Learning about sustainable oil palm production: a guide for training small-scale farmers in West and Central Africa

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About STCP

The Sustainable Tree Crops Program (STCP) constitutes a coordinated and innovative effort made by farmers and producer organizations, industry and trade, national governments, research institutes, the public sector, policymakers, donors and development agencies to facilitate the improvement of smallholder agricultural systems based on tree crops in West and Central Africa. The goal of STCP is to improve the economic and social wellbeing of smallholders and the environmental sustainability of tree crop farms in West and Central Africa. STCP is hosted and managed by the International Institute of Tropical Agriculture.

About IITA

The International Institute of Tropical Agriculture (IITA) was founded in 1967 as an international agricultural research institute with a mandate for improving food crop production in the humid tropics and to develop sustainable production systems. It became the first African link in the worldwide network of agricultural research centers known as the Consultative Group on International Agricultural Research (CGIAR), formed in 1971.

IITA's mission is to enhance the food security, income, and well-being of resource-poor people in sub-Saharan Africa by conducting research and related activities to increase agricultural production, improve food systems, and sustainably manage natural resources, in partnership with national and international stakeholders.

Content

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Most of the exercises in this manual were developed by participants of a workshop organized by STCP in November 2007 in Limbe, Cameroon.

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Sonii David, STCP and Jim Gockowski, STCP	Recording inputs for improved oil palm production Calculating the profitability of improved oil palm production
Geoffrey Nsofon Guemuh, STCP-Cameroon and Claude Bakoume, IRAD	Pruning oil palm
Claude Bakoume, IRAD and Sonii David, STCP	Deciding when to replant oil palm
Sonii David, STCP	Introduction to the FLG FLG evaluation

Sections of this manual on the importance of the oil palm were taken from P. Griffee, P. Diemer and C. Chinchilla, Smallholder oil palm manual, FAO, Rome Italy, 2004. (www.ecoport.org/ep?SearchType=earticleView&earticleId=180&page=2). The figure on page 10 was taken from K. Poku, 2002. Small-scale oil palm processing in Africa. FAO, Rome, Italy.

Photo credits

Photos on the cover page were taken by staff of IRAD Dibamba, Cameroon

Preface

The strong global demand for oils and fats has caused a rapid growth of the oil palm industry in the West and Central African region and other parts of the world, creating new opportunities for small-scale oil palm producers. While several manuals exist for training smallholders on oil palm, there has been little innovation with regard to training methods and approaches. The Sustainable Tree Crops Program is piloting the farmer learning group (FLG) approach for training oil palm farmers. This method draws on elements from the farmer field school approach (experiential, group based learning) but the key objective of teaching farmers specific skills and practices, as opposed to a focus on ecological principles. More details on the FLG method are provided in S. David 2008. A guide for implementing farmer learning groups on oil palm integrated crop management.

A FLG consists of 20-30 farmers who meet regularly in a field led by a trained facilitator who follows a set curriculum. The key characteristics of an FLG are:

- Technically competent facilitators who lead group activities and facilitate learning.
- Hands on learning whereby farmers learn and practice implementing skills and best practices
- Flexible, interactive, non-lecture demonstrations and practical field exercises conducted on one or several learning fields
- Strong emphasis on discussion and debate which allows farmers to become aware of misconceptions and the limitations of certain existing practices and how improved practices and knowledge can boost productivity

This manual was developed by STCP as a guide for trainers leading FLGs or other group based, hands-on training approaches. Trainers may be extension agents or farmers who have gone through a comprehensive training of trainers (ToT) program on the FLG method and oil palm integrated crop management. The exercises contained in this manual should be treated as guides to be used flexibly and creatively by trainers.

The manual is divided into two parts. Part one contains bulletins that provide trainers with technical information on key topics in the oil palm integrated crop management training curriculum. Part two consists of training exercises for farmers. The content of this manual should be adapted to the context and situations of farmer training, by, for example, changing the names of currencies, measurements etc.

This work is very much a work in progress, therefore feedback and comments are warmly welcome and should be sent to:

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Glossary of technical terms

Braken	A type of fern with large leaves
Broadleaves	Types of plants that have large, wide leaves
Culling	The process of removing and destroying abnormal seedlings in a nursery
Epiphytes	A type of plant (e.g. some mosses and ferns) that grow on another plant or object but is not rooted in soil. It does not directly harm the other plant
Fern	A kind of plant with no flowers and delicate feather-like leaves
Frond	Large, finely divided leaf of a palm or other plants such as ferns
Larva (pl. larvae)	Any young insect from the time that it hatches from the egg until it becomes a pupa or chrysalis
Petioles	In plants, the stalk by which a leaf is attached to a stem
Plumule	The developing bud of a plant embryo (part of a plant contained in a seed)
Pupa	The stage in an insect life cycle after the larva stage
Radicle	The part of a plant embryo that develops into a root. In most seeds, the radicle is the first structure to emerge on germination
Sedges	A grass like plant

Part I: Technical bulletins for trainers

The oil palm

The oil palm (*Elaeis guineensis*) is one of the largest of the palm species and produces more oil per hectare than any other oil crop. Palm oil is the world's second major vegetable oil, after soybean, with world annual production of fresh fruit bunches approaching 100 million metric tonnes per year.

The mature palm has around 36-40 leaves, 5-8 meters long and 5-8 kg each, with 250-350 leaflets per leaf and 12 m^2/leaf. The growing point of the adult oil palm produces 20 to 25 leaves every year.

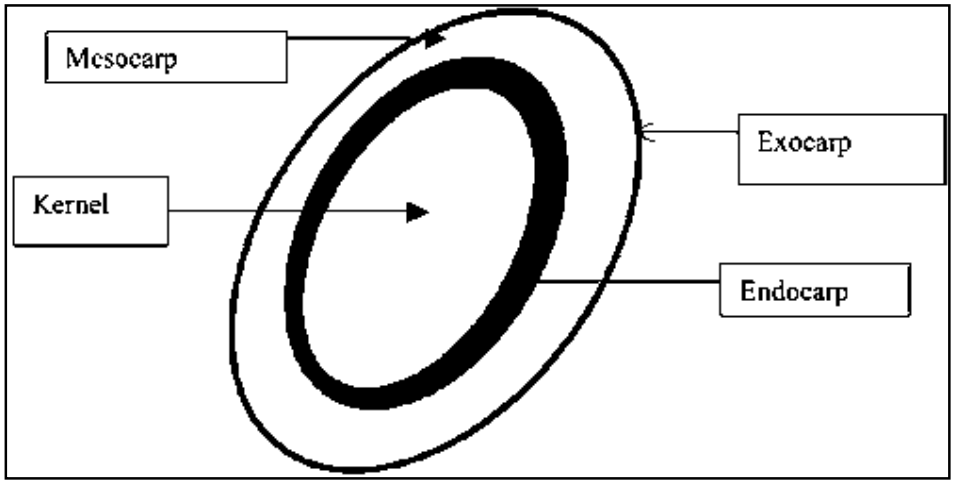
The palm has no branches. The stem is up to 30-60 cm in diameter, can reach up to 15 m in height after 25 years, and remains covered with persistent leaf bases for up to 16-20 years. Afterwards they will normally detach. The stem is crowned by the palms growing point. If this growing point dies, the palm dies. The palm has a productive life of about 25 years and the years of peak production are from 6-15 years after planting.

The oil palm has a fibrous root system concentrated in the top layer of soil as far away as 20 m from the plant's base. Some roots may deeply penetrate into the soil and serve as a secure anchorage for the plant. Larger, primary roots originate secondary, smaller-diameter roots, and these give rise to the terciary and quaternary root systems. Most feeding roots are quite superficial, and this is why soil compaction and disturbance must be avoided.

The oil palm is an important tree crop grown widely by small-scale farmers in West and Central Africa. Oil palm is also grown on large plantations in this region.

The palm bears its fruit in bunches varying in weight from 10 to 40 kg. The individual fruit, (Fig. 2) ranging from 6 to 20 gm, are made up of an outer skin (the exocarp), a pulp (mesocarp) containing the palm oil in a fibrous matrix; a central nut consisting of a shell (endocarp); and the kernel, which itself contains an oil (palm kernel oil).

Figure 1: Structure of the palm fruit



Source: FAO, 2002 www.fao.org/docrep/005/Y4355E/y4355e00.htm

There are three oil palm varieties which are distinguished by the quality of fruit produced. The wild oil palm groves of Central and West Africa consist mainly of a thick-shelled variety with a thin mesocarp, called Dura. The shell-less variety is known as Pisifera. Using these two varieties, plant breeders have developed a hybrid with a much thicker mesocarp and a thinner shell, known as Tenera.

Due to its thick mesocarp and high oil content in the fruit, Tenera is recommended for planting by small-scale farmers. The Tenera nut is small and is easily shelled to release the palm kernel. The Tenera palm kernel is smaller than the Dura kernel although the Tenera bunch is much larger than Dura.

Many households in West and Central Africa make palm oil from wild palm trees that grow unattended in the forest but many farmers also plant oil palms, usually on a small-scale, as a cash crop. It is estimated that a small scale farmer needs to have at least 3 hectares (about 429 trees) planted to oil palm to make a profitable return.

Many farmers grow oil palm without following recommended practices. The cropping calendar below shows the recommended activities and times for growing oil palm in West and Central Africa. During the training it is important to discuss farmers' existing practices and knowledge about the crop in order to compare them with recommended practices.

Example of an oil palm cropping calendar for West and Central Africa

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Pre-nursery												
Transfer of seedlings to main nursery												
Main nursery												
Land clearing												
Felling, cutting and clearing of trees												
Burning of farm												
Plant food crops and/or leguminous cover crops												
Staking, lining and planting												
Weeding*												
Pruning												
Harvesting**												

* = As frequently as needed in mature plantations
** = 2 - 3 rounds every month

Oil palm nursery management

Importance

Good nursery techniques are important to produce healthy, vigorous seedlings and reduce the number of abnormal seedlings which will need to be eliminated later on.

Two types of nurseries can be made for oil palm:

- One-stage nursery: no pre-nursery is made, seed is directly planted in large polybags (38 cm x 51 cm). Seedlings are ready for planting in the field after 11 months.

- Two-stage nursery: a pre-nursery is made where seed are planted in small polybags and grown for 3-4 months. Seedlings are transplanted at 3-4-leaflets stage into large polybags and kept in a nursery for 8 months.

