Research Findings in Sarawak Oil Palm Industry: Upstream Sector

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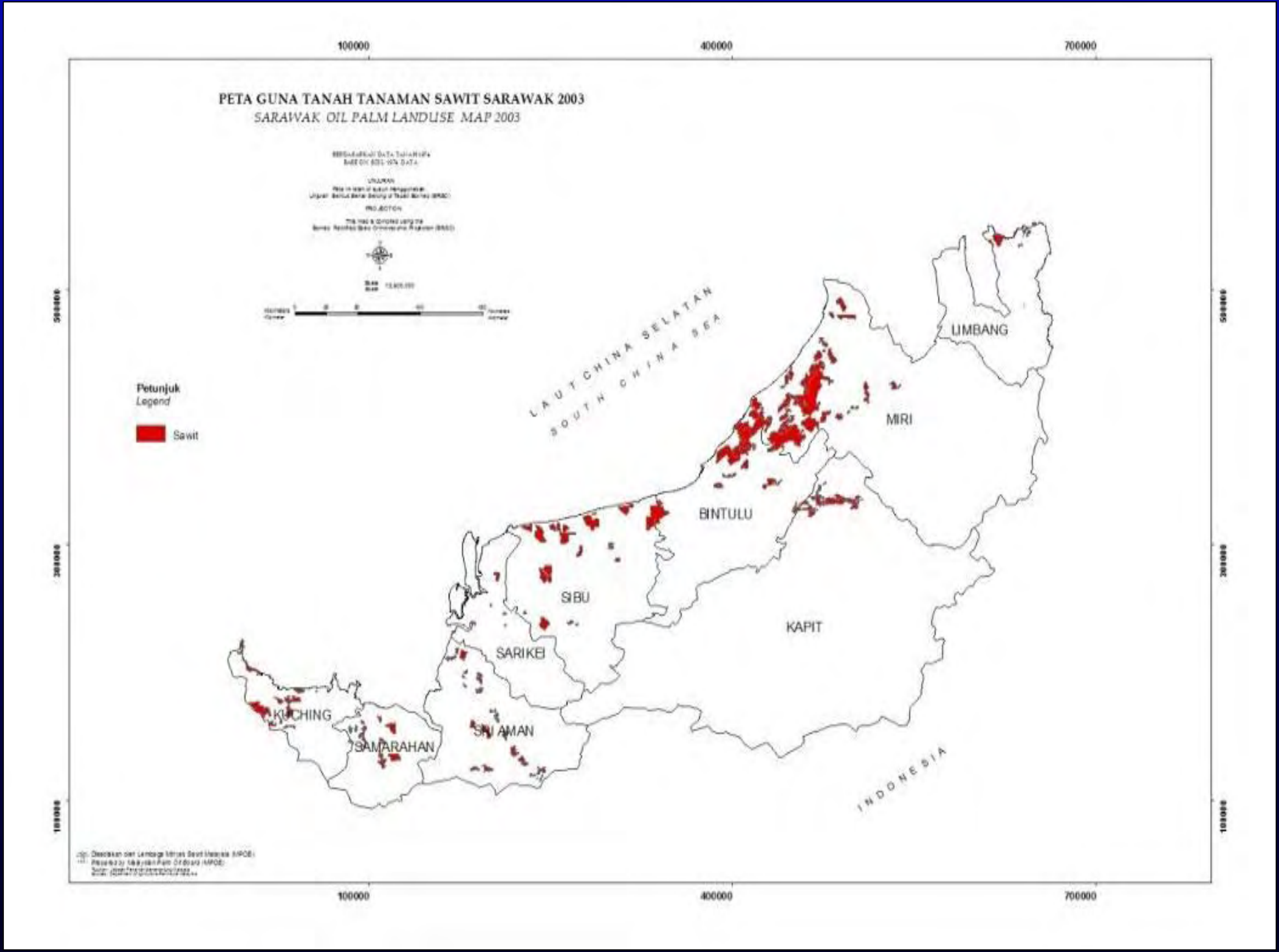
MALAYSIAN PALM OIL BOARD

Oil Palm Planting Areas in Sarawak



Total Oil Palm Planted Area

(according to Divisions in Sarawak, 2013)

