COCONUT INDUSTRY DEVELOPMENT PROGRAM (CIDP) 10th MALAYSIA PLAN (10MP) MECHANICS AND GUIDELINES

SECTION I : BACKGROUND

1.0 Current Status

Coconut is planted entirely by smallholders. An estimated 10,000 rural families are involved in planting the coconut. Average size of coconut farms is about 2 ha. Yield varies from 3,000 to 8,000 nuts per hectare.

Based on 2009 statistics (see table below), the existing area under coconut is estimated at 23,885 hectares, comprising 21,258 ha of mature trees and 2,627 ha immature. Among the mature trees, about half are older than 30 years of age.

Division	Division Main Coconut Area	
Kuching	Beliong, Sibu Laut	2,637
Sri Aman	Sri Aman, Lubok Antu	54
Sibu	Sibu, Selangau	10
Miri	Kuala Sibuti	335
Limbang	Limbang	551
Sarikei	Meradong	2
Kapit	Belaga	4
Samarahan	Samarahan, Serian, Simunjan, Asajaya,	14,903
Bintulu	Bintulu, Tatau	821
Mukah	Mukah, Dalat, Daro, Matu	2,135
Betong	Saribas, Kalaka	2,433
Total		23,885

 Table 1.0 – Existing Area of Coconut (2009 Agriculture Statistics)

Most coconut farmers are located in existing DID scheme areas where drainage and water control structures are already in place. The exception is Simunjan District where an estimated 2,000 hectares are planted outside DID scheme areas.

Coconut processing factories are mostly located in Samarahan and Kuching Divisions. Products from these factories include coconut cream, desiccated

coconut, coconut dust & fibre, granulated charcoal, activated charcoal, refined coconut and copra cake.

2 Policy Objective

2.1 Development Goals of DOA

- (i) To increase and sustain the contribution of the food production sector towards the Gross Domestic Product (GDP) of the state of Sarawak.
- (ii) To develop the food production industry into one that can generate good incomes for the primary producers, processors and businesses that are involved in the industry.
- (iii) To promote food safety and sustainable development principles in the pursuit of economic growth for the food production and agriculture sector.

2.2 Development Policy of CIDP

Development policy is to maintain the existing coconut industry where possible and to exploit the market potentials. Coconut cultivation will aim at fulfilling domestic requirements for young nuts and providing raw materials for downstream activities e.g. virgin coconut oil, desiccated coconut etc. Inter-cropping and intensified land use will continue. Coconut is also an important cash crop in the coastal areas and therefore contributes to the socio-economic welfare of farm families in those areas.

3. Broad Development Strategies in 10MP

3.1 Broad/Strategic Objectives of DOA in 10MP

- (i) To support the food production industry in increasing local food production and reducing the food trade deficit
- (ii) To develop agriculture entrepreneurs within the smallholder sector as a means of commercializing smallholder agriculture
- (iii) To increase rural farm incomes to a level at least above the poverty line
- (iv) To support the sustained growth of the agriculture sector for increased economic growth
- (v) To facilitate the participation of private sector in agriculture production
- (vi) To develop skilled and knowledgeable human resource within the agriculture sector

- (vii) To promote the conservation and sustainable use of natural resources for agriculture production, and
- (viii) To promote the adoption of quality assurance systems in agriculture production

3.2 Development Strategies of CIDP

i) Increasing Efficiency and Productivity

- Increasing the productivity of existing coconut farms by replanting old and unproductive trees as well as rehabilitating the poorly maintained farms to meet the needs of downstream processing industries and to meet market demand for young and tender coconut.
- Increasing marketing efficiency by establishing coconut collecting centres.
- Encouraging downstream processing for high-value quality end-products.

ii) Rationalising Resource Use

- Focusing development effort in areas where there are existing drainage and water control infrastructures.
- Promoting inter-cropping with suitable perennials as well as integration with short terms crop.

iii) Strengthening Competitiveness by

• Supporting the private sector in the production of quality planting materials.

iv) Strengthening Institutional Support by

- Facilitating the establishment of a more organized system of marketing.
- Intensifying extension and farmer training services to promote the adoption of proper cultural practices and cost-effective technology.

SECTION II – PROGRAMME COMPONENTS

1 **Program/Project Objective**

- (i) To increase income of coconut planters through integration of coconut with cash crops.
- (ii) To promote planting of coconuts to ensure adequate supply of nuts to meet domestic demand and to support downstream processing activities.

2 Target Group

The target groups are:

- (i) smallholders
- (ii) entrepreneurs

Priority will be given to the owners of the existing coconut farms who are prepared to replant their coconut farms under integration system / mono-cropping system.

3 Eligibility / Selection Criteria

The eligibility criteria for CIDP projects are as stipulated below and they are similar for the rest of all the programme components:

- i. An applicant must be Malaysian citizen domiciled in Sarawak, between the age of 18 to 65 years.
- ii. An applicant must be a full time farmer who owns titled/NCR/rented lands. For Land under NCR, the application must be endorsed by Superintendent of Land and Survey Department OR a Tuai Rumah/Ketua Kampung; and if the applicant is a Tuai Rumah/Ketua Kampung, the application must be countersigned by a Penghulu.
- iii. An applicant is preferably a member of the nearest PPK / or participants of Taman Kekal Pengeluaran Makanan (TKPM)
- iv. Have access to suitable land of adequate size
- v. An applicant must have sufficient labour to carry out the farm activities
- vi. Have some experience in the projects applied
- vii. They must be able to find their own market outlet for their produce
- viii. Willing to top up the financial assistance given by the Governments
- ix. The project participants are required to follow the Departmental instructions and guidance.

4 Program/Project Components

The Coconut Industry Development Program in the 10MP comprises the following components:

- i. Integrated Coconut Replanting with Short Term Crops
- ii. Assistance to Existing Coconut Garden Project
- iii. Young Coconut Production Project / Replanting of Pandan and Matag Variety in Sarawak (Penanaman Semula Kelapa Jenis Pandan dan Matag di Sarawak)
- iv. Coconut Seedlings Nursery
- v. Coconut Collecting Centre and the Procurement of De-husking Machine
- vi. Support Services / Implementation, monitoring and evaluation (IME)

4.1 Integrated Coconut Replanting with Short Term Crops

4.1.1 Purpose

To replant the existing old and unproductive coconut gardens with high yielding hybrid planting materials and also to integrate the project with crops where ever applicable. This will involve the felling of the existing unproductive coconut trees in the farms.

Integrated Coconut Replanting Project is mainly for those in the traditional coconut planting area. The project shall facilitate the development of the coconut industry in Sarawak and will produce adequate supply of raw materials for domestic as well as for industrial uses, at the same time to ensure that coconut farmers derive profitable sustainable incomes.

4.1.2 Scheme Value and Period of Assistance

The rate per hectare for Integrated Coconut Replanting Project is RM13,890. The project value are based on the cost of land preparation, cost of planting material and fertiliser as well as for maintenance of the farm for a period of 4 years. Provision is also catered for the integration of crops.

Quotation should be called for land preparation (chopping of old tress, drainage, field planting etc.).

Table 4.1.2Detail Breakdown of Entitlement for Integrated CoconutReplanting with Short Term Crops

No	Type of work	Year 1 (RM)	Year 2 (RM)	Year 3 (RM)	Year 4 (RM)	Total (RM)
a)	Land preparation	1,500	-	-	-	1,000
b)	Planting materials	3,640	-	-	-	3,640
c)	Fertilising	350	700	700	700	2,450
d)	Maintenance (chemicals)	-	600	600	600	1,800
e)	Crop Integration {farm inputs & planting materials (banana and other short term crops)}	2,000	2,500	-	-	5,000
	Total	7,490	3,800	1,300	1,300	13,890

Note: The value of each item indicated in Table 4.1.2 above only serves as a guideline.

Inter-purchase of items is only permitted with the approval from Jawatankuasa Perancangan dan Pembangunan Bahagian Tanaman Ibu Pejabat.

4.1.3 Project Farm Size

Minimum	:	1.0 hectare per participant
Maximum	:	4 hectares per participant

4.2 Assistance to existing Coconut Garden Project

4.2.1 Purpose

The purpose of this project is to increase the yield of the existing unproductive coconut gardens by supplying fertiliser, chemicals and improvement of drainage system and farm road in the garden.

4.2.2. Scheme Value and Period of Assistance

The rate per hectare for Assistance to existing Coconut Garden Project is RM3,600. The project values are based on the cost of drainage & farm road improvement, fertiliser as well as for maintenance of the farm for 2 years period.