There are advantages and disadvantages to choosing either the single stage or the double stage nursery as outlined below:

A comparison of the two types of nurseries

	Advantages	**Disadvantages**
Single stage	• Avoids transplanting shock caused by moving plants from small to large polybags • No pre-nursery requirements (layout, equipment, labour) needed	• Observation, supervision and other activities are difficult because seedlings are spread over a wide area • Large quantities of water are needed to cover the whole nursery area
Double stage	• More labour efficient because all activities (field observations, manuring, treatment against pests and diseases, watering) are carried out in a compact area • Culling is carried out quickly and easily at pre-nursery stage, resulting in fewer empty bags in the main nursery	• Transplanting shock may occur when moving plants from small to large polybags

Farmer practice

Many farmers use planting materials of unknown origin. Farmers often establish nurseries in unfenced areas near their homes which may result in stray animals destroying their seedlings.

Some farmers do make their nursery near a source of water and as a result suffer heavy loss of seedlings during the dry season.

Some farmers are not efficient and effective in removing and destroying abnormal seedlings in the nursery (culling).

Farmers often do not use fertiliser or use the wrong type of fertiliser on oil palm seedlings.

Best Practices

Site selection

It is important to consider the following when selecting a nursery site:

- ***Flooding***: Is the area prone to flooding or water logging?
- ***Water source and quality***: there a permanent and unpolluted water source?
- ***Soil***: Is the soil on the site of good quality and quantity?
- ***Shade***: Is there too much natural shading from crops or shade trees?
- ***Security***: Does the location offer security against thieves?
- ***Pests:*** Are there likely to be pests that could attack the seedlings?

Setting up a nursery

- Fill polybags with fertile top soil that has medium texture, friable consistency, and good water holding capacity. Mix with coarse sand (40%) for heavy textured soil. Avoid contaminated soil. Do not use wet soil to fill the polybags.
- Use perforated black polythene bags (size 38 cm x 50 cm x0.12 mm),
- Arrange polybags in the main nursery at 0.9 m x 0.9 m in a triangular arrangement.
- Choose superior planting material (germinated Tenera seeds) from reliable seed producers
- Do not sow seeds too deep in the soil or upside down. Sow at 19 mm below soil surface, with the radicle downwards, and the plumule upward. You can tell which one is which because the radicle is darker than the plumule.
- Avoid mixing the seed with chemicals

- Provide shade to protect young seedlings from too much exposure to sunlight by covering the nursery area with coconut or oil palm leaves.

- Thin and gradually remove 1 out of 3 leaves starting at the end of the 3rd month.

- Water seedlings in a small nursery with a watering can. You will need 0.5 to 2.0 litres of water for each seedling per day.

- Weed three different areas of the nursery: weed the nursery site before setting out the polybags, remove weeds growing in the polybags, and weed between the polybags.

- Remove weeds from the polybags by hand every month until you plant the seedlings in the field. Weed between the polybags by hand or with herbicides.

- To control pests and diseases, use pesticides on the seedlings. Twice a month, apply a mixture of an insecticide (carbamate:Decis) and a fungicide (Benlate). To treat 1000 seedlings, mix 25 ml of Decis and 15 grams of Benlate in 15 liters of water.

- Remove abnormal seedlings from the main nursery every three months. Signs of abnormality:

<u>Pre-nursery</u>

✓ Narrow leaf seedlings

✓ Crinkled leaf seedlings

✓ Twisted leaf seedlings

✓ Rolled leaf seedlings

✓ Stunted seedlings

✓ Seedlings with a dry spear

<u>Nursery</u>

✓ Upright or sterile seedlings

✓ Flat top seedlings

✓ Stunted seedlings

✓ Leaflets inserted very close to each other in the leaf stalk

✓ Leaflets too widely spaced from each other in the leaf stalk

✓ Small leaves and leaflets

- ✓ Seedlings with white leaflets
- ✓ Dry spear

Applying fertiliser in a nursery

Importance

Applying fertiliser to young oil palm plants ensures that they get enough nutrients to be able to grow well and produce large bunches and high quantities of oil.

Farmer practice

Farmers often do not use fertiliser or use the wrong type of fertiliser on oil palm seedlings.

Best practices

Recommended fertilisers are: nitrogen in the form of urea, potassium in the form of potassium chloride (Kcl) and magnesium in the form of kieserite (Kies). Mix 50% urea + 25% Kcl + 25% Kies. Apply 5 grams (about the amount that can fit into a mineral water bottle top) of this mixture to each seedling once a month during the first 3 months (at the pre-nursery stage). This mixture should be mixed with water before use. During the main nursery stage, apply 10 grams of this mixture per plant directly in the polybag once a month.

Application procedures

It is best to apply fertiliser in the evening to avoid the heat during the day.

Weed polybags before applying fertiliser.

Apply fertiliser uniformly in a circle midway from the edge of the bag.

Lightly water the seedlings after applying fertiliser to avoid possible leaf scorch from contact with the fertiliser.

Pre nursery

Fertilisers are not required until the first leaf is fully developed. Thereafter, choose fertilisers preferably in liquid form, e.g. urea or a N: P2O5:K2O: MgO compound fertiliser (e.g. 15:15:6:4) dissolved in water at the following rates for every 400 seedlings:

Choose fertilisers preferably in liquid form, e.g. urea or a compound fertiliser (15:15:6:4 of N:P2O5:K2O:MgO) dissolved in water at the following rates:

- 4^{th} week (1^{st} leaf): 30 g urea in 18 litres (l) water
- 5^{th} week: 60 g 15:15:6:4 of N:P2O5:K2O:MgO in 18 l water
- 6^{th} week: 60 g 15:15:6:4 of N:P2O5:K2O:MgO in 18 l water
- 7^{th} week: 75 g 15:15:6:4 of N:P2O5:K2O:MgO in 18 l water

- From 8th – 12th week: 90 g 15:15:6:4 of N:P2O5:K2O:MgO in 18 l water

If you do not have enough money or time, apply 5 g of the mixture 50% urea + 25% Kcl + 25% Kies per seedling once a month during the first 3 months.

Main nursery

Two types of fertilisers are recommended: granular compound fertilisers, or the much cheaper straight fertiliser mixtures:

For the granular compound fertiliser, use the following application schedule per seedling:

- 12th – 23 th week: 7 g 15:15:6:4 of N:P2O5:K2O:MgO + 7 g kieserite
- 24th – 33 th week: 15 g 15:15:6:4 of N:P2O5:K2O:MgO + 15 g kieserite
- 34th – 60 th week: 30 g 12:12:17:2 of N:P2O5:K2O:MgO + 30 g kieserite

You may need to adjust this schedule depending on soil type and other conditions;

If you do not have enough money or time, apply, 8 g of the mixture 50% urea + 25% Kcl + 25% Kies could be applied per seedling once a month during the 8 months that the seedlings remain in the main nursery.

Land preparation

Importance

Oil palm is plant that needs a lot of water and good soil. All land preparation activities should help to maintain soil moisture and improve soil fertility. It may take between 12-14 months to start an oil palm plantation. The initial steps involve obtaining land, ordering germinated seed, preparing the land and field planting.

Farmer practice

Most small-scale oil palm farmers use land preparation methods that are not efficient for conserving soil moisture. These methods result in:

- Poor drainage in flat areas, leading to flooding during the rainy season
- No terracing, platform construction or placement of pruned fronds in hilly areas, leading to soil erosion and fertiliser run-off
- Absence of cover crops, leading to surface run-off of water.

Best practices

- Choose the best site for your oil palm plantation. Avoid unproductive areas such as swampy, hilly, stony areas. The proposed site should be near a road, with gently undulating or flat terrain (slope should be less than 25°), and deep soil. Avoid areas with a lot of stones or lateratic soils.
- Make provision for roads and drains in the farm to make transportation of fresh fruit bunches easier. To capture maximum benefit from light, use the equilateral triangle design of 9m x 9m x 9m for planting. The oil palm lining rows should preferably follow a north-south direction, while roads should be exposed to morning and afternoon light (east-west directions). The land should be divided into blocks. In hilly areas (more than 10%) palm lines should be perpendicular to the slope.
- A cover crop should be planted as soon as you complete the stacking of all debris to prevent erosion and to help recycling of nutrients. *Pueraria javanica* and *Mucuna bracteata* are recommended but it is also possible to use empty fruit bunches when available.
- A 9 m-equilateral triangle is commonly used to spacing oil palm plantings. Adjacent rows are spaced 7.80m from each other, and trees are 9 m distant in the row. This design gives 143 trees per ha.

Planting oil palm in the field

Importance

Planting density is an important factor that influences oil palm yield. When oil palms are planted too close together, they compete for nutrients and produce less. As oil palms require a lot of sunlight, the planting arrangement is important.

A good planting arrangement allows farmers to intercrop oil palm with other crops which can increase farmers' income and food security.

Farmer practice

Small farmers usually plant at less than 9 m between palm trees. This spacing is too wide and results in a rectangular arrangement.

Many smallholders intercrop young oil palms with annual or perennial food or cash crops either to reduce the amount of weeds or to make use of the empty space before the farm gets into production. If not properly managed, intercropping could lead to lower oil palm yields.

Best practices

Sole planting

The most common design is a 9 meter equilateral triangle. Adjacent rows are spaced 7.80m from each other, and trees are 9 meters in distant in the row. With this design, you can plant 143 trees per hectare.

Plant trees in holes larger than the dimension of bags.

Avoid high planting density as this may cause competition for light and nutrients. Avoid wide planting density as this exposes the soil to direct sunlight and erosion.

Protect the young plants against damage using wire nets, small bamboo sticks fences, vehicle tires or other materials.

Intercropping

Crop integration is best at the immature phase of oil palm plantation (first 3-4 years after planting).

Plant seasonal or short-term crops (such as maize, groundnuts, etc.) in the inter row areas of immature oil palms. Do not intercrop oil palm with tuber crops such as cassava because these crops use up the nitrogen reserves in the soil.

To capture maximum benefit from light and land resources, plant oil palm in a triangular arrangement and ensure that the oil palm lining rows follows a north-south direction.

Plant trees in holes larger than bags dimension on the rows staked before and protect plants using wire nets, small bamboo sticks fences, vehicle tires or other materials.

Soil fertility management

Importance

Because oil palms require good soil fertility, proper soil fertility management practices are important for sustainable oil palm production. This is because cropping removes considerable amounts of nutrients from the soil which must be replaced and applied nutrients may be lost through soil erosion or leaching.

Farmer practice

Smallholders apply little to no mineral fertiliser or mulch.

Best practices

Soil fertility can be improved through non-chemical or chemical methods.