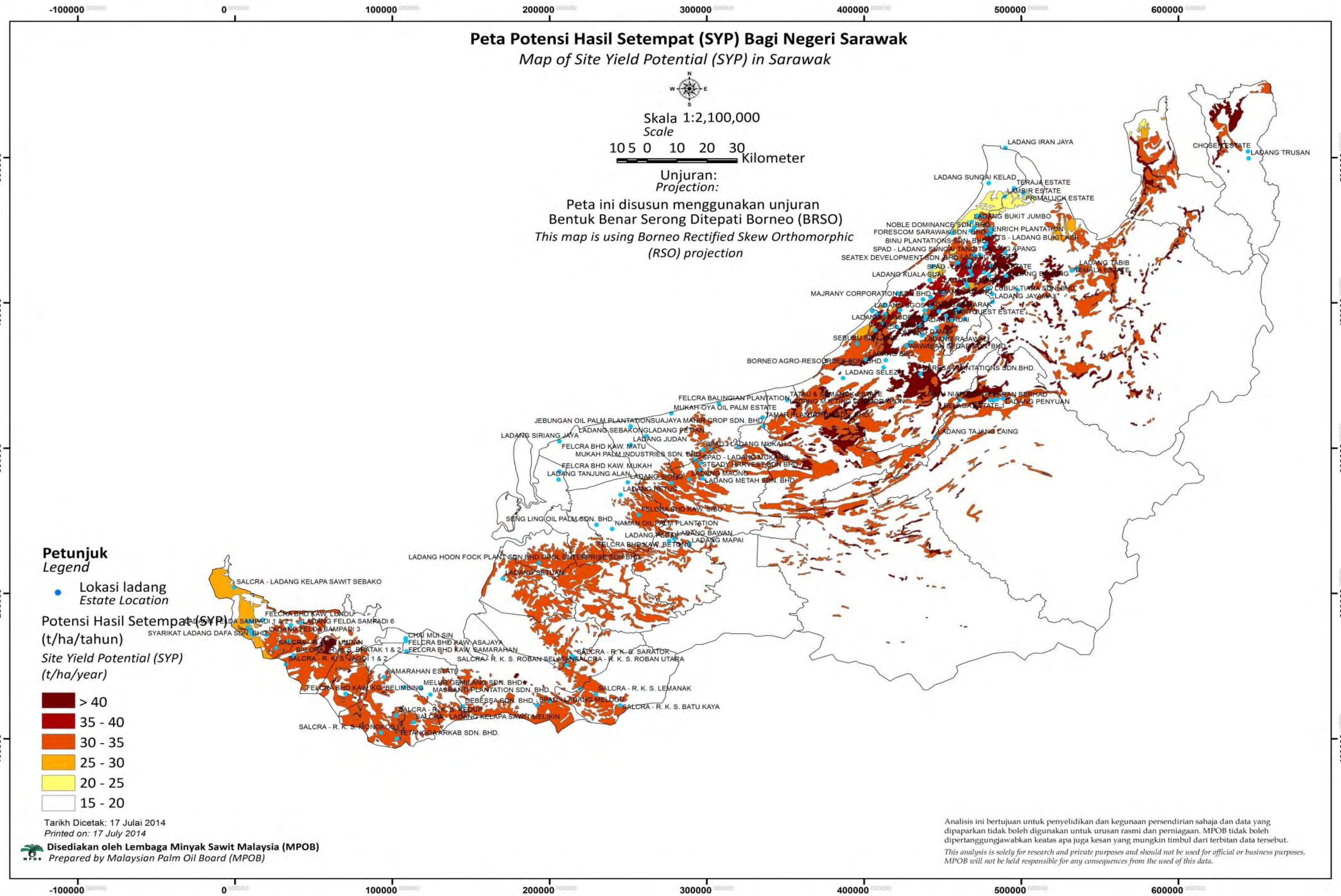
Division	Mature	%	Immature	%	Total
Betong	37,433	76.9	11,218	23.1	48,652
Bintulu	166,133	86.7	25,548	13.3	191,681
Kapit	47,058	79.7	11,977	20.3	59,035
Kuching	44,609	85.6	7,504	14.4	52,112
Limbang	14,745	84.1	2,795	15.9	17,540
Miri	277,495	85.1	48,576	14.9	326,070
Mukah	165,105	82.9	33,997	17.1	199,101
Samarahan	81,156	82.4	17,347	17.6	98,503
Sarikei	8,584	79.5	2,218	20.5	10,802
Sibu	79,197	74.3	27,392	25.7	106,588
Sri Aman	40,343	79.4	10,470	20.6	50,813
Total	961,857	82.8	199,041	17.2	1,160,898

Peatland Areas in Sarawak

Peatland Areas in Sarawak

State/Division	Hectares	%
Sibu	540,800	20.9
Sri Aman	283,076	10.9
Miri	276,579	10.7
Samarahan	192,900	7.4
Sarikei	169,900	6.6
Bintulu	146,121	5.6
Limbang	25,300	1.0
Kuching	23,059	0.9
Total Area for Sarawak	1,657,610	64
Malaysia	2,588,866	

EPP2: Distribution of Low Yielding Estates in Sarawak



Research on Planting Materials:

Breeding and Selection

Breeding and selection of parental palms

A total of 26 breeding trials were laid in MPOB Research Station Sessang, Sarawak.DxP progeny testing are useful in evaluating the tenera progenies on Sarawak peat environment. This will allow selection of parental palms with good combining ability. In addition oil palm clones and inter-specific hybrids are being evaluated.

Oil palm breeding is a lengthy process, taking some 20 years to develop progeny tested planting materials. While R&D continues in Sessang, Sarawak, breeding and selection programmes in Semenanjung were evaluated and selected. The resultant selected elite parental materials were distributed to members of the industry for breeding and seed production.

Breeding and selection of parental palms

Oil palm pollen and breeding materials (seeds of DxD and TxT crosses) have been distributed to the Sarawak Plantation Bhd (**SPB**) in Miri, Sarawak for breeding and seed production.

SPB started seed production in 2008 and is now a seed producer with about one million seeds produced annually. In 2012, seed production had exceeded 2 million seeds. The production is projected to increase to four million in the coming years.

Elite pollen from AVROS genetic background is used as paternal parent for production of commercial DxP by SPAD. The resultant tenera progenies have potentially high oil yield of more than 9 t/ha/year. Income gain (at various price of oil/t) from high oil yield planting materials are expected to be from RM3600 to RM9600/ha/yr.

Breeding and selection of parental palms

MPOB Population 12 pollen, known for dwarf characteristics, is used as paternal parent to produce dwarf DxP planting materials upon crossing with established commercial advanced breeding populations. Population 12 genetic material was distributed to SPB.

PS1 breeding material, known for its dwarf characteristics, would ease harvesting, reducing labour costs and prolonging economic life of the palm. PS2 breeding material provides oil with high iodine value, hence more liquid oil. This provides potential for marketing the oil to temperate countries.