Table 4.2.2	-	Detail Breakdown	of	Entitlement	for	Assistance	to	existing
		Coconut Garden Pr	oje	ct				

No	Type of work	Year 1 (RM)	Year 2 (RM)	Total (RM)
1	Drainage & Farm road improvement	1,000	-	1,000
2	Fertilising	700	700	1,400
3	Maintenance (chemicals)	600	600	1,200
	Total	2,300	1,300	3,600

Note: The value of each item indicated in Table 4.2.2 above only serves as a guideline.

Inter-purchase of items is only permitted with the approval from Jawatankuasa Perancangan dan Pembangunan Bahagian Tanaman Ibu Pejabat.

4.2.3 Project Farm Size

Minimum	:	1.0 hectare per participant
Maximum	:	4 hectares per participant

4.3 Young Coconut Production Project / Replanting of Pandan and Matag Variety in Sarawak (Penanaman Semula Kelapa Jenis Pandan dan Matag di Sarawak)

4.3.1 Purpose

The purpose of the Young Coconut Production Project and Replanting of Pandan and Matag Variety in Sarawak is to assist enterprising farmers in planting selected coconut varieties for the production of young nuts to supply the fresh nut as well as the old nuts to the market. Recommended varieties include aromatic coconut such as Pandan, Dwarf, *Matag* and other suitable hybrid varieties.

4.3.2 **Project Value and Period of Assistance**

The project value is based on the cost of land preparation, planting materials, fertilizer, and for the maintenance of the project for a period of 4 years.

Table 4.3.2Detail Breakdown of Entitlement for Young CoconutProduction Project and Replanting of Pandan and Matag Variety in Sarawak(Penanaman Semula Kelapa Jenis Pandan dan Matag di Sarawak)

No	Types of Assistance	Year 1	Year 2	Year 3	Year 4	Total
1	Land preparation	1,000	-	-	-	1,000
2	Planting Materials	3,870	-	-	-	3,870
3	Fertiliser	600	1,200	1,200	1,200	4,200
4	Maintenance (chemicals)	-	600	600	600	1,800
	Total	5,470	1,800	1,800	1,800	10,870

Note: The value of each item indicated in Table 4.3.2 above only serves as a guideline.

Inter-purchase of items is only permitted with the approval from Jawatankuasa Perancangan dan Pembangunan Bahagian Tanaman Ibu Pejabat.

4.3.3 Project Farm Size

Minimum :1.0 hectare per participantMaximum:3.0 hectares per participant

4.4 Coconut Seedlings Nursery

4.4.1 Purpose

The purpose is to assist in the development of coconut seedling production. Coconut seeds are supplied from the genuine coconut garden so that the seedlings supplied are of high quality.

4.4.2 Target Group

The target are three Agriculture Research Centres that supply coconut seeds, they are Tarat (Matag seedlings), Rampangi (Pandan seedlings) and Kebuloh (Pandan seedlings).

4.4.3 **Project Value and Period of Assistance**

Table 4.4.3- Detail Breakdown of Entitlement for Each Coconut Seedlings
Nursery Station

No	Types of Assistance	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	Fertiliser	10,800	10,800	10,800	10,800	10,800	54,000
2	Maintenance (chemicals/ grass cutting)	8,790	8,790	8,790	8,790	8,790	43,950
	Total	19,590	19,590	19,590	19,590	19,590	97,950

(i) Tarat Agriculture Station (1,800 palms)

(ii) Rampangi Agriculture Integrated Research Station (246 palms)

No	Types of	Year	Year	Year	Year	Year	Total
	Assistance	1	2	3	4	5	
1	Fertiliser	1,476	1,476	1,476	1,476	1,476	7,380
2	Maintenance (chemicals/ grass cutting)	2,400	2,400	2,400	2,400	2,400	12,000
	Total	3,876	3,876	3,876	3,876	3,876	19,380

(iii) Kebuloh Agriculture Station (246 palms)

No	Types of	Year	Year	Year	Year	Year	Total
	Assistance	1	2	3	4	5	TOLAL
1	Fertiliser	1,476	1,476	1,476	1,476	1,476	7,380
2	Maintenance (chemicals/grass cutting)	2,400	2,400	2,400	2,400	2,400	12,000
	Total	3,876	3,876	3,876	3,876	3,876	19,380

Note: The value of each item indicated in Table 4.4.3 above only serves as a guideline.

Inter-purchase of items is only permitted with the approval from Jawatankuasa Perancangan dan Pembangunan Bahagian Tanaman Ibu Pejabat.

4.5 Coconut Collecting Centre and the Procurement of De-husking Machine4.5.1 Purpose

The purpose of the component is to provide fund to set up collecting centre for coconut and for the procurement of de-husking machine in the main coconut growing areas. This is for block and individual planting.

The facilities could facilitate a more organised collection and delivery of nuts, copra and fruits from the farm to the marketing and processing centres. The collecting centres can also accommodate the de-husking machine. This is to improve on the present unorganised system where farmers have to find their own means of delivering the nuts to the buyers.

4.4.2 Target Group

The centre will be set up in block planting areas. Priorities are given to areas implemented with Integrated Coconut Replanting in the 9MP with organised system of collecting and marketing of nuts and fruits.

The main beneficiaries are those coconut entrepreneur farmers who are engaged in contractual supply of nuts and copra to processing factories and marketing institutions or agencies.

4.4.3 Project Value

Each collecting centre is expected to cost RM 40,000 (RM 30,000 for the centre and RM 10,000 for purchasing de-husking machine).

Table 4.4.3– Detail Breakdown of Entitlement for Coconut Collecting
Centre and The Procurement of De-husking Machine

No	Type of Assistance	Amount Assisted (RM)
1	Coconut Collecting Centre	30,000
2	Procurement of De-Husking Machine	10,000
	Total	40,000

Note: The value of each item indicated in Table 4.4.3 above only serves as a guideline.

Inter-purchase of items is only permitted with the approval from Jawatankuasa Perancangan dan Pembangunan Bahagian Tanaman Ibu Pejabat.

Guidelines for the design and size of the centre are attached in **Appendix I and II**. There are 2 options (Option 1 & Option 2) to be used as a guideline.

4.4.4 Implementation and Operation

The Coconut Collecting Centres will be set up in areas where there is no organised marketing structure. The proposals for setting up the centres will be submitted by the District in Charge for the consideration and approval by the Divisional Planning and Development Committee (DvPDC).

The centres are for individual or blocking planting areas with matured and good producing coconut farms. Area extension staff and project owner are responsible to identify the site for the construction of the collecting centres.

Entrepreneur farmers who wish to apply Coconut Collecting Centre must have at least 5 hectares of coconut farms, enough capital for purchasing nuts from the nearby farmers and having land for erecting the coconut collecting centre.

Proper agreement should be made between the entrepreneur-farmer on the use of his/her land for erecting the coconut collecting centre. The contents of the agreement are as follows:

i. The land owner should not claim any compensation for the use of his/her land.

ii. The coconut collecting centre should be utilized accordingly once completed. iii. He/she must agree to give information on records of purchased and sold of nuts to the nearest Agriculture Department Office.

iv. Other things that may relevant for the well-being of the project.

4.5 Support Services / Implementation, Monitoring and Evaluation

4.5.1 Purpose

The proposed budget for support services is around 10% of the 10MP CIDP ceiling, and will be utilized to fund the following activities.

(1) Extension and Technology Promotion

The training and visit (T&V) system is to be adopted in this program. Fund will be used for:

 Upgrading the knowledge and skills of both the staff and farmers. They need to be exposed to current knowledge and technologies via training courses, seminars, conferences and study tours. (b) Procurement of appropriate extension and communication materials and equipment required for the transfer of technologies to the target groups by the extension agents.

(2) Farm (Verification) Trials/Research and Demonstration Plots

This is an essential activity to assess the in-situ effectiveness and adoption of the new technology under the actual farmer's managed condition. The R&D works cover mainly farm productions and to some extent, post-harvest handling and value adding processing.

(3) **Promotion of New Products**

Fund is used for the following activities:

- (a) R&D and promoting the use of machinery and equipment in the farm
- (b) For promoting new products in the markets as well as establishing its market information system
- (c) R&D in the products development (new or value-added products)

(4) Quality Assurance Activity

Fund is used for the following activities:

- (a) Purchase of farm produce for laboratory analysis
- (b) Handling and transportation of samples
- (c) Laboratory consumables

(5) Implementation, monitoring and evaluation of the projects.

Funds will be utilised for the implementation, monitoring and evaluation of the projects.