Non chemical methods: Organic manuring and mulching with empty fruit bunches and crop residues from pruning can improve soil fertility. The disadvantage of these practices is that they require large quantities to be efficiency (e.g. 40 tons/ha of bunches for immature plantations, and 80 tons/ha for mature plantations, with bunches spread in the interlines).

Chemical fertilisers: Two types of fertilisers can be use: single or mixture fertilisers. Single fertilisers recommended for oil palm include: Nitrogen (urea), Phosphate (simple or triple Super Phosphate), Potassium (Muriate of Potassium) and Magnesium (Kieserite, Dolomite). These fertilisers can be applied separately or mixed according to specific ratios to suit a particular nutrient combination (ask an extension agent for more information).The rate for fertiliser application for oil palm will depend on the characteristics and soil properties of the site where it will be applied.

Frequency of fertiliser application

Apply fertilisers two times a year where there are two rainy seasons (in April and in September-October); in areas with one rainy season apply at the beginning and at the end of the rains.

Method of fertiliser application

The mode of fertiliser application depends on type of fertiliser, age of the palm, rate of application and solubility. For nitrogen for instance, during the early years (3-4 yrs), apply the fertiliser in the weeded circle where the feeding roots are most dense. In plants more than 4 years of age, if the farm was intercropping with cereals and tubers during the early stage, apply N fertiliser in the avenues.

Fertilisers other than nitrogen should be applied to older palms (above 4 years) based on leaf symptoms, as described in the table below.

Leaf symptoms of nutrient deficiencies in oil palm

Deficient nutrient	**Leaf symptom**
Nitrogen	Pale-yellow leaves
Phosphorus	No easily recognizable symptoms but plants may be stunted with short fronds and the trunk may have a pronounced pyramid shape.
Potassium	Orange spotting, yellowing on the mid-crown Diffused or mid-crown yellowing: this may
Magnesium	Absence of chlorosis on sections of pinnae shaded from direct sunlight SIMPLE ENGLISH Olive-green to reddish patches on the end of the older frond pinnae, particularly those exposed to sunlight

Managing weeds

Importance

Weeds need to be managed in oil palm plantations to prevent them from competing with palms for nutrients. If not controlled, they can cause 6-20% yield losses.

Types of weeds

There are five main types of weed in oil palm plantations:

- grasses
- sedges and broadleaves
- ferns and brackens
- epiphytes
- volunteer oil palm seedlings

Farmer practice

Not many farmers weed more than twice a year, mainly using manual labour.

Best practices

You can remove or control weed through various methods including hand weeding, mulching, planting leguminous cover crops and using herbicides.

Manual weeding: Weed with a machete 3-4 times a year for immature palms and 2 times for mature palms. Do circle weeding (clearing of rings) with a machete 5-6 times a year for immature palms and 3-4 times a year for mature palms.

Mulching: Mulch with layers of empty fruit bunches during the first 2 years of immature growth. In mature palms, place cut fronds in the inter rows.

Leguminous cover crops: Plant cover crops such as *Pueraria javanica* and *Mucuna* species in the immature phase of oil palm cultivation.

Herbicides: It is important to use the right herbicide to avoid affecting the palms. The table below gives recommended application rates for herbicides. Round Up (Glyphosate) and Gramoxome (paraquat) are commonly used in oil palm plantations. In the 3-year immature phase, you may need to apply up to 3 rounds of herbicides. If you plant a cover crop, use herbicides only for ring weeding. Apply herbicides with a knapsack sprayer.

Herbicide application rates

Herbicides used for weed control in palm circles of early immature palms (1-18 months)*		
Type of weed	**Herbicide**	**Rate (L/ha in 45 l water)**
Broadleaves, grasses	Gramoxone (Paraquat 13.0% w/w); (apply when the leaves are dry).	2 l
Herbicides used for weed control in palm circles of immature palms (18 months and above)*		
Type of weed	**Herbicide**	**Rate (g or L/ha in 45 l water)**
Grasses	Round-up (Glyphosate isopropylamine 41% w/w)	1.5 l
Grasses and broadleaves	Glyphosate isopropylamine (41% w/w) + Metsulfuron-methyl (20% w/w)	1.5 l + 75 g
Herbicides recommended for use in oil palm nursery		
Type of weed	**Herbicide**	**Rate (g or L/ha in 45 l water)**
Grass weeds	Glyphosate isopropylamine (41% w/w). NB: No watering after spraying for one day; spray drifts can damage spears and new fronds.	1.5 l
Broadleaves or mixed weeds	Gramoxone (13.0% w/w)	2 l
Herbicides mixtures for general weed control for circle and harvesting path in mature palms		
Type of weed	**Herbicide**	**Rate (g or L/ha in 45 l water)**
General weeds	Paraquat (13.0% w/w) + 2,4-D amine	2.08 l + 0.7 l
Grasses and broadleaves	Glyphosate isopropylamine (41% w/w) + Metsulfuron-methyl (20% w/w)	1.5 l + 5 g
	Glyphosate isopropylamine (41% w/w) + dicamba dimethylamine (48% w/w)	1.5 l + 0.6 l
	Paraquat (13.0% w/w) + Metsulfuron-methyl (20% w/w)	2 l + 75 g
	Paraquat (13.0% w/w) + dicamba dimethylamine (48% w/w)	2 l + 0.6 l

* Avoid spraying drifts when spraying a contact herbicide.

Fusarium wilt

Importance

Fusarium or vascular wilt is the most damaging disease of oil palm in West and Central Africa (Renard 1976; Turner 1981). It is caused by a soil-borne fungus, *Fusarium oxysporum* f. sp.*elaeidis*, which enters the plant through the roots to initiate infection.

Yield losses due to vascular wilt are estimated at 25-50% or more.

Spread

Fusarium wilt spreads by transporting planting material from *Fusarium* wilted areas to non infected areas and using soil or cover crop (*Pueraria javanica*) harvested from *Fusarium* wilted areas.

Symptoms

Nursery/pre-nursery

Fusarium wilt does not naturally occur in the pre-nursery or nursery. When the disease occurs in the nursery, seedlings do not grow well and develop short and narrow inner leaves. This gives the seedlings a flat-topped appearance, sometimes with a depressed centre.

Mature plant

The disease may exhibit either chronic or acute symptoms as described below. In both chronic and acute forms of the disease, cross-sections of affected fronds and trunks reveal the presence of brown fibres (vascular strand discolouration).

***Fusarium* wilt symptoms in oil palm**

Chronic symptoms	**Acute symptoms**
The palm develops slowly and may take a long time to die	The first frond affected by the disease is towards the centre of the crown. This is followed by the death of the outer fronds and surrounding fronds
Affected fronds are mostly in the crown; other fronds gradually wilt and eventually turn brown and dry up	The plant dies, usually 2-3 months after the first symptoms appear on the leaves
Dead fronds break near the base, forming a skirt like shape surrounding the palm	
Growing fronds become smaller, less than half their normal size;	
The trunk or stem tapers towards the crown and starts to look like a pencil tip	
Symptoms may continue for up to 15 years before the whole crown dies and falls off	

Control measures

You can control the disease by:

- Planting disease tolerant planting materials
- Removing palms infected by the chronic form in the first generation planting of oil palm
- When replanting, avoiding planting at the exact location where infected trees grew (e.g. planting the young palms in the interrow)
- Planting *Brachiara*, instead of *Pueraria* or *Centrosema* as cover crop
- Applying potassium

Oil palm leaf miner (Coelaenomenodera minuta)

Importance

The orange-yellow beetle (*Coelaenomenodera minuta)* is the most serious leaf miner affecting palms in Africa. It attacks the leaves of the oil palm. When attacks are severe, 90% of the leaves on a palm tree may be lost in less than a year. The yields of an affected tree decrease by about half in two years.

Damage

The leaf miner is harmful both at the larva and adult stages but the larvae causes the most damage. While a single larva only causes damage in a small area (3-4 cm^2), during swarming several thousands of larvae can be found on one leaf which results in the destruction of the frond.

The upper side of the leaf becomes swollen as a result of tunneling by larvae. Tunnels can also be observed on the under side of the leaves as a result of feeding by adults. Damage symptoms first appear on the lower leaves then move to the crown.

Control measures

Carry out routine checks every two months on your oil palm plantation to assess the number of living adults, larvae, and pupae (see record sheet on p xx). The procedure is as follows:

- Randomly select 30 to 40 trees per area with 143 trees. Carry out counts on 2 to 4 leaves
- Examine the underside of the leaves and count living adults
- Next turn the frond over, open the burrows and count the number of small larvae, large larvae, pupae, and adults inside
- Calculate the average number of large and small larvae on your farm by dividing the number of larvae by the number of trees inspected
- If the average number of larvae is less than 10, continue to check your farm every two months
- If you find an average of 10 to 40 larvae, inspect your farm once a month
- If you find an average of 40-99 larvae, inspect your farm twice a month
- If you find an average of 100 or more and you notice serious damage on lower leaves, use an insecticide

Guidelines for controlling the oil palm beetle based on farm inspection

Average number of larvae counted	**Action to be taken**
10 or less	Inspect your farm every two months
10 - 40	Inspect your farm once a month
40 - 99	Inspect your farm twice a month NOTE: Inspect 15-20 trees per hectare in this case
100 or more	Spray with a contact insecticide

Oil palm brown-black stem beetle (Rhynchophorus phoenicis)

Importance

The brown-black weevil attacks the stem and growing point of young oil palms.
The pest is most harmful in the larva form. Severe attacks can kill young palms (3 years old or less).

Damage and symptoms

The seriousness of the damage depends on the site where the larva burrows. When the larva drills into tissue close to the growing point, the latter can be injured and may result in the death of the tree. When the larva attacks the crown or the root bulb of a young palm, it causes yellowing of the leaves.

Attacks on the stem are less frequent and usually less serious. When the larva burrows into the plant, it throws out plant debris which you can often see. Sometimes there may be a smell of rot.

Farmer practice

Some farmers extract the larvae with a hook.

Control measures

- To prevent beetle attacks, avoid making deep wounds on the tree as these become a good site for the insect to lay its eggs. These wounds can be the result of: rodents eating into the bottoms of young palms, the rhinoceros beetle on oil palm (*Oryctes*) attacking the spear.

- Extract larvae with a hook. The frequency of this activity depends on insect population level

- Fell and destroy dead trees.

The oil palm blast vector (Recilia mica)

Importance

The oil palm blast vector is a leaf hopping insect that has mottled spots on the wings. It spreads blast disease in oil palm which occurs mainly in nurseries, but occasionally it appears after field planting. The oil palm blast vector attacks young plants and is harmful both at the larva and adult stages. In the most severe attacks, more than 50% of plants can be destroyed.

