters need to be aware that the land use for coconut development should be agricultural land or land gazetted for coconut planting.

Variety to be planted depends on the end-use of the coconut. It was recommended that Pandan, MYD or MRD be used for tender coconut production; MATAG, Tacunan for mature fruit production. Planting material

requirement need to be planned for at least 18 months in advance.

Planting of cover crops is encouraged to prevent soil erosion. It also provides organic material to the soil, avoids weed development and fixes nitrogen in soil and retains soil moisture. The cover crops will help to prevent the invasion of pest and diseases in the fields. Mixture of *Pueraria*, *Calapogonium* and *Centrosema* or *Mucuna bracteata* can be planted. Cover crop maintenance, weed control, fertiliser application etc. are general maintenance work in the plantation after crop planting.

Fertiliser needs to be applied. The manuring guide is as in *Table 8* (Fong, 2001). The fertilisers are usually applied under the crop canopy which is the root zone area. The

TABLE 8
COCONUT MANURING GUIDE

<i>Age after planting (month)</i>	<i>Rate (kg/palm) NPK Mg 12:6:22:3</i>
During planting	0.5*
6	0.5
12	0.5
18	0.6
24	0.8
30	1.0
36	1.2
42	1.5
48	1.8
54	2.1
60 above	2.5

* additional 200 g of phosphate rock applied into planting hole

fertiliser rates vary depending on soil fertility, foliar nutrient status, palm age and yield targets.

Coconut will come into production in three to four years after planting. Tender nuts are harvested when nuts are about 7 months old, harvesting intervals are once every 3 weeks. Mature nuts are harvested monthly from the same palm, when the husk turns brown. For large area, the harvesting schedule in plantation need to be planned. The yield potential of coconut depends on the variety planted and farm input (Table 9).

All harvested fruits are carried to the warehouse or collecting centre. Mature fruits need to be sold or processed within two months i.e. before germination. Normally, the husk of the mature fruits need to be peeled off before sending to market to reduce bulk.

Fresh tender nuts can be kept in store for about one week under room conditions. The tender coconuts also need to be trimmed and treated with sodium metabisulfite to prevent browning before delivery to market. The fruits need to be stored at 7-10°C. At such temperature the shelf life of tender coconuts can be extended by 3 to 4 weeks (Narong, 2006).

As environment, biodiversity and climate change have become increasingly important issues in the recent years, sustainable

agriculture can contribute for mitigation and adaptation. The Good Agricultural Practices (MyGAP) need to be adopted and implemented by the coconut plantations so as to ensure the sustainability of its plantation production. Those plantations with processing plants need to practice product quality control and compliance to international standards e.g., GMP, HACCP (Hazard Analysis and Critical Control Points) and *Halal* certificate etc. This is to enhance the competitiveness of the local producers, manufacturers, traders and entrepreneurs through grading or developing strong brand name with guaranteed quality safe product.

Labour and mechanisation

Worker requirement for general coconut field work is less during the crops' pre-mature stage; but additional labour are required for harvesting and fruit collecting after 3 to 4 years of planting. A worker could manage 10 hectares of general field work. Labour requirement for harvesting tender coconut and mature coconuts are different due to different handling, as more frequent harvesting is needed for tender coconuts. Workers need to be trained to harvest tender coconuts at the right stage. Every 40.47 hectares (100 acres) of coconut

TABLE 9
PLANTING DENSITY AND ESTIMATED COCONUT PRODUCTION PER HECTARE PER YEAR

<i>Variety and (planting distance)</i>	<i>No of palm /ha</i>	<i>nut/palm /year</i>	<i>No of nuts /ha/year</i>	<i>Fresh meat (g)/fruit</i>	<i>Fresh meat (t/ha/year)</i>
MATAG (MYD X TAGT) (8 m x 8 m)	180	107	19,260	481	9.26
Tacunan (TACD) (7.5 m x 7.5 m)	236	92	21,712	460	9.98
Pandan (AROD) (6.5 m x 6.5 m)	272	94	25,568	251	6.42
Average			22,180	397	9.00

need two workers to do maintenance and harvesting for mature coconuts i.e. 20 to 25 days harvesting and 5 days maintenance but four to five workers are needed for tender coconut production. Harvesting needs to be done every day.

Mechanisation is needed to speed up field operation in plantations, as labour shortage and increasing labour cost are the current issues. Mini evacuation machines (or motorcycle trailer), fertiliser spreaders etc. need to be used for daily activities such as transporting fruits, carrying out farm inputs and applying fertilisers. The use of tractor with trailer is common in plantations with flat to undulating terrain. One tractor operator and two workers are required to load fruits into the trailer.

Pest and disease management

Philippine recorded about 150 pest species including insects, plant pathogens, vertebrates and weeds in their country (Anon, 1992). Some of these are also recorded in Malaysia and are potential threatening species in our country.

Sivapragasam (2011) has reviewed and listed the major pests and diseases on coconut in Malaysia and the control measures used. Among the 184 insect pest species and a number of pathogens, the major insect pests which are perennial in nature are Rhinoceros beetle (*Oryctes rhinoceros*) and red palm weevil (*Rhynchophorus ferrugineus*). These two major insect pests caused more than 25 per cent loss of coconut in Malaysia (Dilipkumar & Tang, 2013). Coconut leaf-eating beetles, particularly *Plesispa reichei*, have become important pests in Malaysia as well. Frequent and sporadic infestations of *P. reichei* beetle have been reported on coconut and ornamental palms throughout the country (Anon, 2004). Leaf-eating caterpillars, *Setora*

nitens, *Hidari irava*, *Darna diducta* and *Darna trima*; termites have been reported. Bud rot and nut drop due to *Phytophthora palmivora*; leaf spot due to *Curvularia* sp., *Helminthosporium* sp. or *Pestalotiopsis* sp. commonly infest coconut in the nursery or field planting. Integrated pest management approach is the best control measure to be taken for the pest management in the coconut plantation.

Cost of planting and returns

Cost of planting depends on type of land developed, planting materials, products targetted, farm input, labour cost and mechanisation. Investment for replanting is less compared with that for new land development as the existing infrastructure, machinery, labour could be adopted from ex-farm.

The income gained from coconut has been improved due to higher production and farm gate price. The gross income gained are expected to be higher compared to oil palm (*Table 10*).

CONCLUSION

The growth of the coconut industry bears significant impact on the country's development especially with the objective to upgrade the living standards of the coconut growers. It is the responsibility of all those involved in the R & D, policy-makers, planters, manufacturers, traders and consumers in order to ensure revitalisation of the coconut industry. With careful planning for sustainable production, technology adoption, any investment in the coconut plantation should give viable returns.

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TABLE 10
GROSS INCOME OF COCONUT FRUIT PRODUCTION COMPARED WITH OIL PALM PER HECTARE

Items	Oil palm	Coconut variety		
		MATAG	Tacunan	Pandan
No. of palm/ha	136	180	236	272
Production/ha/year	30 t (FFB)	19,260 nut	21,712 nut	25,568 nut*
Price (RM)	500 pert	1	1	1.5
Gross income per ha/year (RM)	15,000	19,260	21,712	38,352
Gross income per ha/month (RM)	1,250	1,605	1,809	3,196

* Tender coconuts

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