4.5.2 Project Value

The value of assistance will be much depending on the services and activities requested and the availability of fund, and the guidelines are as follows:

4.5.2.1Extension and Technology Promotion

The farmers who are attending the formal residential short courses/ training at ATCs and in-situ training at farm/District Office are **NOT** eligible for pocket money allowance. They are **ONLY** provided with food and refreshment at the rate of RM30.00 per person per night (for overnight course/training) and RM20.00 per person per day (for day-trip course/training). In cases where the transport is **NOT** provided by the Department, the farmers are eligible to claim the transportation allowance at the rate of RM15.00 from home to ATC/farm/District Office and RM15.00 from ATC/farm/District Office back home.

The farmers who are going for study tour are eligible for food allowance at the rate of RM40.00 per person per day. They are also eligible for hotel accommodation at the rate RM50.00/person/night in Sarawak and Sabah while as in Semenanjung the rate is RM70.00/person/night.

The farmers who are attending farmers' dialogue and seminars are eligible to claim the transportation, food and drink allowance at the rate of RM15.00 per person per session.

(i) <u>Pocket Money and Lodging (hotel) for Farmers' Study Tour, Farmers' In-</u> <u>situ Training, Conferences and Seminar</u>

	Types	Transportation	Allowance	Food Refreshme	ent per person		
	of training	Incentives Per Person per session (RM)	Per Person (RM)	Overnight (RM)	Day Trip (RM)		
1.	In-situ Training at Farm/ District	-	-	30.00	20.00		
2.	Farmers' Dialogue and Seminars	-	15.00	-	-		
3.	Formal Training at ATC	30.00	-	30.00	20.00		
4.	Farmers'	-		Hotel Rate in Sarawak & Sabah	Hotel Rate in Semenanjung		
	rour		40.00	50.00	70.00		

(ii) <u>Procurement of appropriate extension and communication</u> <u>materials and equipment</u>

The fund allocated for the procurement of appropriate extension and communication materials and equipment are based on the actual current prices of the goods/services available in the market.

4.5.2.2 Farm (Verification) Trials/Research and Demonstration Plots

The expenses would be based on the actual current prices of the goods/services available and also the availability of fund.

4.5.2.3 **Promotion of New Products**

Promotion of new product will be carried out if the fund is available.

4.5.2.4 Quality Assurance Activity

Fund is used for the transportation of farm produce for laboratory analysis.

4.5.2.5 Implementation, monitoring and evaluation of the projects.

Funds will be allocated for the implementation, monitoring and evaluation of the projects.

5 Implementation Method

The detailed work process and scheduling for the planning and implementation of CIDP will follow the procedures prescribed in the DOA Operation Manual. Project approval shall be vested with the Divisional Planning and Development Committee (DvPDC).

SECTION III : AGRONOMIC PRACTICES AND CROP PROTECTION

Matag Coconut Integration

1.0 Planting material

This is the main component crop under coconut integration. MATAG is a hybrid coconut through crossing of Tagnanan tall as male parent and Malayan Yellow/Red dwarf as female parent. This hybrid is high yielding and early in maturity with round large fruit. The produce is versatile as it can be used as fresh drinking coconut at tender flesh forming stage or at maturity, the latter as raw material for santan, desiccated coconut and other industrial uses. The shell and husk are good raw materials for charcoal (activated carbon) and for cocopeat and fibre respectively.

Seedlings selected should be true-to-type. The recommended stage for field planting is at 4-6 months old. Advanced planting materials are used as in-filling of vacant points but should be nursed in large polybags to avoid severe transplanting shock.

2.0 System of planting and spacing

Hedge Planting

For permanent integration of coconut with fruit trees, the hedge planting design is recommended. Coconut is planted as twin rows, at 7m x 7m, alternate with the alley at a width of 18 m. The plant stand for coconut is 110 palms/ha. The alley is separated from the coconut by field drains at 1.5m from the palm row (see diagram).

Square planting

For integration of coconut with other suitable Crops, the square planting design is recommended. Coconut is planted $9m \times 9m$ apart. The plant stand for coconut is 123 palms/ha. The intercrops are planted between the planting rows.

3.0 Land Preparation and Field Planting

Trees should be felled, destumped and stacked in accordance with the zero burning guideline. Drains should be constructed before field planting. Field planting should be carried out at the beginning of the rainy season.

4.0 Planting hole

Planting hole should be dug at the dimension of 60 cm \times 60 cm and 45 cm deep.

5.0 Maintenance

A good standard of maintenance is required to ensure vigorous growth and a high yield. After establishing the garden, maintenance aspects such as drainage, weeding and manuring require particular attention.

5.1 Drainage

For satisfactory performance of coconut, it is advisable to clean and deepen the drains regularly in order to maintain the water table to a depth of 75 - 100 cm.

5.2 Weeding

Ring weeding to a radius of 2 m around each palm at least 6 times a year should be carried out. Weeding can be done manually or by the use of suitable weedicides. It is a bad practice to burn the dry grass as very often the coconut trees are damaged.

5.3 Fertiliser Application

Year	Appln Round	Age (month)	Fertilizer	Rate kg/ tree	Rate kg/ha	Bags 50kg	Cost (RM)
Planting		0	R Phosphate	1.5	165	3.3	62.7
hole			GML	1.8	198	3.96	55.44
	1st	1	Compound 25	0.3))	
First	2nd	5	Compound 25	0.3) 121) 2.42	130.68
	3rd	10	Compound 25	0.5))	
Second	1st	15	Mixture 44	1.0	110	2.2	118.8
			Borate 48	0.1	11	0.22	55
			GML	1.0	110	2.2	30.8
			Kieserite	1.0	110	2.2	44
	2nd	19	Mixture 44	1.0) 220) 4.4	237.6
	3rd	23	Mixture 44	1.0))	
Third	1st	27	Mixture 44	1.0) 220) 4.4	237.6
	2nd	31	Mixture 44	1.0))	
			Kieserite	1.0	110	2.2	44
			Borate 48	0.1	11	0.22	55
	3rd	35	Mixture 44	1.0	110	2.2	118.8
Total					1,190.42		

The recommended fertilizer is as tabulated below:

<u>Note:</u>					
Rock phosphate		: RM19/50kg			
GML: RM14/50kg					
Fertilizer	Ν	Cost/ 50kg	P ₂ O ₅	K ₂ O	MgO
Compound 25	14	RM54	13	9	2.5
Mixture 44	12	RM54	6	22	3

It is advisable to weed the garden before applying the fertilisers. For a young palm apply the fertiliser around it to a radius corresponding to the horizontal stretch of its leaves. For a mature palm, apply the fertiliser evenly at 2 m radius around the base of palm.

6.0 CROP PROTECTION

Pests Of Coconut

1.0 Rhinoceros Beetle

1.1 Damage

The adult beetle bores into the crown to feed on the tender tissue at the growing point thus causing fan-shaped fronds when the spears unfold.

1.2 Control

- i. Keep field clean by removing and burning decaying wood to eliminate all suitable larval breeding places.
- ii. Regular field inspection to destroy the grubs and the breeding places.
- iii. Drench the crown with lindane or diazinon.
- iv. Trunk injection with monocrotophos or methamidophos at early stage of damage.

2.0 Coconut Skipper

2.1 Damage

The larvae of skipper butterflies feed on the leaf blades leaving only the midrib. In serious cases, the palms look totally barren except for the youngest fronds.

2.2 Control

These outbreaks usually come and go. Flocks of birds usually predate on them most of the time. Natural parasites are also found. Spray trichlorfon or any pyrethroid if necessary.

3.0 Bagworm

3.1 Damage

The caterpillars scrape the epidermis whilst leaving the palm leaves skeletonised.

3.2 *Control* : Chemical control is often not necessary.

4.0 Nettle Caterpillar

- 4.1 **Damage** : Feed on young leaflets of the fronds leaving only the midrib.
- **4.2** *Control* : Spray trichlorfon if necessary.
- 5.0 Rats, Squirrel
- 5.1 *Damage* : On fruits mainly.
- 5.2 Control : (i) Poison with zinc phosphide at 1 : 20 ratio bait
 - (ii) Shoot or trap if possible.

Diseases of coconut

1.0 Tapering Disease

1.1 Symptoms

Yellowing of the tips of leaflets and a dwindling of their size, coupled with a corresponding diminution in the diameter of the trunk. Finally the crown might fail to produce new leaves and the palm dies.

1.2 Control

Associated with malnutrition, lack of adequate drainage and neglected condition.

2.0 Grey Blight Leaf Spot

2.1 Symptoms

Yellow to greyish white spots with dark-brown margin, surrounded by yellow halo on the leaves. This is a minor leaf disease.

2.2 Control

Maintain good growth of the palm to reduce the disease incidence.