Damage and symptoms

During the day the oil palm blast vector is often found on the ground or on the undersides of the oldest leaves, which makes it very difficult to see. At night, this insect is usually found on the tenderest tissues of the plant, around the young but still folded leaves.

The main symptom of blast disease is the quick withering of the plant. The first symptoms appear at the base of the spear, which decays and can then be pulled away easily, giving off a strong odor of rot. The leaves dry up from the base upwards and the root system is soon completely destroyed.

Blast does not always kill oil palm plants. In a few cases the spear grows again and the plant grows new roots. However in such cases the plants will always be stunted and should be eliminated.

Farmer practice

Some farmers remove attacked plants from the nursery.

Control measures

Always ensure that the nursery and surrounding areas are clean and well weeded because the oil palm blast vector generally lives in grass.

Planting a leguminous cover crop such as *Pueraria javanica* in the oil palm plantation helps to control the pest.

Treat once a month with Benlate (15 g/15 liter-sprayer/1000 plants) as soon as the plants are transferred from the pre-nursery to the main nursery (i.e. as from 3 months old).

Oil palm black weevil (Temnoschoita quadripustulata)

Importance

The oil palm black weevil attacks the bulb base of the leaves. It causes the most damage at the larva stage. Plants attacked by the black weevil are nearly always killed.

Damage and symptoms

The black weevil causes the most damage to seedlings in nurseries and sometimes to young plants the first year after planting in the field.

A young plant attacked by black weevils shows the following symptoms:

- drying of the spear, which can then be pulled off easily (this symptom can be easily confused with blast attack)
- drying of leaves
- presence of cocoons or tunnels caused by larva
- a smell of rotting

The insect is often present in great number during the main oil palm harvesting period. Adults feed and lay eggs on wounds caused by harvesting or pruning. However, attacks on mature trees have no effect on tree health.

Farmer practice

Some farmers eliminate attacked plants from the nursery.

Control measures

- Set up your nursery far from oil palm and banana plantations as the black weevil breeds in these locations.
- Inspect your nursery weekly to detect plants attacked by the black weevils. Immediately remove and destroy attacked plants.
- Avoid wounding plants in the nursery as the weevil feeds and lays eggs on wounds.
- If the nursery is attacked, treat the plants once a month with Decis (25 ml/15 l knap-sack sprayer/1000 plants). In cases of severe attack, treat twice a month.

Pruning

Importance

Pruning an oil palm consists of removing dead and unnecessary leaves and plants to make harvesting easier. Pruning removes the following:

- Dead leaves
- All leaves below the second leaves that support the oldest bunches (ripening or not) from the base of the canopy by cutting the petiole close to the trunk
- Epiphytes and parasitic plants (such as ferns) from the crown and above 1 m from the ground on the trunk to just below the crown

Pruning is important because it:

- Makes if easier to see ripe bunches
- Allows detached fruits from ripe bunches to fall down and indicate the present of a ripe bunch
- Reduces the number of leaves that have to be cut when harvesting
- Reduces the loss of detached fruits that get stuck between the weeds in the crown of leaves or along the trunk
- Improves air flow thereby increasing the spread of pollen which contributes to increasing the number of fruits on the bunches

Farmer practice

Farmers often do not prune or prune incorrectly. Farmers often cut the petioles very close to the trunk and accidentally wound it, creating a breeding ground for pests. Some farmers climb tall trees to prune, a dangerous practice that may result in injury to the farmer. Other farmers remove too many leaves which results in reduced photosynthesis and lower yields. A common practice which should be discouraged as much as possible is using harvested palm branches for other purposes such as thatching houses.

Best practices

- Prune once a year between July to October when there are few bunches on the trees
- Avoid taking pruned branches off the farm as these branches are a source of nutrients for oil palm and when kept on farm reduce inorganic fertilizer requirements

Trees less than 5 years

On young palms (below five years), pruning consists of removing epiphytes and parasitic plants (such as ferns) on the trunk and in the crown. Take care not to cut the leaves of young palms as they contribute to the transversal growth of the trunk which anchors the plant in the soil and prevents it from falling over during storms.

Trees more than 5 years

- For trees less than 9 years, use a machete for pruning.

- For tall trees (trees more than 9 years) attach a harvesting knife to a pole for pruning. It is important to make sure that the knife if tightly and properly fixed to the pole. If the knife is not properly fixed on to the pole, the person pruning may be injured if the knife falls off the pole or the knife may get stuck in the crown.

- Remove all dead leaves, leaves below the second leaves that support the oldest bunches whether they are ripe or unripe

- Maintain about 48 fully opened leaves on palms not bearing bunches

- Where there a sloping areas in the farm, arrange the cut leaves in the wind row or in the inter row but out of the circles to reduce soil erosion and fertilizer run off

Harvesting oil palm bunches

Importance

Oil palm is cultivated for its fruit bunches. The fruits contain palm oil in the mesocarp and the kernel. The quantity of oil obtained depends on the type and number of bunches and processing efficiency.

Only ripe bunches are good for harvesting and milling because they have maximum oil content. It is therefore important to know when bunches are ripe and the right time for harvest.

Farmer practice

Many farmers do not harvest first year bunch production

Many farmers harvest bunches when they are overripe; this reduces the time needed for the fruits to detach from the bunch

Most farmers supplying palm oil mills usually harvest bunches at early stage of maturity; this to avoid loose of fruits and thus gain in bunch weight.

Some farmers continue to climb tall palm trees to harvest fruit bunches, a dangerous practice.

Best practices

Identifying ripe bunches

- Bunch ripeness affects cost, oil quantity and quality. When a bunch is ripe, the fruit colour changes from black to orange. When ripe 5-15 fruits fall from the bunch by themselves.

- When pruning and weeding your farm, look out for ripe bunches in the crown of tall palms and fruits on the ground.

Harvesting

- Harvest trees every 10 days (3 times per month)

- In 3-4 years old trees, only cut the fruit bunches; avoid cutting the palm fronds. In trees 5 years and older, cut palm fronds and fruit bunches

- Collect bunches as well as loose fruits that have fallen under the trees.

- For you take bunches to a mill, transport them there on the day you harvest to avoid drying of bunches and fruits and weight lost.

- Cut fronds 15-20 cm from the base to increase the productivity of the tree.

Harvesting tools

- Use a chisel on a short handle for 3-4 years old palms
- Use a sharp cutlass for 5-7 years old palms
- Use a hooked knife attached at the end of a long bamboo, or fixed to an aluminum pole for tall palms (> 8 years old).

Part II: Training exercises

Exercise 1: Introduction to the farmer learning group (FLG)

The FLG can only become a success with active participation from the farmers. For most of the farmers the FLG approach is new and they are not used to the kind of learning methods used. It is important for the successful development of the group that the farmers know what they can expect from the FLG and what is expected from them during the FLG.

Objectives

- To enable participants to fully understand the concept of FLG
- To allow participants and the facilitator to discuss their expectations
- To allow participants and the facilitator to develop "house" rules

Time needed

1 hour

Materials

- Flip chart paper and stand
- Markers

Procedure

Present the objectives and approach of the FLG and what the participants can expect to learn.

Main points to mention:

- ✓ FLGs provides training based on field exercises
- ✓ Adults learn best by doing rather than talking
- ✓ In the FLG we work in groups
- ✓ Every participant must participate actively by sharing his/her experiences, thinking about their past experiences and drawing lessons from them
- ✓ Every participant must share the new knowledge learned with others
- ✓ Maximum number of sessions

Facilitate a discussion about what is expected of participants and of the facilitator. Write up agreed points on a flip chart. This provides an opportunity for the facilitator to respond to those expectations that are not likely to be met.

Facilitate a discussion about the types of “rules” needed for the FLG. Develop “rules” regarding the following: arrangements for providing food/drink, late arrival of participants, missing a certain number of sessions, sharing knowledge with other farmers (you may even ask participants to sign a “sharing contract” and any other issues mentioned by participants.

Guide questions for discussion

1. What is the role of participants in FLGs in your opinion?

2. What is the role of the facilitator in the FLG in your opinion?

3. What can we agree on about the role of participants and the facilitator?

4. What rules do we need to make sure our group works well?

Exercise 2: Oil palm cropping calendar

A cropping calendar is important to help farmers know the appropriate time for carrying out oil palm cropping activities. This exercise also allows the facilitator to develop the FLG training schedule with participants.

Learning objectives

- To improve farmers' awareness of the correct time for carrying out the major oil palm cropping activities
- To develop the FLG training schedule with participants

Materials

- Flip chart paper and stand
- Markers
- A calendar

Procedure

A cropping calendar is a representation of all oil palm production tasks performed at three key stages: pre-nursery/nursery, immature and mature. It is depicted as a timeline (X-axis) divided into monthly periods, with drawings of crop stages at the top of the matrix. Tasks are listed along the Y-axis and the time period these are applied are listed along the X-axis.

Ask participants to list all activities done in oil production at the pre-nursery/nursery, immature and mature stages. Go through the entire oil palm production cycle, including site selection, pre-nursery/nursery, land preparation, planting, farm management, applying fertiliser and harvesting. Draw the calendar and have participants fill it out in as much detail as possible. Where women and children are involved in oil palm production, one variation of the cropping calendar is to indicate what work is done by men, women and children. This can be done using different color markers.

Example of an oil palm cropping calendar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Pre-nursery												
Transfer of seedlings to main nursery												
Main nursery												
Land clearing												
Felling, cutting and clearing of trees												
Burning of farm												
Plant food crops and/or leguminous cover crops												
Staking, lining and planting												
Weeding*												
Pruning*												
Harvesting**												

* = As frequently as needed in mature plantations.
** = 2-3 rounds every month

Preparing a training schedule

After completing the cropping calendar, inform participants of all training topics/exercises to be covered. List the topics on flip chart paper. Discuss when each topic will be covered based on the cropping calendar and prepare a second calendar like the one below, with the input of the participants, indicating topics by month.

Training schedule

Training topic/exercise	**Month**

Exercise 3: Ballot box

This exercise evaluates participants' knowledge at the start and end of the training, which enables facilitators to assess the impact of training. It can be adapted for illiterate participants by having literate participants or non-participants read the questions out loud.