MPOB-Tanzania germplasm has been identified to have thin-shelled tenera, hence the potential to increase production of oil yield due to the higher mesocarp to fruit ratio. The state's extraction rate could be increased by 5%, from 20% to 25%

Best Management Practices (BMP)

of Oil Palm on Peat

Completed Research Projects

No.	Title	Objectives	Locations
1	**Potassium Nutrition of Mature Oil Palm Planted on Peat in Sarawak**	• To determine the best sources of potassium fertilizer for oil palm on peat soil in Sarawak. • To determine the optimum rate of potassium fertilizer for oil palm on peat in Sarawak	Sessang, Sarawak
2	**Planting Density x NPK Requirement on Shallow Peat in Sarawak.**	• To determine the NPK requirement of oil palm on peat soil in Sarawak. • To determine the optimum planting density of oil palm on shallow peat soil.	Sessang, Sarawak
3	**Evaluation of Malaysian Oil Palm Planting Materials in Relation to Land Preparation and Planting Technique on Deep Peat in Sarawak**	• To study the performance of Malaysian oil palm planting materials planting planted on deep peat in Sarawak. • To evaluate the potential of different levels of soil compaction and planting technique on oil palm performance on deep peat in Sarawak.	Sessang, Sarawak
4	**Technique for Mechanically Forced Unidirectional Leaning of Oil Palm on Deep Peat.**	To evaluate the technique for mechanically forced unidirectional leaning of oil palm on deep peat.	Sessang, Sarawak

Completed Research Projects

No.	Title	Objectives	Locations
5	**Fertilizer Requirement and Performance of Oil Palm In Relation to Drainage Intensity in Sarawak**	• To arrive at the optimum field drain intensity for oil palm on peat. • To evaluate the optimum fertilizer requirement in relation to drainage intensities.	Sessang, Sarawak.
6	**Planting Density x NPK Requirement of Oil Palm on Deep Peat Soil.**	• To determine the NPK requirement of oil palm on deep peat soil. • To determine the optimum planting density of oil palm on deep peat soil.	Teluk Intan, Perak.
7	**Land preparation X K Fertilizer Requirement of Oil Palm on Deep Peat Soil.**	• To determine the effect of compacting peat during land preparation on the yield performance. • To determine the K requirement of oil palm supplied either as KCL (MOP) or bunch ash .	Teluk Intan, Perak.
8	**Micronutrient Requirement of Oil Palm Planted on Deep Peat Soil.**	To determine the Copper (Cu), Zinc (Zn). Boron (B) and Manganese (Mn) Requirement and Method of Application for Oil Palm Planted on Deep Peat Soil.	Teluk Intan, Perak.

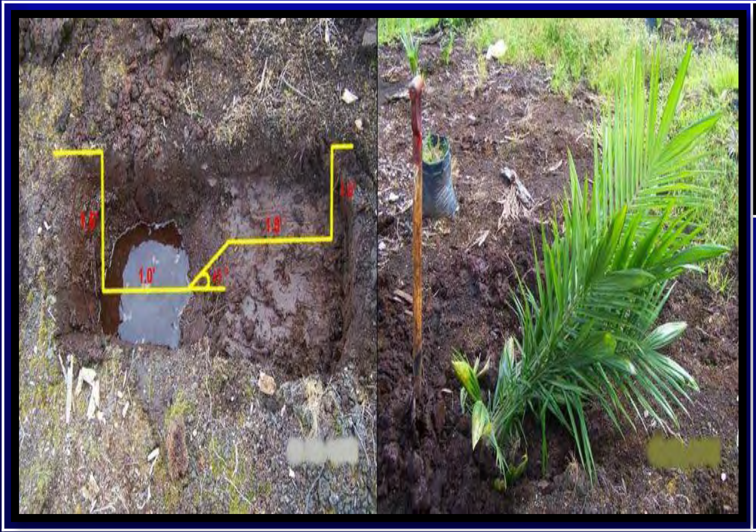
On-going Research Projects

No.	Title	Objectives	Locations
1	**Oil palm yield potential and limiting factors under ex-Padang Paya Peat Forest**	To study the limiting factors that influence the yield production of oil palm planted on *ex-Padang Paya Peat Swamp Forest*	Miri, Sarawak.
2	**Oil palm yield potential and limiting factors under ex-Alan Batu Peat Forest**	To study the limiting factors that influence the yield production of oil palm planted on ex-*Alan Baru Peat Forest*	Betong, Sarawak.
3	**Nutrient cycling and residue management for oil palm replanted on peat soil.**	Maintaining economic viability and sustainability of oil palm on peat through utilization and recycling of nutrients during oil palm replanting.	Sessang, Sarawak.
4	**Assessment of nutrients and carbon stock from different ground cover vegetation and their effect on oil palm performance on peat in Sarawak.**	• To study the oil palm performance in relation to nutrient dynamic of different cover crops. • To quantify carbon dynamic of different ground covers under oil palm	Sessang, Sarawak.

On-going Research Projects

No.	Title	Objectives	Locations
5	**Role of boron in pollen viability and fruit set formation of oil palm on peat.**	• To assess the status of boron for oil palm planted on different types of ex-swamp peat forest in Sarawak. • To determine the effect of boron application rates for pollen viability of oil palm planted on peat.	Sessang Sarawak
6	**Investigation on premature frond desiccation in oil palm develop on peat soil in Sarawak**	To further explore and investigate factors affecting premature frond desiccation	Bintulu Sarawak
7	**Nitrogen fertilizer requirement in relation to ground cover management for oil palm planted on peat**	• To assess the performance of several types of legume cover crops (LCC) on peat; • To determine N fertilizer requirement of oil palm on peat in relation to LCCs establishment.	Teluk Intan, Perak

MPOB Transfer of Technology



MPOB TT No. 345
Uni-Slant : Unidirectional slanting-hole planting technique for oil palm on deep peat.

- ✓ Minimizes FBB yield loses through proper leaning direction and early leaning recovery.
- ✓ Avoided the haphazard direction of leaning that poses difficulty to the field operation.

MPOB TT No. 417
Technique for mechanically force unidirectional leaning of oil palm on peat.

- ✓ Avoid incidence of severe leaning and palms uprooted.
- ✓ Improve efficiency of field operations especially harvesting works.

MPOB TT No. 472

Best management practice for oil palm planting on peat: Optimum groundwater table.