SECTION IV - CROP INTEGRATION

1.0 **PINEAPPLE**

1.1 Integration of coconut with pineapple

Pineapple grows and yields well under hot humid tropics with abundant rainfall and sunshine and warm temperature all day round. It is a popular intercrop with immature coconut due to the relatively short maturity period and is rather hardy. The choice of varieties of pineapple is left to participants. The planting distance is 0.6 meter by 0.6 meter in six rows between 2 rows of coconut, at 2.5 meter between pineapple and coconut and a mid foot path of 1.2 meter between third and fourth pineapple rows. The planting density is at 20,000 per hectare.

Pineapple can be maintained for 3 years as coconut intercrop.

1.2 Agronomy

Recommended Varieties:

For fresh fruit - Nanas Pada, Nanas Samarahan(Smooth Cayenne), Nanas Sarikei(Mauritus), Josapine and N36 are recommended for planting as intercrop with coconut.

1.3 Planting materials

Suckers, slips or crowns can be used for planting. Suckers are commonly used.

1.4 Soils

Coastal marine soils, riverine alluvial and drained peat are well suited for pineapple planting. Good drainage is essential with average water table of 70 cm below ground level.

1.5 Spacing

For nanas Pada or nanas Samarahan, the vegetative growth is more vigorous, thus the recommended spacing is 60 cm by 60 cm apart in the rows with 120 cm paths between 2 to 3 rows.

1.6 Land preparation

Land preparation will include underbrushing, felling, lopping, stacking and removal of timber and stumps from the field. This work will be carried out manually as well as mechanically to ensure that the field is removed of most of the timbers. For intercropping, the alley between coconut rows should be clean cleared as above.

1.7 Fertilizer application

Peat Soil			
Age	Method/Rate	Jenis Baja	18 litres
(month)			air
			(gm)
1-1.5	Foliar Spray #1 @	Copper sulphate	42
	the rate 50ml/plant	Ferrous sulphate	21
		Zinc sulphate	42
		Hydrated lime	640
3	Broadcast #1 @ the	BCN (Baja Campuran Nanas)*	
	rate of	Pineapple Fertiliser Mixture	
	14 gm/plant		
4.5-5	Foliar Spray #2 @	Copper sulphate	42
	the rate of	Ferrous sulphate	21
	100ml/plant	Zinc sulphate	42
		Hydrated lime	640
		Urea	640
6	Broadcast #2 @ the	BCN	
	rate of 14gm/plant	BCN	
9	Broadcast #3 @ the	BCN	
rate of 14gm/plant		Den	
		Mineral Soil	
1-7 hari	Broadcast @ the rate	CIRP	
1.5 month	Foliar Sprav #1 @	Copper sulphate	42
	the rate of	Ferrous sulphate	21
	50ml/plant	Zinc sulphate	42
		Hydrated lime	640
3 month	Broadcast #1 @ the		
	rate of	N:P:K (15:15:15)	
	20gm/plant		

4.5 month	Foliar Spray #2 @	Copper sulphate	42
	the rate of	Ferrous sulphate	21
	50ml/plant	Zinc sulphate	42
		Hydrated lime	640
		Urea	640
6 month	Broadcast #2 @ the	N:P:K:Mg+TE (12:12:17:2+TE)	
	rate of 20gm/plant		
9 month	Broadcast #3 @ the	N:P:K:Mg+TE (12:12:17:2+TE)	
	rate of 20gm/plant		

*BCN : Every 100 kg mixture contains 72 kg ammonium sulphate (SA) or urea, 1 kg Christmas Island rock phosphate (CIRP), and 27 kg muriate of potash (MOP).

1.8 Weeding

Manual weeding is carried out during the first 6-8 months. Avoid spraying with herbicide.

1.9 Flower Induction

To induce flowering during the off season, it is recommended to apply 4 $\frac{1}{2}$ - 5 months before the expected date of harvest, to the heart of the plant (10-12 months old at 40-45 leaf stage), using the commercial NAA tablet available from the market or ethrel (10.8% a.i.) spray.

For ethrel, first a mixture of 1.85 ml Ethrel + 40 gm urea in 1 litre water (33.3 ml Ethrel + 720 gm urea in 18 litres of water) is prepared. 50 ml of the mixture is then applied to the centre of the plant. Higher percentage of flowering was observed if application of flower induction hormone is done early in the morning or late evening.

1.10 Harvesting and Post-harvest Operations

The first harvest is 14-16 months after planting. The crop is then replanted however 2-3 rations could be allowed. Replanting ensure excellent quality of fruits. Ration plant might cause fruits which are not uniform. The normal periods of harvest are May to July and December to January. In any one area the fruit will ripen over a period of 3 - 3 1/2 months from flowering stage.

Two to three months after harvest the upper part of the old plant will have dried back and should be cut off. Suckers and slips of plants showing undesirable characters should be split lengthwise and be chopped up to form mulch between rows. Suckers of 45 to 60 cm can be planted in any empty spaces in the rows.

2.0 BANANA

2.1 Integration of coconut with banana

Banana is a compatible intercrop with coconut, in particular at the immature stage of coconut. Some shade tolerant banana are performing well up to the mature stage of coconut, especially along the periphery of the coconut garden. Overtime, the income from banana could supplement the earning from the coconut farm.

2.2 Planting materials

2.2.1 Cultivars

There are basically two main types of banana, the cooking and the desert varieties. Among the cultivars that can be eaten fresh are *mas*, *rastali*, *berangan* and *embun*. The cultivars for cooking are *kapok*, *tanduk* and *rajah*.

a) Mas

This variety is very sensitive to its environment. The tree is 2.2m - 2.6m in height. The bunches are small weighing about 6 to 10kg and each fruit is between 9-10cm long. The fruit has a thin skin which turns yellow on ripening. The flesh is yellowish and easily bruised.

b) Berangan

The tree is 2.5m - 3.0m. The bunches are big and weigh between 8 - 20kg. The skin is thick and the fruit is yellow when ripe.

c) Cavendish (*embun*)

The tree is 3.0m - 3.5m tall. The bunches are big weighing about 10 - 20 kg and each fruit is between 15 - 20cm. The skin is thick and the fruit is yellow when ripe.

d) Rastali

The tree is about 4.0cm high. The bunches weigh about 10kg each. The fruit is half the size of the embun, yellow rough skin with black to brown dots on the surface of the skin. The flesh is distinctive and slightly acidic in taste. It has poor keeping quality.

e) Tanduk

Each bunch weights about 7-10 kg with only 2-3 combs in a bunch. Each comb consists of about 5-7 fingers (fruit). Each fruits is about 25-35 cm long with 6-7 cm diameter. The flesh is creamy white. The skin is thick and the fruit is yellow when ripe.

f) Kapok

The tree is about 4.0m -5.0m tall. The bunches are big weighing about 15 - 25 kg. The skin is thick and the fruit is yellow when ripe.

2.3 Soil and weather conditions

Banana grows well on flat land but can tolerate slightly undulating areas. Suitable soil types are sandy clay loam, well drained with pH> 4.5, good moisture holding capacity. The banana thrives well in the Malaysian climate. It requires a rainfall of 1000 - 2000cm a year but should not be in damp conditions for too long. The optimum temperature is $21^{\circ} - 32^{\circ}$ C.

2.4 Propagation

Suckers are normally used as planting material. There are many types of suckers namely sword suckers, water suckers, maiden sucker and peepers. Sword suckers, which are conical with very narrow leaves, are preferred because of their robustness.

2.5 Spacing

The planting distance is 2.6 meter x 2.6 meter with a distance of 3 meters from coconut. Two rows of banana are planted in between the coconut area giving a planting density of 700 points per hectare. Banana can be planted during the first 3 years.

The average planting distance is $3.0m \times 3.0m$. Planting holes of $60cm \times 60cm \times 30cm$ are dug and into each hole are placed 100 grams of phosphate (TSP) before planting.

Time	Type of Fertiliser	Fertiliser Rate/ ha	Bags/ha
At time of planting TSP		110 kg	2.2
1 month	NPK 15:15:15	275 kg	5.5
3 months	NPK 15:15:15	385 kg	7.7
5 months	NPK+mg 12:12:17:2	385 kg	7.7
1 month after harvesting	NPK+mg 12:12:17:2	385 kg	7.7
3 months after harvesting	NPK+mg 12:12:17:2	385 kg	7.7

2.6 Fertiliser

2.7 Weeding

As banana roots are superficial, care is taken during weeding to ensure that root damage does not occur. Weeds in between rows are controlled with herbicides using sprayer with a protective cone to the spray nozzle.

2.8 Sucker removal and pruning

Desuckering is done when the trees are 4-5 months old and is done every 8 - 10 weeks.