Objective

To obtain information on FLG participants' level of knowledge before and after training

Materials

- "Ballot boxes"--boards on which are mounted a question and 3 answers with 3 compartments in which participants can cast their "votes"
- 2 m poles to form stations on which the ballot boxes are mounted
- Oil palm farm
- Vials, alcohol, live and dead pest specimens
- Materials with symptoms
- Plastic bags for collecting specimens
- Whistle
- Strings of ballots for each participant indicating the participant's number (see example for participant # 1 in the drawing below). There should be as many ballots per participant as there are questions. For example, if there are 25 questions, each participant should have 25 ballots.
- String of ballots

1	1	1	1	1	1	1	1	1	1

Procedure

A. Preparing questions and stations

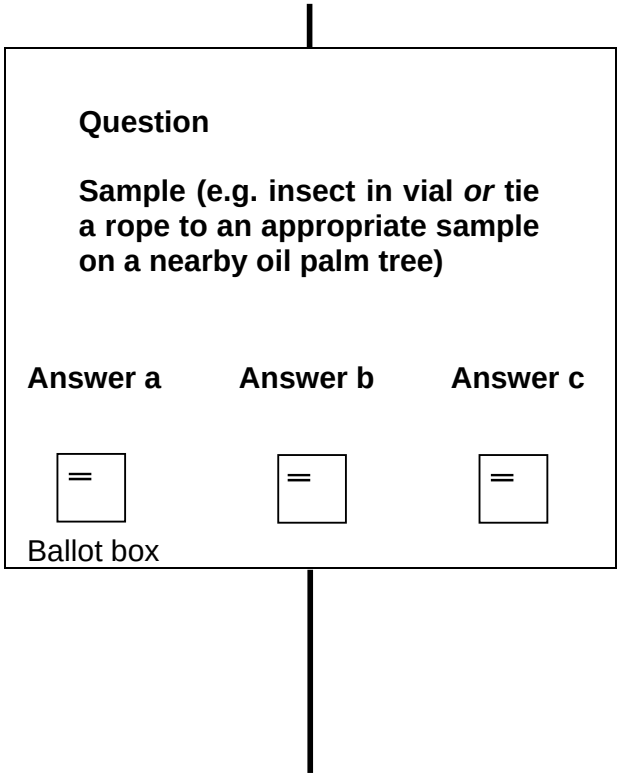
Facilitators (in small groups or altogether) should prepare questions with 3 multiple choice answers each that will gauge the knowledge level of participants. The categories and questions must be based on the prepared training curriculum. Categories of questions that may be considered include:

o Recognising pests/disease

- Disease/pest management
- Pre-nursery and nursery practices
- Management practices
- Harvesting practices

Examples of questions are attached. Prepare as many questions as there are participants. For example, if there are 25 participants, prepare 25 questions.

Collect samples and prepare as many stations as there are participants, following the below design. The ballot boxes are small compartments that can hold the ballots, e.g. carton paper envelopes or cigarette boxes. To avoid cheating, consider putting dummy ballots into each ballot box. Tie each ballot box to a pole ('station') and post each ballot box station in the cocoa farm in a large circle, with at least 1m between stations.



B. Implementation

Give each participant a number and record each participant's number and name somewhere for future use. Give each participant strings of paper ballots with their number on each ballot. Each participant should have enough ballots to answer all questions, using one ballot per question.

Explain to participants that they should cast a "vote" in the ballot box corresponding to the answer they want to give. To cast a "vote", participants should tear off a ballot from the string they have. Explain that the whistle will be blown to indicate when participants

have to move to the next station to answer the next question. Participants should move in a clock-wise direction around the circle.

Invite participants to take one station each. Blow the whistle and keep time to 1 or 2 minutes per station. Continue the exercise until all participants have answered each question.

There are several ways to help illiterate participants do the ballot box exercise. The easiest way is to invite a few literate non-FLG participants to help illiterate participants by reading the questions and answer choices to them.

C. Analysis and use of results

Once participants have completed the exercise, collect all ballot boxes and start counting participants scores. Give 1 score for each correctly answered question per participant. Present the results in a list that indicates participants' numbers rather than names to avoid embarrassment.

Example of scoring table (underlined letters are correct answers):

Participant #	**Q. 1 (b)**	**Q. 2 (b)**	**Q. 3 (c)**	**Q. 4 (a)**	**Q. 5 (c)**	**…**	**# correct answers**	**% correct answers = score**
1	a	B	C	b	B	…	…	…
2	c	B	A	c	B	…	…	…
3	b	B	C	a	B	…	…	…

After the entry test, don't go through the correct answers with participants, as a similar test will follow at the end of the FLG. Ask participants similar questions during the exit test to determine whether the FLG training has improved their knowledge. At the end of the FLG training, present both entry and exit knowledge test score (see form), showing the change in score.

The entry test results will give facilitators a clear idea in which categories training is mostly needed. At the end of the training, the entry and exit test results will be compared and both participants and facilitators can see how much the knowledge of the participants has been improved, and therefore, how effective the training has been. The percent of change in score can be used to decide which participants should receive certificates.

Sample ballot box questions: (correct answers are indicated in bold)

Topic	Question	Proposed Answers
Pre nursery and nursery	Which type of area is best for setting up a nursery?	a. A flat field b. A steep field **c. Gently sloppy field**
	What can be done to have good drainage in the nursery site?	a. By completely leveling field **b. Choosing gently slopping field** c. Using a sloppy field
	Why is it important to have shade in the nursery?	**a. To reduce the incidence of blast disease** b. To reduce heavy sunshine c. To control the temperature
	How can you protect the nursery from stray animals?	a. Employ a guard b. Set traps **c. Construct a fence round the nursery**
	Why should polybags be filled to 2 cm below the brim?	**a. To allow space for water, fertilisers and pesticides** b. To allow space for water c. To fight against pests
	What are the two growing parts of the oil palm seed?	**a. The shoot and the radicle** b. The root and shoot c. The root and leave
	Why should fertiliser used in the pre-nursery be dissolved in water?	**a. For quick absorption** b. To avoid burning the plants c. Reduce water deficit
	Why should seedlings be watered immediately after fertilisation?	a. To absorb water deficit b. To dissolve the fertiliser **c. To avoid burning the plants**
	Why should fertiliser be applied away from the base of the seedlings?	a. For better absorption **b. To avoid burning the plants** c. To be better exposed
	Why is it important to select the right type of fertiliser and apply it correctly?	**a. To produce healthy seedlings** b. To avoid burning the seedlings c. To make the seedlings grow faster
	Why should large polybags be used for transplanting from the pre-nursery?	a. To increase the quantity of top soil b. To make the seedlings grow faster **c. To allow enough space for the roots to grow**

Topic	Question	Proposed Answers
Planting	What is the best time to plant oil palms?	a. End of dry season **b. When the rains have started (May-Aug)** c. End of rainy season
	Why should seedling be removed from the polybags before planting?	**a. To ease growth of plant** b. To prevent diseases c. To trim the roots
	Why is it important to look at the dimension of the polybag before holing?	**a. To make sure the dimension of the hole is large enough** b. To ease planting c. To prevent diseases
	Why is it important to protect the young plant?	a. To grow in secured conditions **b. To prevent damage from animals** c. To prevent diseases
Maintenance	What is the best way to weed an immature plantations	**a. Ring weeding around the plants** b. Slash inter rows when weedy c. Spray plants with herbicides
	What is the best way to weed mature plantations	a. Ring weeding around the plants **b. Slash of inter rows when weedy** c. Spray plants with herbicides
	When is it most appropriate to use manual weeding?	a. When herbicides are expensive **b. When Labour is readily available** c. When in a haste to weed
	Why are selective herbicides used?	a. **To kill specific species of weed** a. To kill all the weeds c. To destroy affected plants
	What is a broad-spectrum herbicide?	a. Type of herbicide that kills specific species of weed **a. Type of herbicide that kills all weed species** c. Type of herbicides that destroys both weeds and pests
	Why do legumes make a good cover crop?	**a. They fix nitrogen in the soil** b. They are easy to obtain c. They grow rapidly
	When is the best time to plant the leguminous cover crops in an oil palm plantation?	a. At the end of the rainy season **b. During the rainy season after weeding** c. Any time
	When is the best time to apply fertilisers to an established oil palm plantation?	a. End of dry season b. When rainy season is established (May-Aug) c. **Beginning and towards the end of rainy season**
	What is the best method to use in the application of fertilisers in immature plantations	**a. Broadcasting in the clean rings around plants** b. Placing close to the base c. In the inter rows

Topic	Question	Proposed Answers
Recognising diseases	What is this symptom caused by? (sample from a mature tree affected by Fusarium wilt)	**a. A fungus** b. A bacteria c. An insect
	How can this disease be prevented?	**a. Planting varieties resistant to fusarium wilt** b. By treating planting before planting c. By off rooting affected plants
	How can the disease be treated?	**a. Destroy affected plants** b. Treat with fungus c. Treat with ash
	What is this symptom caused by? (show sample of a seedling affected by Fusarium wilt)	**a. A fungus** b. A bacteria c. An insect
	How can this disease be treated?	a. Treat with a pesticide b. Treat with a fungicide **c. Remove and destroy affected seedlings**
	What is responsible for this symptom? (show sample of a seedling affected by nursery blast)	a. A fungus b. A bacteria **c. An insect**
	How can it be treated?	a. Treat with a pesticide b. Treat with a fungicide **c. Construct a shade over the nursery**
Recognising Pests	What kind of damage does this insect cause in oil palm plantations? (show vial with oil palm leaf miner in alcohol)	**a. Kills insects that are harmful to oil palms** b. Damages oil palm trees c. Is not harmful
	Which plant part does this insect (oil palm leaf miner) attack?	a. Roots **b. Leaf** **c.** Stem
	What are the symptoms of attack by this beetle?	**a. Debris from plant stem** b. Holes in leaves c. Destroyed fruits

Topic	Question	Proposed Answers
Harvesting	What are some advantages to using a chisel for harvesting in young palms?	a. Prevents harboring of pest and diseases **b. To avoid cutting the leaves under bunch** c.
	How can you tell when an oil palm bunch is ready for harvesting?	a. When it is quite ripe b. When the leaf dries out **c. When 5 to 15 fruits fall off from the bunch**
	Why cut fronds or the branches 15 to 20 cm during harvesting?	**a. To avoid wounding the trunk** b. To enable climbing c. To absorb remaining nutrients
	Why avoid cutting leaves from a four years old palm tree when harvesting ripe bunches?	a. May cause diseases **b. Will reduce transversal growth** c. Will reduce shade
	What should a farmer do when he experiences declining oil palm yields over several years?	a. Abandon the farm b. Add quantity of fertiliser **c. Replant with young palms in the inter row**

Results of entry and exit ballot box test

ID number	Entry test Question:											Exit test Question:											Change in score (%)
	1	2	3	4	5	6	7	8	9	10	**Score**	1	2	3	4	5	6	7	8	9	10	**Score**	

Exercise 4: Getting to know each other

To develop a suitable atmosphere for learning, FLG participants need to know details about each other at the start of the training. They also need to identify indicators to help them monitor change related to the application of new practices and knowledge. At the same time, facilitators and FLG program managers need to have detailed information on participants to monitor who they are training.