- ✓ Retain an optimum water-table for superior palm growth and high yield.
- ✓ Minimise excessive peat subsidence, thus, minimising CO_2 emission;

MPOB TT No. 501

Best management practices for oil palm cultivation on peat: *Macuna bracteata* as ground covers crop

- ✓ Minimize peat subsidence subsequently minimize CO2 emission.
- ✓ Prevent irreversible peat drying.
- ✓ Reduce the risk of peat fire.

MPOB TT No. 254
Bunch Ash: An efficient and cost effective K fertilizer source for mature oil palm on peat under high rainfall environment.

- ✓ Strongly alkaline (pH=12) that help to improve the soil pH
- ✓ Increased FFB yield from compare with the equivalent quantity of K applied as MOP and SOP
- ✓ The FFB production cost was lower compared with the equivalent quantity of K applied as MOP and SOP

MPOB TT No. 528
Best Management Practices for Oil Palm Cultivation on Peat: Using Zeolite as Soil Conditioner

The combination application of 3.0 kg palm^{-1} year^{-1} zeolite and 3.5 kg palm^{-1} year^{-1} MOP is the agronomically and economically optimum input for oil palm on peat.

BMP: Ground Covers Management

Natural ground covers
Nephrolepis

Legume cover crop
Mucuna bracteata

Ground coverage (%) of various ground cover management

Ground covers management	Month after planting			
	6	12	18	24
Control	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
Conventional LCC	80.0 ± 0.0	54.2 ± 11.2	50.4 ± 5.8	55.4 ± 4.0
Mucuna bracteata	30.8 ± 5.1	57.9 ± 12.7	75.0 ± 10.2	77.5 ± 7.8
Mucuna + conventional LCC	31.7 ± 3.9	66.7 ± 8.9	74.6 ± 6.0	80.8 ± 6.7

- *Mucuna bracteata* is generally slow starter legume cover crops but had performed very well under oil palm planting on peat.

Effect of Ground Covers Management on Oil Palm Performance

Ground covers management	Vegetative Growth[1]			FFB Yield [2] (tan/ha/year)
	Rachis length (cm)	Palm height (cm)	Petiole section (cm)	
Control	393.5 b	60.7 b	0.167 b	13.58 b
Conventional LCC	402.5 ab	67.2 ab	0.183 a	15.24 a
Mucuna bracteata	409.7 a	68.9 a	0.179 a	15.11 ab
Mucuna + conventional LCC	415.1 a	66.8 ab	0.177 a	14.85 ab

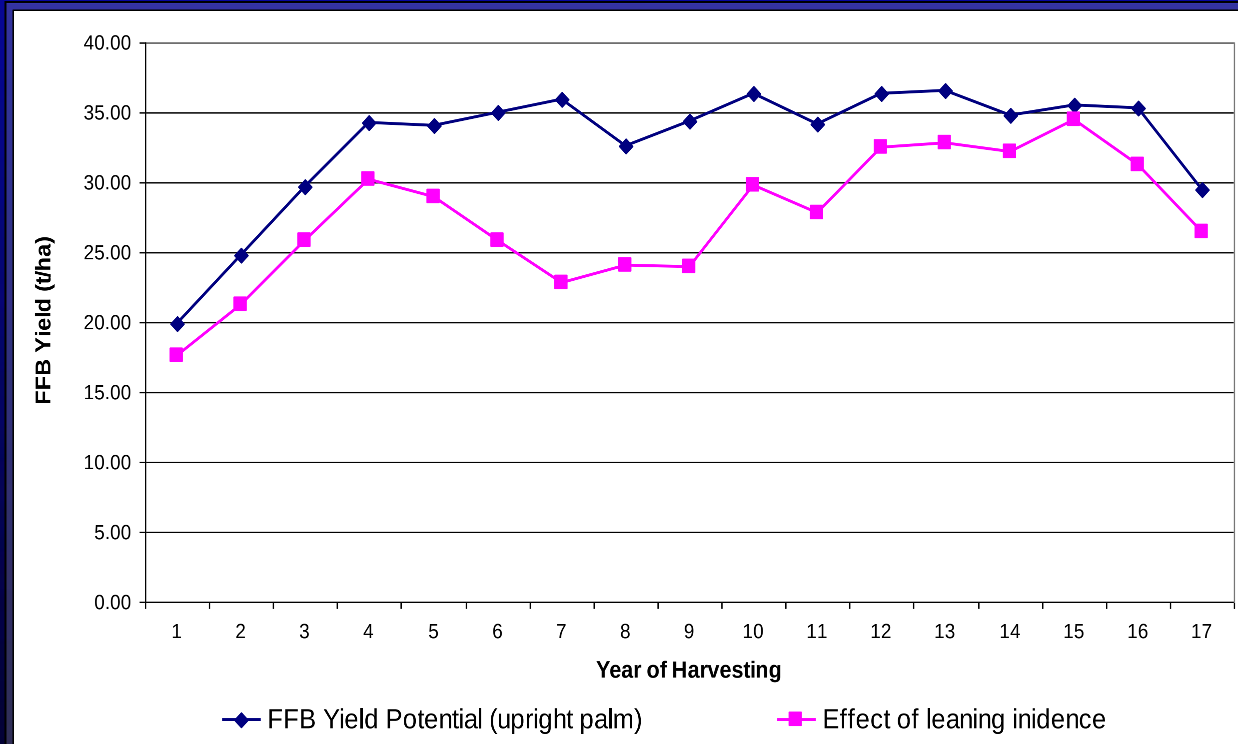
- These results clearly indicate that establishment of ground covers such as *Mucuna bracteata* on peat gave better early palm growth as well as yield

Assessment of nutrients and carbon stock from different ground cover vegetation and their effect on oil palm performances on peat in Sarawak

The study consists of five treatment which are as follows; T1: No ground covers (control), T2: Natural ground covers, T3: Nepherolepis biserrata, T4: Mucuna bracteata and T5: Legumes cover crops. Measurement in soil respiration will benefit in improvements in carbon sink potential through potential cover crops selection under oil palm cultivation on peat.