2.9 Pests and diseases

Banana wilt is the most serious disease. Wilting begins with the leaf, followed by petiole and pseudostems. Control is by use of disease free suckers. Another fungus causes leaf spot and this is controlled by using copper oxychloride or propiconazote on the affected parts.

Pest include the borer caused by the weevil using suckers which are free of borers. Incisions of 0.5cm can be made in the skin and a combination of formula and Benomyl can be applied and left to dry to control this pest. Another pest, the banana stem borer (*Odoiporus longicollis*) is controlled by applying 50gm of carbofuran in each hole before planting.

2.10 Harvesting

The banana tree starts to produce flowers in 7 - 12 months after planting and is ready for harvesting about 7 - 11 weeks later, depending on the variety. Mass flowers 7 - 8 months after planting and is ready for harvesting 7-9 weeks later. The 'follower' plant will produce 3 - 4 months later, thus about four harvests from 1 clump per year is possible.

2.11 Yield

The average yield per year for a 3 year-cycle is 9.6 tonnes per hectare for mas, 12.0 tonnes per hectare for rastali and 20 - 40 tonnes per hectare for embun. The general average yield is about 7 tonnes for the first year, 12 tonnes for the second year and 10 tonnes for the third year per hectare.

2.12 Uses

- Fresh consumption.
- Processed products: Chips, cracker, powder, flour, jam fermented products, jelly, canned in syrup and dried dehydrated fruits.

3.0 <u>COCOA (In Collaboration with MCB)</u>

4.0 MELON / SWEETCORN

4.1 Integration of coconut with melon/sweetcorn

4.1.1 Introduction

Crops such as melons and sweet corn could be intercropped with coconut at the immature stage. The practice of crop rotation of sweet corn with melons will help in controlling weeds, and reduce pests and diseases build up.

4.1.2 Rock melon

The crop is fast gaining popularity among the local consumers and farmers have acquired the skill of planting rock melon under Sarawak condition.

The soils suitable for melons are sandy loam to sandy clay loam that is well drained with pH 6 to pH 8 and flat terrain.

Hot, sunny weather with irrigation is ideal. Continuous rain during planting season will increase disease problems, reduce flowering and fruit setting and may result in poor quality fruits.

Varieties recommended:

lada Daw	Round, smooth skin, light yellow white, large (1.3kg) fruit with
Jade Dew	thick light green flesh. Heavy yielder and good keeping quality.
Pania Dow	Round, smooth, large (1.9kg) fruit with light yellow rind and
Kalija Dew	qrange flesh and medium flavor
Red Queen	Round, smooth, light yellow rind, medium sized fruit with
	sweet, orange flesh and medium strength flavor. Weight 1.2 kg.
Cup Lady	Round-oval, medium sized fruit (1kg) with smooth, creamy,
Sull Lauy	yellowish white rind and good quality, orange flesh.

a) <u>Land preparation</u>

Land preparation will include under brushing, felling, lopping, and stacking to removal of timber and stumps from the field. This work will be carried out manually as well as mechanically to ensure that the field is removed of most of the timbers.

b) <u>Spacing</u>

Space plants 40 cm apart in double row of 4 m apart on each bed of 4.4 m wide (10,416 plants/ha). Sowing rate is about 0.5 kg of seeds per ha for transplanting and 2.0 kg/ha for direct seeding. There are about 30-40 seeds per gram.

c) <u>Sowing</u>

Seeds can either be directly sown in the field or raised in polythene bag or seedling pot. Seedlings are transplanted when they have 3 to 4 true leaves.

Time of application	Type of fertilizer	Rate/10m bed(kg)
Basal	Organic manure	8.00
Basal	Dolomite	5.00
Basal	12:12:17:2+TE	0.50
2 weeks after sowing	12:12:17:2+TE	0.50
4 weeks after sowing	12:12:17:2+TE	1.00
6 weeks after sowing	12:12:17:2+TE	1.00
8 weeks after sowing	12:12:17:2+TE	1.00

Fertilizer Application

e) <u>Weed control</u>

Within bed weeding is done manually. The use of agricultural cover is recommended with drip irrigation. Inter-row space can be sprayed with weedicide when the plants are small.

f) <u>Pruning and training</u>

Prune the seedling at the four leaf stage to allow 3 good primary branches to develop and allow fruiting on the tertiary branches.

g) <u>Harvesting</u>

The crop takes 65-75 days and 4-5 rounds of harvesting. Fruits are ready to be harvested at the half slip stage. At full ripe stage, the fruit stalk will easily slip smoothly from the fruit.

4.1.3 Sweet corn

a) <u>Introduction</u>

Sweet corn is popular and the value is higher and is recommended for planting as an intercrop in rotation with melons under young coconut.

b) <u>Variety recommended</u>

The recommended varieties are Thai super sweet, and the potential varieties are Honey Jean, Manis madu and Hibrix 5.

c) <u>Cultural practices</u>

• Land Preparation

Land preparation will include under brushing, felling, lopping, stacking and removal of timber and stumps from the field. This work will be carried out manually as well as mechanically to ensure that the field is removed of most of the timbers.

• Spacing

The recommended spacing is 60 cm x 60 cm or 90 cm x 40 cm, planted at 2 seeds per point. For fresh cob production, the seedlings at 2 weeks old are thinned to 1 plant per point. The sowing rate is 9-12 kg/ha.

• <u>Fertilizer application</u>

The recommended fertilizer rate is as follows:

Туре	At Planting	Six weeks After Planting
Dolomite	2 mt/ha, one week before planting	nil
Urea	75kg/ha	75 kg/ha
Triple Super Phosphate	190 kg/ha	nil
Muriate of Potash	75kg/ha	nil

• <u>Weeding</u>

One to two rounds of manual weeding should be carried out at fourth to eighth week after sowing.

• Pests and Diseases control

The common pest are the stem and cob borer. These could be controlled by spraying with Dimethoate or Formethion or Pyrethroid.

The common diseases are leaf blight which could be controlled through sanitation or chemically using Thiram or Captan by the seed dressing technique. Common smut is minor and could be avoided through seed treatment with Thiram. Bacterial Wilt and Stalk Rot could be avoided through sanitation.

d) <u>Harvesting</u>

The cobs are harvested as soon as the kernels are well-filled and succulent. The cobs should be marketed as soon as possible as any delay will result in the loss of sweetness and freshness. Storage in chilled condition could delay deterioration in the quality.

The practice of crop rotation with rock melon will help in controlling weeds, and reduce pests and diseases build up.

4.1.4 Water melon

Although it is better for watermelon to be cultivated on sandy loam to clayey loam, heavy soils on hill slopes have also been shown to produce good quality watermelons. The following technique is suitable for watermelon growing in both coastal and inland areas.

a) <u>Variety</u>

Although there are numerous varieties available, recent market demand is mainly on Empire No.2/Farmers Giant/Red King/Black Beauty. Some of the dragon series, yellow-fleshed and ice-box types are also acceptable to consumers. Seedless watermelon is very popular in West Malaysia and Singapore. It is convenient to eat as one do not have to spew out the seeds. It is sweeter, set colour earlier, firmer and tolerant to handling and transportation.

b) <u>Water requirement</u>

Adequate rainfall is essential during vegetative and fruit development. If there is insufficient rainfall, watering is essential. However, excessive rain will usually encourage disease buildup and cause subsequent failure of the crop.

During fruit maturation, less rainfall and ample sunshine will reduce disease incidence as well as enhance the sweetness of the fruit.

c) Land preparation and planting

The land is either slashed or sprayed with herbicide, burned and cleared of debris.

Planting on mounds at a distance of 3 m x 4 m is recommended on undulating or uneven terrain where power tillers cannot be used. The mound should be about 1 m in diameter, at a height of about 10 cm. It is important to mix in the fertilizer (basal dressing) thoroughly in the soil during mound preparation. This will greatly reduce the loss of fertilizer which is important for the healthy development of the crop at the early stage.

For the basal dressing, 500 g Dolomite, 2 kg well-decomposed chicken dung and 200 g 12:12:17:2+TE is recommended. They are mixed in together during mounding (some fertilizer nullifying effect by dolomite can be neglected.

Before sowing, four seed holes are made on the mound at even spacing of about 50 - 60 cm apart. Two seeds are sowed to a depth of 2 - 3 cm in each seed hole. Watering is required if rainfall is inadequate. Mound mulching with lallang or padi straw is advisable. About two weeks after germination, thin to one healthy seedling per hole. Train the seedlings to 4 different directions.