Learning objectives

- To enable participants to know more about each other
- To allow participants to develop their own indicators for monitoring change related to application of new practices learned from the FLG
- To provide FLG facilitators and program managers with detailed information on participants for monitoring and planning purposes

NOTE: This exercise should be done 3-4 sessions after the start of the training to make sure that it covers all FLG participants. It should be carried out over two to three sessions, allowing a short period for this exercise during each session.

Materials

- Flip chart paper and stand
- List of questions
- Markers
- Tape

Procedure

This exercise involves four steps: 1. getting to know each other, 2. identifying things participants want to look at (monitor) to be able to observe change related to applying the knowledge and skills learned in training, 3. summarizing the results (to be done by the facilitator after the session) and 4. presenting the results of the exercise to the group and discussing them.

Step 1: Getting to know each other

Before the session, prepare a table on flip chart paper (you may need to tape two pieces of paper together) for filling in with the information to be collected. The table should have a row for each participant and a column for each question. At the top of each column,

indicate with one word the type of information to be collected. The table should look like this:

Name	Sex	Village	Married	Age	Schooling	…	…	..	…	…	…

List the questions on a separate sheet of flip chart paper.

The questions for “getting to know each other” are as follows:

	Question	What to write
1.	Name	Name of person
2.	Sex	Male/female
3.	Which village are you from?	Name of village
4.	How old are you?	Age in years
5.	How far have you gone in school?	Did not go to school, Primary, secondary, above secondary
6.	Are you married?	Yes/no
7.	What type of labour do you use on your oil palm plantation?	Household, hired, sharecropper, other (can have more than one answer)
8.	How did you get the land for your oil palm farm?	Own land, inherited, family land, other
9.	Do you own an oil palm mill?	Yes/no
10.	How many kilometers is your oil palm farm from a processing mill?	Number of kilometers
	QUESTIONS 11- ARE ABOUT NON-IMPROVED OIL PALM (NATURAL AND OTHERS)	
11.	How many productive non-improved oil palm trees do you own?	Exact number
12.	What area does your non-improved oil palm plantation cover?	Size in hectares/acres
13.	Every year how many bunches do you harvest from your non-improved oil palm trees?	Exact number

Question	What to write
14. Every year, how many litres (or use traditional measure) of oil do you produce from the bunches harvested from your non-improved oil palm trees	Exact number
QUESTIONS 16-21 ARE ABOUT IMPROVED OIL PALMS 16. How old is your plantation of improved oil palm?	Number of years
17. What is the size of the plantation?	Exact size in hectares or acres
18. What spacing did you use?	Exact measurement in meters or feet
19. Is the oil palm planted alone or with other crops?	Sole cropped, intercropped
20. What thick is the shell of the fruit from the improved palms on your plantation?	Thick shell, thin mesocarp (Dura) Thin shell, thick mesocarp (Tenera) No shell (Pisifera)
21. Where did you get the planting materials?	From a seed production center? From agro-industries? From NGO? From Government agencies? From farmers' groups? From your own field? From unknown source?
22. Do you use fertilisers on your oil palm?	Yes/no

During the session, introduce the exercise and explain the objectives of "getting to know each other" (to allow participants and the facilitator to know more about each other). Calling on each participant in turn, ask each question and fill in the table. Do not insist if participants do not want to answer sensitive questions (for example, age or size of their plantations).

Step 2: Observing change (participatory monitoring)

Once the "getting to know each other" exercise is completed, ask participants to suggest a list of things (indicators) that will tell them whether they have benefited from the training. Indicators should be things that can be observed. **Note that for most indicators, participants will have to observe and draw conclusions based on this monitoring on their own when the training is completed.**

List the indicators on a flip chart. Include the following indicators, if not mentioned:

- Type of nursery (single or double stage)
- Amount of abnormal seedlings removed from the nursery
- Seedlings well-lined in the field
- Number of times you weed (mature and immature farms)

- Number of time you clean circles around palms (mature and immature farms)

- Oil palm yields (bunches harvested, quantity of oil produced)

- Palm oil quality

Mention that to tell whether change has taken place, it is important to compare the situation before and after the training took place. Together with participants, develop questions for each indicator proposed by participants. These questions will be used to measure the situation of each participant before the training. It is important to collect information from the previous year. List the questions on a flip chart.

Include the following questions as well as those developed by participants:

Question	**What to write**
What type of nursery do/did you set up?	One stage, two stage
How many abnormal seedlings do/did you remove from the main nursery?	Exact number
How do/did you line the seedlings in the nursery?	Mostly straight lines Paid no attention to lines
Number of times weeded in a year	Exact number
Number of time you cleared rings in a year	Exact number
Number of bunches harvested	Exact number
Liters of palm oil produced	Exact number
Quality of palm oil produced	Very good, good, fair, poor

Prepare a table on flip chart paper for the new questions and attach it to the “who are we” table. Calling on each participant in turn, ask the questions for observing change and fill in the table.

Step 3: Summarizing results (to be done by the facilitator)

After the session, look at the completed table and copy the information for each participant exactly as you recorded it on the attached participant information summary sheets. These summary sheets should be given to the Master Trainer or supervisor. It is also important to summarize the information for presenting back to the school. You may use the following guideline to summarize the information by counting the numbers for each of the following categories:

Participants

- Number of participants who took part in the exercise:

- Number of men

- Number of women

Villages where participants come from

List names of villages and the number of participants from each village

Age

- Number who are 0-20 years
- Number who are 21 to 40 years
- Number who are 41 to 55 years
- Number who are above 55 years

Education

- Number who never attended school
- Number who attended school to primary level
- Number who attended school to secondary level
- Number who attended school beyond secondary level

Family situation

- Number of married participants
- Number of non-married participants

Labour

- Number using household labour
- Number using hired labour
- Number using sharecroppers
- Number using other type of labour

Land ownership

- Number with own land
- Number with inherited land
- Number with family land

- Number with other type of land ownership system

Own oil palm mill

- Number with oil palm mill
- Number with no oil palm mill

Distance to processing mill

- 5 km
- 6-10 km
- 11+

Number of productive non-improved palms

- 6-220 trees
- 221-435 trees
- 436-1000 trees
- More than 1000 trees

Area of non-improved palms

- 1-5 acres
- 6-10 acres
- 11-25 acres
- 26+ acres

Bunches harvested from non-improved palm per year

- 0-3
- 4-6
- 7+

Liters of oil produced from non-improved palm

- Less than 65 liters
- 65-330 liters
- 331-650 liters
- 651-1000 liters
- More than 1000 liters

Age of improved plantation

- 0-4
- 5-7
- 8-15
- 16+

Size of improved plantation

- 1-5 acres
- 6-10 acres
- 11-25 acres
- 26+ acres

Spacing of improved palms

- Less than 9 m
- 9 m
- More than 9 m

Intercropping

- Number who planted oil palm alone
- Number who planted oil palm with food crops

- Number who planted oil palm with other crops

Varieties

Number who planted each variety:

- Thick shell, thin mesocarp (Dura)
- Thin shell, thick mesocarp (Tenera)
- No shell (Pisifera)

Source of planting materials

- Number who planted volunteer seedlings
- Number who planted materials obtained from another farmer
- Number who planted materials obtained from a certified seed producer

Fertiliser use

- Number who use fertiliser
- Number who don't use fertiliser

Presentation and discussion of results

At the next session, present a short summary of the results to participants (speak for no more than 20 minutes). Keep this summary for your records. Remember to collect background information from participants who join the school late or were not present for the session. You may also need to summarize the results for the FLG program manager. In that case, copy the information you collected on the attached form.

Guide questions for discussion

1. What things do most participants have in common?
2. How might these similarities affect our work in the FLG, in a good or bad way?
3. What are some things that are different among participants?
4. How might these differences affect our work in the FLG, in a good or bad way?

Participant information summary sheet (1) for _____ FLG

Name	**Sex**	**Village**	**Age**	**Educational level**	***Married***	**Labour**	**Land**	**Own mill**	**Distance to mill**

Participant information summary sheet (2) for _____ FLG

Name	No of NI tree	Area of NI palms	Bunches from NI palms	Liters from NI palms	Age of I palms	Size of I palm farm	Spacing	Other crops intercropped	Varieties	Source of planting material	Use of fertiliser

Exercise 5: Recording inputs for improved oil palm production

Learning objective

To develop simple record keeping and accounting skills needed to estimate the annual profitability of a hybrid oil palm enterprise

Timing

The second FLG session and at the end of every session where field operations were undertaken.

Materials

- Markers
- Flip chart
- Input and harvest record forms

A. Procedure

At the start of the training

Before the session, copy the forms below onto flip chart paper. Read the following case study and start a discussion using the guide questions for discussion.

Case study

Farmer A (use local name) produces oil palm using only his hard labour. He learned how to grow oil palm from advice given by other farmers in his village and never applies insecticide or fertilizer to his oil palm plantation. In the same village, farmer B (use local name), who attended a trained course on oil palm, follows all recommended practices by buying seed from a recommended seed supplier, doing a two stage nursery, applying fertilizer to the seedlings, protecting the young plants in the field, planting a cover crop, using the correct spacing, using herbicide and pruning.

Guide questions for discussion

1. Which of these two farmers makes a profit from oil palm? How can you tell?
2. What do you need to know to tell if a business if profitable? Do farmers keep record of this information?

Explain the importance of farmers being able to estimate whether they are producing oil palm profitably. Explain the steps involved in calculating oil palm profitability. The steps are as follows:

- Identify all activities conducted in the production and marketing of the product over a year

- Estimate the amount of labour used for each activity in man days (one man-day = 6 hours)

- Estimating the cost of labour (how much it would cost of hire someone to do the work)

- Estimate the amount and cost of all inputs (fertilizer, insecticide, herbicide, etc.) used during the production period.

- Calculate total profit and then divide by the total area harvested to calculate net return per ha.

It is important to compare the profitability of growing oil palm using recommended practices with farmers' typical practice. There are several ways to estimate input use by untrained farmers. One way is for participants to agree on average input use. Another way is to identify one farmer to represent a "typical" farmer and use information on labour and other inputs from that farmer. Which ever approach is use, estimate input use on a 1 ha (or 1 acre) oil palm plantation.