Preliminary data in the early development of ground vegetation, T3 emit lowest soil respiration and potentially serves as sink to carbon dioxide followed by T4.

BMP: Management of Leaning Palms



Effect of leaning palms on FFB yield on deep peat at MPOB Research Station Teluk Intan, Perak

Technique for Mechanically Forced Unidirectional Leaning of Oil Palm on Peat

The Technology

- The young palms were forcibly pushed using an excavator to lean in one direction
- And day after, the mechanically forced palms leaned progressively and unidirectional

Work Schedule

	**Step 1:**	When the palms reached 30 months old, they were forcibly pushed using an excavator to lean at 45º in one direction
	**Step 2:**	Soil mounding of palms was conducted
	**Step 3:**	The soil was compacted or levelled and cleared of any stumps along the harvesting paths
	**Step 4:**	Pruning of damaged fronds was carried out.

Benefits

- Help to alleviate haphazard leaning, and subsequently minimize FFB yield losses;
- Providing good in-field accessibility, thus increase the efficiency of field operations; and
- Having a more uniform palm height that increase the productivity of harvesting operations

BMP: Drainage & Water Management

An efficient and sufficient drainage systems and water management are keys to successful oil palm planting oil palm on peat

Objectives of water management;

- to retain an optimum water-table for superior palm growth and high yield;
- to drain out excess water and avoid prolonged flooding periods;
- to minimise excessive peat subsidence, thus, minimising CO_2 emission;
- to avoid irreversible drying of the peat surface; and
- to minimise the risk of peat fires.

For best management practices in water management:

1. Field design need to accommodate space for machineries to manoeuver and for maintaining the collection and main drains;
2. Vary the intensity of field drains according to the peat decomposition stages, i.e. higher in which higher intensity required for *sapric* as compared to *fibric* peat;
3. Monitoring the groundwater levels in the collection drain by piezometers installed in planting block



For best management practices in water management:

4. Drainage systems should be able to flush the stagnant water in drains for good soil water quality and soil aeration;

5. To install a stop-off or weir for every 20 cm drop in water level along collection drain; and

6. Engaging a full-time water management worker for monitoring water level and maintenance of drainage system.




Optimum groundwater table

The groundwater level in the oil palm planting block was dependent on the intensity of field drains and degree of peat decomposition. In order to maintain a uniform groundwater table in the planting block, a higher intensity of field drains (every four planting rows) was required for the sapric peat materials area, while less intensity of field drains was needed for the fibric peat materials area.

At MPOB Research Station Sessang, Sarawak, a subsidence rate of 13.4 cm/year was recorded during the initial three years of development, followed by 5 to 6 cm/year over the subsequent three to nine years after development. Thereafter, the subsidence rate was recorded at 2 to 4 cm/year. Overall, the subsidence rate can be significantly reduced by increasing the groundwater table up to 30 to 40 cm from the surface during the early years of development. The study also showed that a high oil palm yield could be obtained by maintaining a higher groundwater table. Highest yield was recorded at the 43 cm groundwater table block during the first four and subsequent years of harvesting as compares to 49 and 53 cm groundwater table block.

Optimum Groundwater Table

Development stage	Field drainage intensity (for every oil palm rows)	Water level from ground surface (cm)	
		Groundwater table in field	Water level at collection drain
Immature (1-3 years old)	> 8	30 to 40	35 to 45
Young mature (4-7 years old)	8	35 to 45	45 to 55
Fully mature (> 8 years old)	4	40 to 50	50 to 60


Measuring groundwater table


Measuring groundwater level

BMP: Fertilizer Management

- **Low soil bulk density** – nutrients leaching
- **Very acidic** – low availability of micronutrients
- **High C/N ratio** - low availability of N
- **Peat decomposition** – release high N
- **High organic matter** – high availability of P
- **High soil Mg** – depress uptake of K
- **Low soil fertility** – K, Cu, Zn and B
- **Low water retention** – affect nutrients uptake

Re-evaluation of Nutrients Requirements for Oil Palm Planting on Peat Soil

(The Planter Vol .90 No. 1056, March 2014)

N Fertilizer Requirement

- The low or non-significant of N fertilizer treatment was due to a sufficient supply of natural N sources from peat mineralization.
- Sharif *et al*. (1986) had estimated that about 5.0 t N ha^{-1} was present in the top of peat.
- Excessively high N inputs will lead to high nitrous oxide and methane emissions (Melling, *et al,* 2006; Melling, *et al,* 2011).
- The optimum rate of N fertilizer application is lower than N1 rate (0.5 to 0.6 kg urea $palm^{-1}$ yr^{-1}).

Re-evaluation of Nutrients Requirements for Oil Palm Planting on Peat Soil

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P Fertilizer Requirement

- No significant response of oil palm to P fertilizer application (Gurmit *et al*, 1987; Gurmit, 1999).
- Researches on deep peat in North Sumatra proposed that 0.5 kg phosphate rock $palm^{-1}$ yr^{-1} which should be sufficient for optimum leaf P status (Manjit *et al*, 2004).
- Excessive P fertilizer application should be avoided to ensure lower *Ganoderma* basal stem rot incidence (Mohd Tayeb, 2002).
- The optimum rate of P fertilizer for oil palm on peat should not exceed 1.0 kg RP $palm^{-1}$ yr^{-1}.

Re-evaluation of Nutrients Requirements for Oil Palm Planting on Peat Soil

(The Planter Vol .90 No. 1056, March 2014)

K Fertilizer Requirement

- Fertilizer application in peat area in Sarawak becomes more critical due to the high leaching environment.
- K that leached rapidly from the peat is a contributory factor to the low effective cation exchangeability capacity (CEC) of the peat (Malcolm *et al*.,1997).
- The optimum rate of K fertilizer for oil palm on peat recommended at 4.0 - 6.0 kg MOP palm^{-1} yr^{-1}.