On flat terrain, watermelon planting on raised beds made by power tiller is preferred as is time saving. Each bed is about 1 m wide by 15 cm high, separated at 5 m apart. Basal fertilizer (500 g dolomite, 2 kg chicken dung and 200 g 12;12:17:2 + TE per m length of the bed) is mixed in thoroughly by a power tiller. The bed is mulched with agro-cover sheet to prevent weed growth as well as fertilizer loss through wash-off. Holes of about 20cm to 25cm diameter (small holes normally result in scorching of young seedlings by heat and ammonia) are made at 1 m intervals on the cover sheet. Two seeds are planted to a depth of about 2 cm into the soil at the middle of the hole. At about two weeks after germination, thin to 1 seedling per planting point. Vines are trained to grow in a single direction (along the wind direction, if applicable).

d) <u>Seedless watermelon</u>

Seedless watermelon is cultivated in a similar manner to that of seeded watermelon. Being triploid and sterile, it needs foreign pollen sources to induce fruit set and development.

e) <u>Fertilizer requirement</u>

Basal dressing: as mentioned in bed preparation.

Side dressing: 3 - 4 side dressings of 200 g 12:12:17:2+TE at biweekly intervals, starting at 4 weeks after planting. Fertilizers are carefully broadcasted on the mound, avoiding scorching the plant.

f) <u>Crop Protection</u>

• <u>Weeding</u>

Inter mound weeding with herbicide (paraquat or basta) will reduce labour requirement as compare to manual weeding. Care should be taken to avoid spraying/drifting on the watermelon. Spray when it is not windy, and/or with shielded medium-coarse nozzle will minimize herbicide injury to the crop.

Weeds on the mound or bed should be carried out manually as and when required.

Pest control

Protect the seedling immediately after germination. Furadan 3G is by far the most effective but should be used only at the seedling stage as it is systemic and has a residual period of about 3 months.

Sprinkle about half a tea-spoonful (1 - 2 g) of furadan 3 G near the base of each newly germinated seedling. This should protect the seedlings for about a month.

Control of snails and slugs with snail baits

Spray with Fenthion or dimethoate to control fruit fly and other pests at weekly intervals during fruit development. Shift to cypermethrin or permethrin towards the late fruit development stage to control army or cut worms that feeds on the skin of the watermelon. Follow pre-harvest intervals.

• Disease control

The most serious disease is the downy mildew which caused premature dying of leaves. This can be prevented/controlled by spraying with metalazyl (preferably Ridomil 58 MZ which is cheaper and contains mancozeb) alternate with Monceren. Preventive spray should start at about 4 weeks after planting and repeated at biweekly intervals. Spray with Octave or benlate about 10 days to two weeks before harvesting to reduce anthracnose of harvested fruits.

The following chemicals are recommended for controlling mildews (including downy mildew):

- (1) Daconil & Mancozeb (no scorching problem)
- (2) Radomil (metalaxyl) which may cause scorching

(3) Phosphorus acid (Aliette)

5.0 <u>CITRUS</u>

5.1 Integration of coconut with Citrus

5.1.1 Varietals Recommendation

The recommended cultivars of Mandarin smooth skin orange are 'Kong Ho', 'Santau', 'Kimura' and 'Labi'. 'Binatang' Mandarin orange is popular in some areas. 'Honey' orange is a new variety that produces high quality fruits.

5.1.2 Spacing

5.0 m x 5.0 m

5.1.3 Planting Material

Plants budded on rootstocks like Cleopatra Mandarin and Saccaton Citrumelo. It is very important to obtain materials that are free of Greening Disease.

Year	Time of Application	Type of Fertilizer	Amount/ Year	Rate/ Application
			(kg)	(kg)
0	At planting	Rock Phosphate	0.20	0.20
		Dolomite	0.10	0.10
		Organic manure	5	5
1	Every 3 months	15:15:15	0.5	0.13
2	Every 3 months	15:15:15	1.5	0.38
3	Every 3 months	12:12:17:2+TE	2.5	0.63
4	Every 4 months	12:12:17:2+TE	4.0	1.33
5	Every 4 months	12:12:17:2+TE	5.0	1.67
6 & above	Every 4 months	12:12:17:2+TE	6.0	2.00

Table 1 :Fertilizer Application

In addition, organic manure at 10 - 30 kg/tree/year and dolomite at 0.2 to 0.3 kg/tree/year is recommended.

5.1.4 Pruning

The young trees should be pruned at one year to form an open, wellbalanced canopy. Each should have only a single trunk with three or four well-distributed primary branches originating at different points from 30 to 60 cm above ground level.

Dead twigs and fruit stalks are pruned off from the trees at harvest to give the tree an open, balanced canopy.

5.1.5 Fruit Thinning

Common practice is to allow one or two fruits per twig, thinned when the fruits are less than marble size.

5.1.6 Vegetative Stage

3 years.

5.1.7 Economic Life

20 - 25 years.

5.1.8 Harvesting and Yield

Ripe sweet orange fruits are harvested manually by twisting or jerking the fruit from the branch. They are ready for harvest when they show a tinge of yellow and the skim becomes slightly shiny. Harvesting may be staggered over one to two months.

5.2 Pests of Mandarin Orange

5.2.1 Fruit Sucking Moth

a) <u>Damage</u>

Adults suck juice from the fruit. Damage is similar to the citrus bug. Only night-check can identify the pest.

b) <u>Control</u>

- (i) Bagging of fruits.
- (ii) Destroy infested fruits.
- (iii) Set light trap.

(iv) Spray with any pyrethroid or dimethoate or acephate or fenthion if necessary.

5.2.2 Fruit Fly

a) <u>Damage</u>

Larvae are hatched from eggs deposited in the fruit by adult females. They feed on the content of the fruit causing soft brown patches on the skin. Fruits become rotten and fall off.

b) <u>Control</u>

- (i) Destroy infested fruits.
- (ii) Bag fruits.
- (iii) Bait sprays (e.g. Promar or Lusect).
- (iv) Chemical attractants (e.g. methyl eugenols).
- (v) Spray with pyrethroid.

5.2.3 Fruit Borer

a) <u>Damage</u>

It is common in pomelo. Frass and gummy liquid oozing out are the obvious symptoms on the rind. Attacked fruits fall off prematurely.

b) <u>Control</u>

- (i) Bagging of fruits.
- (ii) Destroy infested fruits.
- (iii) Spray with pyrethroids, dimethoate, acephate or fenthion.

5.2.4 Leaf Miner

a) <u>Damage</u>

Newly hatched larvae bore into the epidermal tissue of the leaf and live inside by burrowing silvery coiled mines on them. Damaged leaf is distorte or curled up resulting in stunted growth.

b) <u>Control</u>

- (i) Pluck infested leaves and destroy.
- (ii) If necessary, spray with petroleum spray oils (e.g. D-C-Tron Plus), acephate or diazinon.

5.2.5 Citrus Bug

a) <u>Damage</u>

Adults and nymphs suck sap from fruits, young shoots and leaves. Affected fruits turn brown at points of feeding and drop prematurely. Shoots wilt and shrivel.

b) <u>Control</u>

- (i) Hand-pick the nymphs.
- (ii) Spray with acephate or dimethoate or fenthion if necessary.

5.2.6 Lemon Caterpillar

a) <u>Damage</u>

Larva eats up a leaf in a few minutes leaving only the midrib. Feeding impairs growth of young plants.

b) <u>Control</u>

- (i) Hand-pick and destroy.
- (ii) Spray with any common insecticide if necessary.

5.2.7 <u>Aphid</u>

a) <u>Damage</u>

They suck sap from young shoots causing yellowing and curling or distorted growth.

b) <u>Control</u>

Spray with malathion and albolineum.

5.2.8 Psyllid Diaphorina citri

a) <u>Damage</u>

It feeds on plant sap and transmits greening disease.

b) <u>Control</u>

This vector should be sprayed with petroleum spray oils (e.g. D-C-Tron Plus) malathion, dimethoate or pyrethroid insecticide particularly during flushing.

6.0 <u>STARFRUIT</u>

6.1 <u>Varietal Recommendation</u>

B2	Large greenish yellow fruit with fine texture, sweet, juicy and with
	good aroma. The fruits do not keep well and softens easily. The tree
	is slower growing
B10	Large, golden fruit with fine texture, juicy, sweet with good flavour
B17	Large, orange coloured, broad winged fruit. The flesh is firm, fairly
	good textured and very sweet. This clone requires a pollinator like B2
	to set fruit.

6.2 <u>Soil Requirement</u>

Flat to very gently sloping terrain with well drained, light to medium textured soil is preferred.