Ask farmers to identify the main activities they normally carry out in producing oil palm at the establishment and mature farm stages. There are different ways to do this. One way is to take one farmer's farm as an example. For each activity, ask participants to estimate the number of hours it takes to complete the task on a one hectare (acre) farm. Convert the number of hours into man-days (one man-day = 6 hours of work). Ask participants to agree on how much it would cost to hire someone to work for 6 hours a day for each task. Ask participants to indicate the quantity of inputs (fertilizer, insecticide) used in a year.

Main activities normally carried out by farmers

1-Activity	2-Number of times done in one year	3-Hours per activity	4-Total days of labor = (col. 2 x col. 3)/6 h/day))	Labour cost	Quantity of inputs purchased & output sold	Input /output price	Input/ output value
Weeding	3	18	9	1000 Fcfa/d x 9 d= 9,000 F	None	0	0
Pruning	4	12	8	8,000 F	None	0	0
Harvesting	26	12	52	52,000 F	None	0	0
Etc. etc.							
Total Costs				69,000			
Total Sales					2000 kg	200 f/kg	40,000 0
Total profits				-29000			-29000

B. Monitoring inputs on the FLG plots

Explain how information will be collected on labour and input use on the FLG learning plots. Each FLG should appoint one or more time keepers. These people will be responsible for recording how much time the group spends on the various activities. Information on the FLG activities will be collected during the training exercises and from field activities conducted between training sessions. For example, labour data will be collected during the exercise on weeding and on weeding done at any other time during the training period.

At the end of the training, the group will use this information to estimate the amount of labour and other inputs needed for 1 ha of oil palm and make conclusions about the profitability of using the ICM practices compared with their normal practices.

Use the table format provided below to record input information. The tables should be copied on large flip chart paper and filled at the end of each session.

Every session

At the end of the each session, fill in the amount of labour and inputs used during the exercise conducted that session.

Monitoring inputs in oil palm production: establishment

Activities	**Date**	**Labour (man days) for FLG plot**	**Type of input used, name of agrochemical, quantity and cost per unit used on FLG plot**
Building a shelter for the nursery			
Total for nursery shelter			
Sowing germinated seed			
Total for sowing			
Transferring seedlings from pre-nursery to nursery			
Total for transferring seedlings to prenursery			
Applying fertilizer in nursery			
Total for applying fertilizer			
Lining and pegging			
Total for lining and pegging			
Planting			
Protecting young plants			
Weeding a young farm			
Total for weeding young farm			

Monitoring inputs in managing a mature oil palm plantation

Activity	Date	Labour (man days) for FLG plot	Type of input used, name of agrochemical, quantity and cost per unit used on FLG plot
Slashing of inter rows			
Total for slashing interrows			
Cleaning of rings			
Total for clearing rings			
Applying herbicide (or manual weeding)			
Total for applying herbicide or weeding			
Applying chemical fertilizer			
Total for applying fertilizer			
Pruning			
Inspecting farm for leaf miner			
Applying insecticide against leaf miner			
Harvesting			
Total for harvesting			
Transporting bunches to the processing mill?			
Total for transporting bunches			

Bunch harvest information for FLG plot

Date	Number of bunches harvested	Weight of bunches

Exercise 6: Identifying improved planting material

Most oil palm farmers use planting material obtained from doubtful sources only to discover 4-5 years later that the material is not productive. This exercise helps farmers to appreciate that there is no physical difference between improved and poor planting material.

Learning objective

To enable farmers to understand that there is no physical difference between improved and poor planting material

Timing of exercise: Before starting the nursery

Location

Pre-nursery/nursery site

Materials

- Two pre-nursery oil palm seedlings from a certified seed producer
- Two pre-nursery oil palm seedlings from a doubtful source
- Two germinated oil palm seedlings from a certified seed producer
- Two germinated oil palm seedlings from a doubtful source
- Two identical eggs
- Paper for labelling the oil palm seeds

Procedure

- Label the different oil palm seedlings and place them in a row side by side on the ground.
- Place the two eggs side by side on the ground.
- Ask participants to look at the two eggs and to identify physical differences between them.
- Ask participants to observe the pre-nursery oil palm seedlings and say whether the seeds are improved or local palms based on their physical appearance.
- Ask participants to observe the germinated oil palm seedlings and say whether they are improved or local palms based on their physical appearance.
- Discuss the conclusions farmers make using the guide questions.

Guide questions for discussion

1. Is there any difference between these two eggs?

2. What will be the sex, colour of feathers of the chicks?

3. Was there any physical difference between the pre-nursery and nursery seedlings?

4. How can you distinguish between improved oil palm planting material and local planting material at the pre-nursery and nursery seedling stages?

5. Have you ever bought planting material that you thought was improved and it turned out not to be? What happened?

6. What have you learned from this exercise?

Exercise 7: Preparing to start an oil palm nursery

The choice of site and preparations to start an oil palm nursery largely determine the quality and quantity of seedlings that are planted on the field. A two stage nursery is recommended for smallholders because it requires less space and is easier to maintain.

Learning objectives

- Understanding the difference between a single and two stage nursery
- Deciding which type of nursery to establish
- How to select the best site for a nursery
- How to build a shelter and protect the nursery from pests

Timing of exercise

At the beginning of the raining season (April-May)

Location

Pre-nursery/nursery site

A. Deciding what type of nursery to establish

Materials

None

Procedure

A. Discussion

Start a discussion about the advantages and disadvantages of a one stage and a two stage nursery using the guide questions.

Guide questions for discussion

1. What kind of nursery do most oil palm farmers make? Why?
2. What is a one stage nursery? What are the advantages and disadvantages of a one stage nursery?
3. What is a two stage nursery? What are the advantages and disadvantages of this kind of nursery?

B. Nursery site selection

Go with participants to the selected nursery site. Start a discussion about what is the best place for setting up a nursery using the following guide questions

Guide questions for discussion

1. What should you look for when looking for a place to put a nursery?
2. Why should the area have a slight slope?
3. Why is finding a place near a source of water important?
4. Why is the amount of shade important?

C. Building a shelter

Materials

- 4 cutlasses and files/sharpeners
- 4 spades, diggers
- 1 measuring tapes
- 10 stakes (wooden poles, bamboos)
- 2 ropes/twines or nails
- 20 palm fronds

Procedure

Discuss why a shelter is needed for the nursery. Organize participants to build a shelter using the palm fronds and stakes.

Guide questions for discussion

1. Why do you need to have a shelter for oil palm seedlings?
2. What effect will shading have on the seedlings?
3. How can we protect the nursery from stray animals?
4. How many seedlings do you need to plant 1 acre (hectare)?

Exercise 8: Sowing germinated oil palm seed in polybags

Farmers need to know how to correctly sow germinated oil palm seed to ensure that they get healthy seedlings.

Learning objectives

- How to fill polybags with soil
- How to sow germinated oil palm seeds in polybags

Timing of exercise

Start of the rainy season (April-May)

Location

Pre nursery/nursery site

Materials

- 50 nursery plastic bags (35cm x 35cm) (Note: this is for a two stage nursery)
- Enough topsoil for the 50 polybags (collected from the forest or existing oil palm plantation)
- Ropes collected from inner part of palm frond rachis
- 90 germinated oil palm seeds
- 1 watering can

Procedure

Introduce the exercise. Discuss how farmers fill polybags and sow oil palm seeds. Correct farmers' misconceptions.

Using one polybag, demonstrate the following:

o Fill the polybag with top soil

o Water the soil in the bags if it is dry prior to sowing

o Use a stick of about 1.5 cm diameter and 10 cm stick to make a hole in the centre of the soil in the polybag

o Sow the seed with the shoot pointing upwards, and the root downwards in the hole at a depth on depending on the root length

o push the soil from the edges of the hole to cover it

- Water the polybags after sowing

Ask participants to organize themselves into small groups to prepare the poly bags and plant the seeds.

Guide questions for discussions

1. What kind of soil is good for polybags?
2. Why is drainage of the soil important?
3. What can be done to ensure proper drainage?
4. How do most farmers plant germinated oil palm seeds?
5. What are the two growing parts of the seed?
6. How can you tell the difference between these growing parts by looking at them?
7. What will happen if you sow the seed with the growing parts upside down?
8. Why should polybags be filled to 1 cm below the brim?
9. Why should seeds never be sown at more than 1 cm below the soil level
10. What happens when the seeds are sown too shallow or too deep?

Field activity associated with this exercise

Watering and weeding the seedlings regularly

Exercise 9: Transferring seedlings from pre nursery to nursery

Transferring seedlings from the pre nursery to the nursery must be carefully carried out to allow seedlings to recover quickly from transplanting shock. In the case of the one stage polybag nursery, the transfer process consists of repositioning the bags to ensure the appropriate spacing. In the two-stage polybag nursery, the process involves transplanting after positioning the polybags.

Learning objectives

- How to safely transfer seedlings from the pre-nursery to the main nursery
- How to position polybags following the appropriate spacing
- How to transplant seedlings into larger polybags

Timing of exercise

Four months after sowing in the pre-nursery (August-September)

Location

Pre-nursery/nursery site

Materials

- 50 seedlings from pre nursery
- 40 perforated polybags (40 cm x 40 cm; or 35 cm x 35 cm)
- Topsoil
- 5 wooden sticks (70 cm long each)
- 2 watering cans
- 2 locally made Richard planters (galvanised iron cylinder equipped with a handle at the upper edge and sharpened at the lower edge)

Procedures

Explain the purpose of the exercise and start a discussion on how farmers normally position polybags.

Demonstrate the following steps:

- Fill the polybags with top soil
- Use the 70 cm wooden sticks to map out the spacing: equilateral triangle of 70 cm

- Position the 40 cm x 40 cm (or 35 cm x 35 cm) polybags following the mapping;
- Completely fill the polybags with top soil to 2 cm below the brim.
- Use a locally made Richard Planter to make holes in the polybag for transplanting
- Detach the polybag from the prenursery seedling, and place the seedling in the filled polybag

Ask participants working in small groups to transfer the rest of the seedlings. At the end facilitate a discussion using the guide questions.

Guide questions for discussion

1. What type of soil should be used for filling polybags? Why?
2. Why should you use large polybags for transplanting?
3. How do farmers normally position polybags?
4. Why is the spacing of the polybags important?
5. Why do we space polybags at an equilateral triangle of 70 cm?
6. What problems would develop if seedlings are not planted straight?

Exercise 10: Applying fertiliser in an oil palm nursery

As fertilisers are important for the proper growth and development of oil palm seedlings, farmers need to know what types of fertiliser to use, the appropriate application rates and frequency to get goods results.