Re-evaluation of Nutrients Requirements for Oil Palm Planting on Peat Soil

(The Planter Vol .90 No. 1056, March 2014)

Mg Fertilizer Requirement

- There was adequate Mg in peat to meet the palm's requirement (Gurmit *et al, 1*987; Jaman and Kueh,1996).
- Leaf Mg levels was significantly reduced by K fertilizer application, however remained high even at the highest K rate of 7.0 kg MOP $palm^{-1}$ yr^{--1} (Manjit *et al*.,2004).
- Excessive application of Mg fertilizer may induce K deficiency (antagonistic relationship).
- Mg fertilizer requirement should be based on leaf analysis results.

MPOB F2 Super K Formulation

- The MPOB F2 Super K is formulated based on various MPOB fertiliser trials.
- **The formulation is designed to suit NPK requirements for oil palm cultivated on peat.**
- The nutrients are chemically bonded together into granules through chemical and thermal reaction.
- Significant amounts of zeolite minerals to effectively promote efficient nutrients uptake by plants and mitigate leaching problem in peat.

Oil palm planting density on peat.

A planting density trial on shallow peat was carried at MPOB Research Station Sessang, Sarawak. The objective is to determine the optimum oil palm planting density on shallow peat under Sarawak environment.

Benefits

Twelve year yield assessment of three oil palm planting densities (120, 160 and 200 palms/ha indicates that the agronomic optimum planting density (density that gives the highest cumulative fresh fruit bunches (FFB) yield over a given period) is 160 palms/ha.

Palms at 160 palms/ha gave the highest profit with the Benefit:Cost (B:C) ratio of 1.43 compared to 1.41 and 1.38 for densities 120 and 200 palms /ha, respectively.

The Pay back period for densities of 160 and 200 palms/ha were similar (7.81 years and 7.84 years) and lower compared to 8.42 years for 120 palms/ha.

Underground microbial biodiversity during conversion of secondary forest to oil palm plantation at Belaga Sarawak

The development of secondary forest on mineral soil to oil palm plantation will affect the underground microbial biodiversity. This is because of the microbial biodiversity is indicative of soil fertility. The objectives of this study are to investigate the composition and diversity of the soil bacteria prior to and at various stages of planting of oil palm, and also to identify genus and species of microbes in the oil palm and various field management using molecular techniques such as sequencing and BLAST analysis.

Benefits

This study is useful to construct a library of the bacterial strains and database and to utilize beneficial microbes as agro-products. Besides, the quantitative analysis and changes in microbial population in relation to agricultural practices and development of oil palm can indicate soil fertility.

Assessment of nutrients and carbon stock from different ground cover vegetation and their effect on oil palm performance on peat in Sarawak

Establishment of oil palm plantations on peatland in Malaysia is currently debated, in part because of CO_2 emissions related to land conversion. Many researches show contradicting findings which could lead to confusion of the GHG effect on oil palm plantation on peat. Most research are focus on CO_2 emissions from the peat soil only, without incorporating the carbon uptake by the vegetation and additional carbon flows such as anaerobic decomposition and leaching. Small variations in parameters can largely influence the estimated amount and hence more precise estimates are needed. Different types on vegetation could be influenced in GHG emissions from soil surface and bulk density of the soil.

The objective of the project was to address the data gaps on the effect of several types of ground covers to oil palm performances and data on carbon uptake of different land management in oil palm plantation in peat area in Sarawak.

Green House Gas (GHG) Emission Studies

MPOB has set up a Tropical Peat Research Institute (TROPI) in 2008, which was approved by the Cabinet Committee Competitiveness on Palm Oil (CCPO) in 2007. TROPI is dedicated to tropical peat research, principally in Sarawak with nine major projects in the state (Table 3.2). These projects will address some of the current issues on greenhouse gas (GHG) emissions from peatlands and provide new information on best management practices for oil palm on peat. TROPI works closely with the industry and experts in the country.

MPIC/MPOB is also funding the Tropical Peat Research Laboratory (TPRL) Unit worth RM16.9 million.

For addressing the GHG issues on minerals soils, MPOB has also undertaken two projects for measuring GHG and carbon stock at MPOB Belaga, Sarawak and MPOB Keratong, Pahang. The information will be useful for comparing GHG and carbon stock from peat areas. MPOB has recruited 8 contract researchers to undertake the research projects, i.e. 5 researchers are based in Sarawak and another 3 are based in Peninsula.

Green House Gas (GHG) Emission Studies

No.	Project Title	Project Leader	Year started (Duration)	Location
1	Review On Working Program Of Green House Gas Flux Studies*	TPRL	2009 – 2013 (5 years)	Naman Oil Palm Plantation, Maludam Forest Reserve, Bentong, Sarawak
2	Carbon Oxidation Loss Using Flux Techniques	MPOB	2010 – 2012 (3 years)	Ldg Pelita Tanah 2, Sibu Sarawak
3	Depth Of Drainage And Oil Palm Cultivation	MPOB	2010 – 2014 (5 years)	Ldg Pelita Tanah 2, Sibu Sarawak
4	OP AGRONOMIC PRACTICES AND CARBON FLUXES	MPOB	2009-2013 (5 years)	MPB Tlk. Intan, Perak
5	Nutrients And Carbon Stock In Different Ground Cover Vegetation	MPOB	2009 – 2014 (6 years)	Ladang FELCRA Dour-Klauh, Sri Aman, Sarawak
6	MEASURING CANOPY CO2 FLUXES FROM OIL PALM ON MINERAL SOIL	MPOB	2013-2018 (5 years)	MPOB Keratong, Pahang
7	Nutrient cycling and residue management for oil palm replanted on peat soil.	MPOB	2009 – 2019 (10 years)	MPOB Research Station Sessang, Sarawak
8	Effect of legume cover crops (LCC) for oil palm on peat	MPOB	2007 – 2015 (8 years)	MPOB Research Station Teluk Intan Perak / Ladang Yayasan Pahang, Rompin, Pahang
9	Microbial study in deep peat Sarawak	MPOB	2010 – 2015 (5 years)	Ladang Pelitanah,Naman, Maludam, Durafarm dan Cermat Ceria di Sarawak

Current Issue on Oil Palm Planting on Peat

1. Premature frond desiccation.

2. Low OER / Poor FFB fruit set.

FELCRA Plantation, Mukah

Selezu Plantation, Bintulu

Taniku Plantation, Miri

Premature Frond Desiccation

- Reported in mature palms after 8 to 10 years oil palm planting and several cases reported occurred at early-mature palms stages.
- Factors that trigger frond desiccation should be investigated as it would cause an impact on oil palm performance.