6.3 Spacing

5 m x 5 m

6.4 **Fertilizer Application**

Year	Time of Application	Type of Fertilizer	Amount/ Year (kg)	Rate/ Application (kg)
		Rock Phosphate	0.20	0.20
0	At planting	Dolomite	0.10	0.10
		Organic manure	5-10	5-10
1	Every 2	15.15.15	0.50	0.08
	months	15.15.15	0.50	0.08
2	Every 3	1 .	1.00	0.25
	months	12.12.17.2 ' 1	1.00	0.25
3	Every 4	12·12·17·2+TF	2.00	0.67
2	months	12.12.17.2 11	2.00	0.07
Л	Every 4	12·12·17·2+TF	3.00	1.00
4	months	12.12.17.2 ' 1	5.00	1.00
5 &	Every 4	10.10.17.0+TF	4.00	1 3 3
above	months	12.12.1/.2 1	4.00	

In addition, an application of organic manure at 15 to 45 kg/tree/year is recommended.

6.5 <u>Pruning</u>

Prune to an open centre system by topping the main stem and allowing 3 to 4 main branches to develop. Another method of tree shaping is also practiced for trees of clone B17 which have long weak branches. In this method three to four branches are trained to grow horizontally on a wire frame. Old trees can be rejuvenated by pollarding the tree back to a metre above ground level and retraining several new branches.

6.6 <u>Vegetative Period</u>

2 years.

6.7 <u>Economic Life</u>

20 - 25 years.

7.0 <u>GUAVA</u>

7.1 Varietal Recommendation

Gu Kong	Large (300 - 600 g) round to oval shaped fruits.
	Sweet, slight acidic, crispy
Gu Thai Seedless,	Medium sized (150 - 300 g), rounded or
Bangkok Apple and	asymmetrical. Crispy, sourish-sweet, seedless
Tropical Apple	

7.2 <u>Soil Requirement</u>

Fertile, loamy well-drained soil. However, guava can grow on a wide range of soils with flat to very gentle slope.

7.3 Spacing

5 m x 5 m

7.4 **Fertilizer Application**

Year	Time of	Type of	Amount/	Rate/
	Application	Fertilizer	Year	Application
			(kg)	(kg)
0	At planting	Rock Phosphate	0.10	0.10
		Dolomite	0.10	0.10
		Organic manure	5	5
1	Every 2 months	15:15:15	0.5	0.08
2	Every 2 months	15:15:15	1.0	0.17
3	Every 3 months	12:12:17:2+TE	2.0	0.50
4 onwards	Every 3 months	12:12:17:2+TE	4.0	1.00

In addition, a yearly application of organic manure at 10 - 20 kg/tree is recommended.

7.5 <u>Weed Control</u>

Keep the weeds low by regular cutting or spraying with weedicide.

7.6 <u>Pruning</u>

Prune back the budded plant to a height of 0.5 m from the budding point to encourage 3 - 4 main branches to grow. Prune back these main branches to two nodes to allow side branches to grow. Keep plants low; to a height of 1.6 m for easy wrapping of fruits.

7.7 Vegetative Period

One year.

7.8 <u>Economic Life</u>

15 - 20 years with maximum yield at 5 - 8 years.

Young Coconut Production Project

1.0 <u>Recommended Varieties</u>

The recommended varieties are Pandan (aromatic coconut), Suitable Dwarf and Hybrid Coconut. Planting of Pandan Coconut would be the priority. Seedlings selected should be true-to-type, for Pandan coconut seedlings that is by the presence of fragrant smell of either young shoot or roots. The recommended stage for field planting is at 4-6 months old. Advanced planting materials are used as in-filling of vacant points but should be nursed in large polybags to avoid severe transplanting shock.

2.0 System of planting and spacing

Pandan coconut and other dwarf coconut could be planted with the spacing of $7m \times 7m$ square planting. This would be about 204 palms/ha.

3.0 Land Preparation and Field Planting

Trees should be felled, destumped and stacked in accordance with the zero burning guideline. Drains should be constructed before field planting. Field planting should be carried out at the beginning of the rainy season.

4.0 <u>Planting hole</u>

Planting hole should be dug at the dimension of 60 cm \times 60 cm and 45 cm deep.

5.0 <u>Maintenance</u>

A good standard of maintenance is required to ensure vigorous growth and a high yield. After establishing the garden, maintenance aspects such as drainage, weeding and manuring require particular attention.

5.1 <u>Drainage</u>

For satisfactory performance of coconut, it is advisable to clean and deepen the drains regularly in order to maintain the water table to a depth of 75 - 100 cm.

5.2 <u>Weeding</u>

Ring weeding to a radius of 2 m around each palm at least 6 times a year should be carried out. Weeding can be done manually or by the use of suitable weedicides. It is a bad practice to burn the dry grass as very often the coconut trees are damaged.

5.3 <u>Fertiliser application</u>

Year	Appln	Age	Fertilizer	Rate	Rate kg/ha
	Round	(month)		kg/tree	
Planting		0	R Phosphate	1.5	165
hole			GML	1.8	198
	1st	1	Compound 25	0.3)
First	2nd	5	Compound 25	0.3) 121
	3rd	10	Compound 25	0.5)
Second	1st	15	Mixture 44	1.0	110
			Borate 48	0.1	11
			GML	1.0	110
			Kieserite	1.0	110
	2nd	19	Mixture 44	1.0) 220
	3rd	23	Mixture 44	1.0)
Third	1st	27	Mixture 44	1.0) 220
	2nd	31	Mixture 44	1.0)
			Kieserite	1.0	110
			Borate 48	0.1	11
	3rd	35	Mixture 44	1.0	110

The recommended fertilizer is as tabulated below:

Fertilizer	N	P ₂ O ₅	K ₂ O	MgO
Compound 25	14	13	9	2.5
Mixture 44	12	6	22	3

It is advisable to weed the garden before applying the fertilisers. For a young palm apply the fertiliser around it to a radius corresponding to the horizontal stretch of its leaves. For a mature palm, apply the fertiliser evenly at 2 m radius around the base of palm.

SECTION V – SUPERVISION, MONITORING AND REPORTING

1.0 <u>Supervision, Monitoring and Reporting</u>

Project implementation involves not only field supervision but also includes monitoring and reporting, evaluation and record-keeping. The responsibility for project supervision lies at all levels of the DOA organization, starting from the project level, through to the Station, Subdistrict, District, Divisional and HQ levels. The centers for monitoring and reporting at the HQ, Divisional and District levels of DOA organization are their respective *Unit Perolehan dan Bekalan (UPB)*. The UPB is expected to perform the role of Scheme/project and Project Secretariat, coordinating the management of project and scheme information at their respective levels.

An effective monitoring and reporting system is a critical part of scheme/project supervision Regular reports on physical and financial progress are essential. The monitoring formats are specific and format below are recommended to be used:

- a) Monthly Work Reports of Project Supervisor
- b) Monthly Progress Reports of Crop Development Project/Scheme by Project Supervisor (PS)/Area Staff (AS)
- c) Monthly Progress Reports of Crop Development Program by District and Divisional UPB
- d) Annual Assessment Reports by SAAO/AAO

Proper records must be maintained and updated for the implementation of schemes and projects. The detailed records are to be kept at the District level. The PS/AS will have the primary responsibility for keeping the current scheme/project records. The main records to be maintained at the District/Sub-District level include.

- a) Register of Project/Scheme Application
- b) Schedule of Recommended/Approved, Reserve and Rejected list
- c) Project File
- d) Project/Scheme record card

The individual Project File shall be used to keep copies of the following records:

- a) Project application form
- b) Letter of approval, Letter of Acceptance by the participant
- c) Project development plan
- d) Project Annual Operational Plan (AOP) & budget
- e) Reminder and warning notice
- f) Certificate of Withdrawal, transfer and cancellation
- g) Project Record Card
- h) Acknowledgment Receipts of project materials
- i) Other correspondence relating to specifically to the project.

Regular checks must be carried out by the *UPB* at District, Divisional and HQ levels on the project/scheme Record Cards.

Details of Supervision, Monitoring and Reporting are as spelt out in the Operation Manual for Crop Planting Programmes.