New Research Proposal 2014

Investigation on premature frond desiccation in oil palm planted on peat soil in Sarawak

Part: 1

To explore and investigate the factors affecting frond desiccation .

Part 2:

To set up field trial with treatments that can reduce or overcome the incidence of frond desiccation.

Low OER / Poor FFB Fruit Set

- Research in Sarawak showed that fruit set formation was low on peat, averaging about 48% (Hasnol *et al.*, 2004) .
- Normal fruit set ranges between 60 – 80% (Basri and Norman, 2000).
- In Sarawak, OER performance less than 15% has been reported.

New Research Proposal 2014

Role of boron in pollen viability and fruit set formation of oil palm on peat.

Part: 1
To assess the status of boron in oil palm planted on three different types of ex-swamp peat forest in Sarawak

Part 2:
Determine the best combination of B application rates and frequency for pollen viability of oil palm planted on peat.

Part 3:
To validate the effectiveness of boron on pollen viability and fruit set formation.

IMPACT ASSESSMENT OF *ELAEIDOBIUS KAMERUNICUS* IN SARAWAK

Achievement

- Information on weevil population and nematode infestation related with fruit set was analysed and presented at MPOB/IOPRI 2011.

Current Efforts

- To study the weevil population on young palms in Sarawak, in deep peat.
- Analysing data on weevil population for the past three decades in Sarawak.
- To conduct trial on assisted pollination at low fruit set area.

***Elaeolenchus parthenonema*, parasitic nematode infesting both weevil adults and larvae. (Coiled shape)**

Study locations in Sarawak

1. MPOB Peat Research Station, Sessang, Sarawak
2. Kenyalang Estate, Pusa, Betong Sarawak
3. Durafarm, Betong , Sarawak

Location	Weevil mean/spk	Weevil/ha	Pollinator force Adult weevil/♀ inflo	% Fruit set (marked Jl-Dec'13)
Kenyalang Estate	9.63 – 37.67	16,640 - 23,771	520 – 2,985	33.66 – 50.15
MPOB	9.89 – 18.63	9,003 – 24,256	281 – 1,376	35.9 – 52.20

Weevil population & fruit set from Jan-Jun'14

Termite Management

Termite is becoming an important pest in peat areas where the remnants of forest logs become nesting sites for subterranean (below-ground) termites. These species later become long term pest to the oil palm. MPOB has several ongoing researches in Sarawak, especially in peat areas (MPOB Station, Sessang; Ladang Trusan, Tradewinds, Lawas), and in logged over forest, developed for oil palm (Belaga). A water table effect on termite population was conducted at Tradewinds Plantations, Sibu.

Samples collected at Belaga logged over forest has revealed 61 termite species from 22 genera. The common species found in oil palm include the Families Rhinotermitidae, Kalotermitidae and Termitidae. Rhinortermitidae includes the pest termite Coptotermes curvignathus (subfamily Coptotermitinae). At MPOB Sessang Station, subfamily Termitinae was more common, with 27 species followed by the other two transects with 15 species each.

In the long term, proper identification and management of termites by correct identification, monitoring water levels and palm census should minimise chemical use and cost of production especially in peat.

POPULATION STUDIES OF TERMITES IN PEAT AND ITS CONTROL

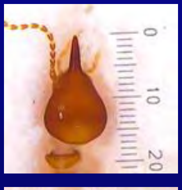
Achievements

- Completed identification of termite population from different locations on mineral & peat soil.
- Information on termite population in oil palm was presented at PIPOC 2011.
- "Termite of oil palm in Malaysia" was published in 2012.

Future Efforts

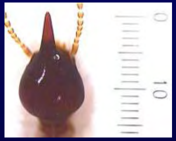
- To conduct detailed study on pest termite population and its control using biological agents in Sarawak

OTHER TERMITES DETECTED WITH TRANSECT BELT



Bulbitermes

Havilandtermes



Hospitalistermes

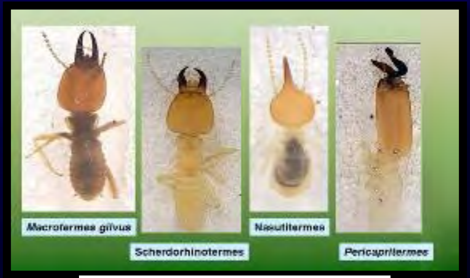
Odontotermes

Termes rostratus

Research locations:

1. Ladang Naman, Sibu (Ta Ann Plantation)
2. Ladang Sg Meris, Mukah (Sarawak Oil Palm Berhad)
3. Ladang Tulai, Sibu (Sarawak Plantation Berhad)
4. Ladang MPOB Sessang (MPOB Sessang Research Station))

Pest termites



Non pest termites

Termites attack on the oil palm trunk

Methods Of Sampling	Termite Families	Termite Subfamilies	Genus	Species
Rubber wood stake (peat soil)	3	5	4	7
Transect – belt (peat soil)	2	4	15	22
Transect – belt (mineral soil)	2	3	12	15

Table 2. Termite species detected in oil palm plantation, Sarawak

Sampling of pest termite with corrugated cardboard in termite detector station

STUDY ON MAJOR INSECT PESTS IN OIL PALM IN SARAWAK

Sub-project: Bunch moth (*Tirathaba rufivena*) infestation and its control

Achievements

- Information on the infestation of *T. rufivena* during wet & dry season.
- Discovered high infestation of *T. rufivena* on male inflorescences.