APPENDICES

Appendix 1

ANGGARAN ALIRAN KEWANGAN SEHEKTAR TANAMAN KELAPA

ANGGARAN ALIRAN KEWANGAN SEHEKTA	R TANAMA	N KELAP	A TINGG	1																	
PERKARA/HEKTAR/TAHUN	Tahun																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21-40
A. ALIRAN WANG MASUK																					
1. Hasil (biji/ha)						300	1000	3000	5000	7000	8000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000
2. Pendapatan Kasar (RM0.50/biji)						150	500	1500	2500	3500	4000	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
B. ALIRAN WANG KELUAR																					
KOS PEMBANGUNAN																					
1. Penyediaan kawasan	2,000																				
2. Parit ladang, jambatan dan pembetong	600																				
3. Jalan ladang	200																				
4. Membaris dan menggali lubang	284																				
5. Cukai tanah	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Jumlah Kecil	3,104	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Kos bahan dan tenaga kerja																					
1. Anak pokok	373																				
2. Baja	68	30	43	58	86	95	118	164	164	164	164	164	164	164	164	164	164	164	164	164	164
3. Racun serangga dan penyakit	90	151	179	179	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Racun rumpai	187	178	133	133	89	89	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
5. Peralatan pertanian	420	0	0	0	420	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Menanam dan menyulam	298																				
7. Membaja	40	40	40	40	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
8. Kawalan serangga dan penyakit	40	40	40	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9. Kawalan rumpai	80	80	80	80	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
10. Memungut hasil	0					45	150	450	750	1050	1200	1350	1350	1350	1350	1350	1350	1350	1350	1350	1350
11. Penyelenggaraan infrastruktur	0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Jumlah Kecil	1,596.00	544	540	555	870	374	457	803	1103	1403	1553	1703	1703	1703	1703	1703	1703	1703	1703	1703	1703
Jumlah Aliran Wang Keluar	5,160.00	620	616	632	979	433	525	906	1236	2028	1731	1896	1896	1896	1896	1896	1896	1896	1896	2358	1896
Baki wang tunai	-5160	-620	-616	-632	-979	-283	-25	594	1264	1472	2269	2604	2604	2604	2142	2604	2604	2604	2604	2142	2604
Baki wang tunai timbunan	-5160	-5780	-6396	-7028	-8008	-8290	-8315	-7721	-6458	-4986	-2717	-113	2491	5095	7236	9840	12444	15048	17652	19793	22397
NPV @10% 3583.36																					
IRR 13.05%																					
B/C ratio 1.22																					

INSECT PESTS OF COCONUT	AND THEIR CONTROL MEAS	URES Appendix 2
Insect Pests	Damage caused	Control measures
Hispid beetles Brontispa longissima (head shape, more rectangular)	The adult and larva of <i>B.</i> <i>longissima</i> and <i>P. rechei</i> feed on the tissues of unopened leaf buds. Serious infestations turn the leaves brown. Damage symptoms caused by both beetles are similar, except for brontispa beetles, their damage is on the young spears.	Curative measures Biological control • A parasitic wasp, Asecodes hispinarum has been introduced into all the coconut growing areas.
Plesispa rechei (head shape, more round) Image: Constraint of the state of the stat	The adult of <i>P. nuciferae</i> feed on the tissue by biting fine grooves on the lower surface of the leaflets, while the larva mines inside the leaflets.	Farsitised brontispa larvae Chemical control • Use acephate during serious infestation
Fromecotheca nuciferae		Biological control • Indigenous parasitic wasp, <i>Pedobius</i> sp. is commonly found Parasitised promecotheca larva

<image/> <image/> <image/>	The larva bore into the crown of the palm and feed on the sap of the soft tissue resulting in wedge shaped or "V" cuts in the fronds or holes through the midrib.	 Preventive measures Fell, chop, dry and burn dead, standing trees. Cut stumps as close to the surface as possible. Curative measures Cultural control Use a hooked wire to attract and destroy the adults feeding in palm crowns. Hand-picking and destroy them. Pheromone trapping using Oryctes aggregation pheromone, ethyl-4-methyloctanoate. Biological control using Fungi, <i>Metarhizium anisopliae</i> Virus, Baculovirus oryctes Chemical control Carbofuran Methamidophos
Cockchafer beetle Adoretus compressus Apogonia spp.	Biting of the fronds, leaving holes behind.	This pest usually does not warrant any chemical control measure.
<image/>	The bagworms eat the leaf lamina, resulting in leaf defoliation, leaving only the midribs and lateral veins on the fronds.	 Curative measures Cultural control Hand-picking the cocoon and destroy them. Biological control Application of <i>Bacillus tuhrigiensis</i> Parasitic Hymenoptera (Braconidae and Ichneumonidae) Parasitic Diptera (Tachinidae) Chemical control Methamidophos (trunk injection, need permission from Pesticide Board Malaysia for use) Acephate
Coconut leaf moth Artona catoxantha	The larva feed upon the lower epidermis of the leaflets resulting in feeding marks with	Curative measures Cultural control • Cut and burn all the leaves except the 3

	characterisitic ladder-like lines. Badly attacked trees show scorching effects.	youngest of each tree when an outbreak is commencing. Biological control • <i>Ptychomyia remota</i> • <i>Bessa remota</i> Chemical control • Trunk injection with systemic insecticide
Coconut skipper Hidari irava	The larva prefers older palms and the attack is sporadic. Serious damage is characterised by the midrib of the pinnae remaining.	 Curative measures Cultural control Hand-picking the larva and pupa and destroy them. Chemical control Trichlorphon Pyrethroid
Red-stripe weevil Rhynchoporus schach	Attack crowns and cause falling of the central shoots. Trunk infection is associated with unhealthiness of the palm. Attack to the growing point of the palm generally kills the palm.	 Curative measures Cultural control Cutting and removing damaged palms and decaying stumps. Paint wounds with tar mixture. Retain at least 1m of petiole while pruning. Chemical control Paste wounds with carbaryl and soil.

Appendix 3

Borang JP/2010/1

JABATAN PERTANIAN SARAWAK

PERMOHONAN PROGRAM PEMBANGUNAN PERTANIAN

BAHAGIAN	:	DAERAH :
Sila tandakan I	kotak yang berkenaan (\checkmark)	
Tanaman		Perikanan Darat
Ternakan		Industri Asas Tani
I : MAKLUMAT	PEMOHON	
Nama	:	kaum :
No.KP Baru	:	Pekerjaan (Gaji bulanan):
PPK (No.Ahli)	:	No. Tel :
Alamat Rumah	:	

Maklumat Projek Sedia ada/Kegiatan Aktiviti Utama Masa Kini:

Bil	Jenis Aktiviti	Keluasan/Unit (ha)	Keluaran/hasil (Kg/Bil/tahun)	Purata Harga Jualan (RM/Kg)	Purata Pendapatan Tahunan (RM)

Maklumat Lesen/Permit/Syarikat: _____

Bantuan Kerajaan yang pernah diterima(dalam tempoh 5 tahun):

Bil	Jenis bantuan	Tahun	Nilai Bantuan (RM)	Nama Agensi

II. Maklumat Projek Yang Dipohon :

Jenis Projek Nilai Bantuan (RM Senaraikan Kepel	1) rluan	: : Bantuan:	Keluasan/Unit: Jenis Tanah :	
Status Tanah Sila (✓)		Bergeran TOL PL (Provisional Lease) NCR Tanah Sewa	Sistem Perlaksanaan	Individu Berkelompok Estet Mini
Alamat Lokasi Pro	ojek :			

Saya mengakui bahawa semua maklumat di atas adalah benar. Jika diluluskan, saya akan patuh kepada semua arahan, syarat/peraturan serta kaedah/Prosidur perlaksanaan pembangunan pertanian Jabatan Pertanian Sarawak.

Tandatangan : _____ Tarikh : _____

Tarikh :

III : PERAKUAN KETUA KAMPUNG/TUAI RUMAH (jika berkenaan)

Saya memperakukan yang pemohon serta keluarga adalah penduduk kampung/rumah panjang ini dan telah mengusahakan kawasan tanah/projek pertanian yang dipohon.

Tandatangan	:	 Tarikh :	
Nama	:		

Cop Rasmi Ketua Kampung/Tuai Rumah

Nama	a Kampung/Rh.Panjang:				
	UNTUR	KEGUNAAN PEJAB	AT PERTAN	IAN DAERAH	
COP TERIMAAN BORANG:		Tindakan:		Tanaman Perikanan Darat Ternakan IATM	
Tanda	atangan(OiC):				
Nama :		Tar	ikh :		
Rujuk	an Pejabat:				
Saranan		Tadatangan:_			
	Tidak disokong	Nama:			
	Tindakan lanjut	Jawatan:		Tarikh:	

Borang yang lengkap diisi hendaklah dikembalikan ke Pejabat Pertanian/Veterinar terdekat **pada atau sebelum 30 April.**

CIDP - Work Flow Chart

Appendix 4



Appendix 5a

COCONUT COLLECTING CENTRE











Appendix 5b

COCONUT COLLECTING CENTRE







Sisi Kiri





Dantai (Ruang Bekerja dan Ruang Menyimpan Tempurung)





SKawasan Atap Bangunan