Larvae


Pupae


Adult

Future Efforts

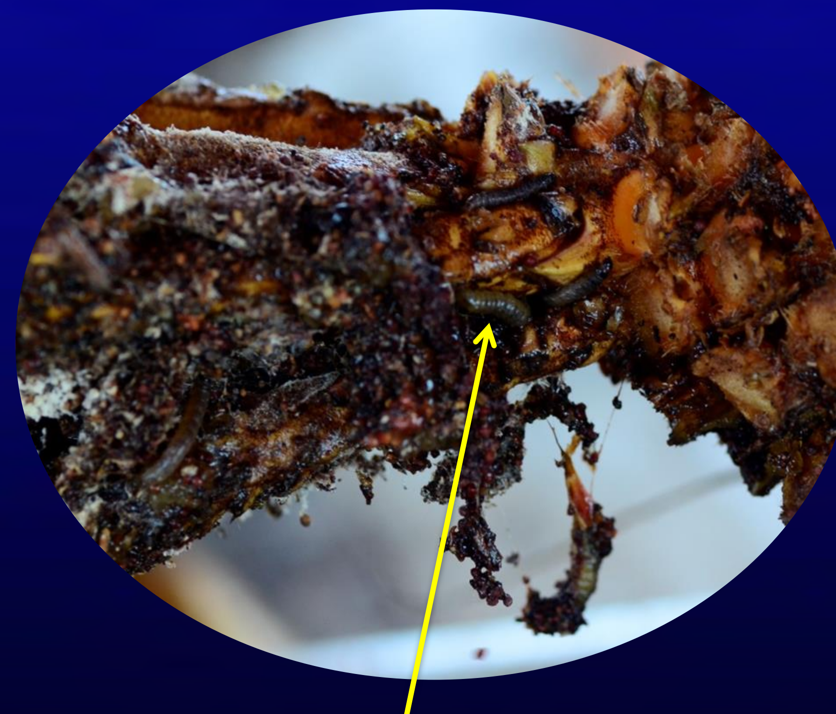
- To conduct trials of different biological agents in controlling the infestation.
- To get more details on the biology of *T. rufivena.*
- To conduct further research of the *T. rufivena* during wet & dry season.

Research locations:

1. Ladang Pelita Igan Plantation, Mukah (Ta Ann Plantation)
2. Ladang Timbarap 9, Miri (Sarawak Oil Palm Berhad)
3. Zumida Oil Palm Sdn Bhd, Sibu. (Ta Ann Plantation)




Anthesising female inflorescence and bunch attacked by the bunch moth



Bunch moth larvae on male inflorescence

Activity during bunch moth sampling from ablation samples

		Number of live larvae	
Inflorescence stage	n	Mean ± SE	Range
Pre- anthesis	17	5.20 ± 1.35	0 – 23
Anthesising	16	7.56 ± 1.97	0 – 27
Post- anthesis	14	8.00 ± 1.91	1 – 21
Bunch	70	4.79 ± 0.55	0 - 18

Mean live bunch moth larvae from infested female Inflorescences & bunches from 18 months oil palm, Miri, Sarawak

		Number of live larvae	
Inflorescence stage	n	Mean ± SE	Range
Female inflorescence	13	19.4 ± 4.4	0 – 39
Male inflorescence	**12**	**35.3 ± 15.7**	**1 - 207**
Bunch	10	9.9 ± 3.5	1 - 30

Mean live bunch moth larvae recorded from young palm (ablation program) in Sibu, Sarawak

Ganoderma Disease

MPOB has been receptive towards the requests on Research and Development (R&D) of oil palm diseases, especially Basal stem Rot (BSR) and Upper Stem Rot (USR), involving aspects of biology, detection, control and disease management.

MPOB has organized roadshows, lectures and field demonstrations on the biology, detection and control of Ganoderma disease in Sarawak since 2000. MPOB conducted the roadshows in collaboration with the plantation companies, government agencies, smallholders, the East Malaysian Plantation Association (EMPA), the Incorporated Society of Planters (ISP), Malaysian Palm Oil Association (MPOA) and Sarawak Oil Palm Plantation Owners Association (SOPPOA). The roadshows were aimed at educating the planters on the awareness, detection, control and management of Ganoderma disease based on technologies developed by MPOB.

Ganoderma Disease

Agencies in Sarawak that participated as hosts for lectures and field demonstrations (disease diagnosis, detection, controls using fungicides and sanitation technique) are as follows:

- o Sime Darby Plantations
- o Sarawak Oil Palm Berhad (SOPB)
- o Sarawak Plantations Berhad (SPB)
- o FELDA Plantations
- o FELCRA Plantations
- o Lembaga Penyatuan and Pemulihan Tanah Sarawak (SALCRA)
- o Tradewinds Plantation
- o Department of Agriculture (DOA) Sarawak

Ganoderma Disease

Hands-on training on Ganoderma technologies transferred (methods on biology, epidemiology, detection, fungicides testing and sanitation technique) to agencies from Sarawak are as follows:

- o Sarawak Plantations Berhad (SPB)
- o Tradewinds Plantation
- o DOA Sarawak
- o SALCRA
- o Sarawak Oil Palm Berhad (SOPB)
- o Students University, e.g. UNIMAS and UPM Bintulu

Concluding Remarks

MPOB has been receptive towards the requests on Research and Development (R&D) on oil palm agronomy and pest and disease control especially in peat areas in Sarawak.

To foster and further enhance two way interaction and collaborations between SOPPOA and MPOB for the adoption and implementation of technologies among members.


Thank You