Learning objectives

- To show farmers what type of fertiliser to apply to oil palm seedlings
- To show farmers the correct fertiliser application rates, frequency of application and method of application

Timing of exercise

Two months after sowing germinated seeds (when two complete leaves have been developed)

After transplanting pre-nursery seedlings in the main nursery

Location

Pre-Nursery/nursery site

Materials

- 20 kg of Urea, 10 kg of KCl, 10 kg of Kieserite
- 90 two-month old pre-nursery seedlings or 50 nursery seedlings
- 1 watering can
- 1 teaspoon (equals 5 grams)
- 2 mineral water bottle tops/caps (or any other available container measuring 5 grams)

Procedure

Start a discussion about the importance of applying diluted fertiliser in the pre-nursery and granules in the main nursery. Discuss which fertilisers are available in the area. Discuss the importance of each type of fertiliser on seedling growth and development.

Demonstrate the following procedure:

1. Application of fertilisers in the pre-nursery

- Dilute 1 teaspoon of Urea + 0.5 tea spoon of KCl and 0.5 spoon of Kieserite in 5 litres of water in a watering can for 500 seedlings. Stir for 5 minutes.

- Water the 90 seedlings with 1.5- 2 litres of the solution
- Pour out the remaining solution. Rinse the watering can 2 times

2. Application of fertilisers in the nursery

- Mix 400 g of Urea, 200 of KCl and 200 g of Kieserite a short time before applying it because Urea easily becomes liquid when it comes into contact with air.
- Measure 1 full water bottle top for each seedling
- Apply the fertiliser to the soil in the polybag at about a 10 cm radius from the base of the seedling
- Avoid touching the leaves with the fertiliser to prevent foliar burns

Guide questions for discussion

1. Do farmers apply fertiliser in the pre-nursery and nursery stages? Why or why not?
2. Why is it important to apply fertiliser in the pre-nursery and nursery?
3. Which types of fertiliser should be applied in oil palm nurseries?
4. How much fertiliser do we need for 500 seedlings (pre-nursery/nursery)?
5. Why should the fertiliser in the pre-nursery be dissolved in water?
6. Why is it important to water the seedlings immediately after applying fertiliser?
7. Why should fertiliser be applied away from the base of the seedlings?
8. What happens if there are no holes in the polybags?

Field activity associated with this exercise

Apply fertiliser once a month during the 3rd and 4th month (pre-nursery stage) and monthly from when the seedlings are transplanted into the main nursery until they are planted in the field at 9 months old

Exercise 11: Selecting normal seedlings from the pre nursery and nursery

Not all seedlings in the pre nursery and nursery are transferable to the nursery or good for planting. Farmers need to know how to recognise abnormal and diseased seedlings that need to be discarded

Learning objective

To show farmers how to differentiate between normal and abnormal seedlings.

Timing of exercise

At the end of the pre-nursery stage (4 months after sowing of germinated seeds)

At the end of the main nursery stage (9 months after transplanting of pre-nursery seedlings in nursery)

Location

Pre-Nursery/nursery site

Materials

Machete

Procedure

Start a discussion about how to distinguish abnormal seedlings at pre-nursery and nursery stages. Go through the nursery and ask participants to identify seedlings which they think are abnormal. Show other abnormal seedlings. Signs of abnormality include the following:

<u>Prenursery</u>

- ✓ Narrow leaf seedlings
- ✓ Crinkled leaf seedlings
- ✓ Twisted leaf seedlings
- ✓ Rolled leaf seedlings
- ✓ Stunted seedlings
- ✓ Seedlings with a dry spear

Nursery

- ✓ Upright or sterile seedlings
- ✓ Flat top seedlings
- ✓ Stunted seedlings
- ✓ Leaflets inserted very close to each other in the long leaf stalk
- ✓ Leaflets too widely spaced from each other in the leaf stalk
- ✓ Small leaves and leaflets
- ✓ Seedlings with white leaflets
- ✓ Dry spear

Working in small groups, ask participants to identify and destroy all abnormal seedlings using a machete.

Guide questions for discussion

1. What do abnormal seedlings look like?
2. Why should such seedlings be discarded?
3. How should you get rid of abnormal seedlings?

Exercise 12: Planting oil palm in the field

Planting oil palm using the correct procedures and at the right density ensures optimum growth and yield. Most farmers either plant at close spacing which may cause competition for light and nutrient or use spacing which is too wide which exposes the soil to direct sunlight and erosion. Some farmers do not know the importance of protecting young plants from animal damage

Learning objective

- To create the awareness of the benefits of planting palms properly and at the recommended spacing
- To train farmers on how to protect young plants from animal damage

Timing of exercise: May-August

Location: Site for newly established plantation

Materials

- 30 pegs of 1.5 meters (about 3 cm diameter)
- 1 rope of 30 m
- 3 ropes of 9 m each
- 2 machetes
- 5 digging chisels
- 1 wire mesh/net
- 20 bamboo sticks
- 1 measuring tape of 20 m
- 4 baskets or head pans
- 4 wheel barrows

Procedure

NOTE: This exercise may be conducted in two sessions

Start a discussion of farmers' planting practices on spacing and planting using the guide questions.

Guide questions for discussion

1. What are the steps in planting oil palm?

2. What is the best time to plant?

3. What spacing do most farmers use for planting oil palm? Why? Is this the recommended spacing?

4. Does this spacing lead to any problems? What problems are associated with close/wide spacing?

5. Why use the 9 m triangular spacing in oil palm?

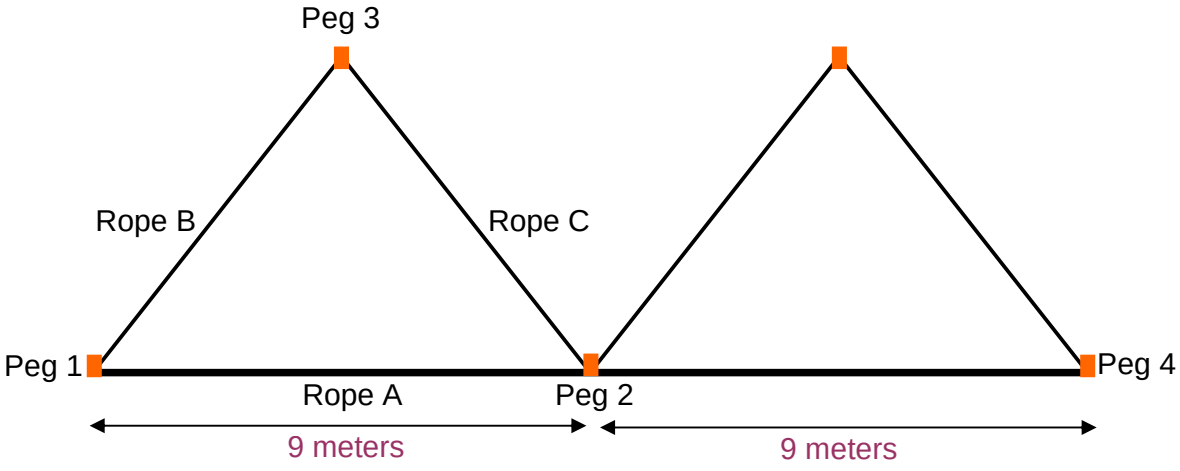
6. Why should the hole be dug according to the sizes of the polybag? ŧDo farmers normally removed the polybags before planting the seedling? Why should you do this?

Introduce the exercise. Demonstrate the following procedures:

A. Pegging

Agree on a reference point in the farm. Have one person stand near the reference point and another person make a line using the 30 m rope to the far end away from the reference point. This line becomes the baseline for pegging. Measure nine meters along the length of the baseline, putting in a peg at each point. Tie a 9 m rope to a peg and stretch it to the second peg along the baseline. Have one person take a 9 meter rope and stretch it from the peg on the right of the baseline. Have a second person take a 9 meter rope and stretch it from the peg on the left of the baseline. Have the two people stretch the rope diagonally until it reaches the middle, forming a triangular shape.

To make a second triangle, put a 4th peg 9 meters along the baseline from peg 2. Tie rope B to peg 4 and move it diagonally to the left. Move rope C, still tied to peg 2 diagonally to the right until it meets rope B. Put in a peg at this point. Continue this process until you have measure all your triangles.



B. Holing and planting

- At the position of each peg dig a hole with dimension slightly bigger than the seedling bag
- After digging the hole, put the removed soil to one side
- Place the whole plant with the polybags in the hole to control the hole depth
- The top of the hole and surface of the soil in the poly bag should be at the same level
- If the hole is too deep, put back a little soil. If it is not deep enough, make the hole deeper.
- Remove the polybag
- Carefully tear the polybag open
- Place the seedling with the ball of soil in the hole
- Fill any space between the ball of soil and the hole with removed soil
- Compact the soil to allow proper establishment
- Ask participants working in small groups to peg, hole and plant the remaining area.

Protecting young plants

Start a discussion about the need to protect young oil palm plants. Discuss different options (wire mesh/net, bamboo etc.) and evaluate each option in terms of the availability of the materials, cost effectiveness etc.

After agreeing on the best material to use, demonstrate how to make a protective ring around the young plants. Have farmers put protective rings around all plants in the newly planted area.

Guide questions for discussion

1. Are young oil palms usually damaged by animals? Which animals attack young oil palm plants?
2. Do farmers protect their young oil palm plants? How do they do this? If not, why don't they?
3. Why is it important to protect the plant?
4. What materials can be used to protect young oil palm plants? What are the advantages and disadvantages of each type of material? What should you consider when selecting protective material? Which material is best for you?
5. When is it safe to remove the protective ring from around young plants?

Exercise 13: Weeding an oil palm plantation

Farmers may not always know the importance of weeding an oil palm plantation or how to weed correctly.

Learning objective

To show the correct way to weed oil palm plantations at different stages

Materials

Machetes

A. Weeding an immature plantation

Timing: Any time weeding is needed

Location: Newly planted farm

Procedure

Start a discussion about weeding an oil palm farm. Review the procedures for hand weeding an immature farm. Discuss the difference between spot and circle weeding.

Demonstrate how to do circling around young trees when weeding.

B. Weeding a mature plantation

Timing: Anytime weeding is needed

Location: Mature plantation

Procedure

Start a discussion about weeding an oil palm farm. Review the procedures for hand weeding a mature farm. Discuss the difference between spot and circle weeding.

Demonstrate the following:

- Slashing of inter rows
- Cleaning of rings

Guide questions for discussion

1. How do farmers weed an immature oil palm farm?
2. Why is it important to keep clean rings around young palms?

3. Do you hire labour for weeding? How much does it cost to weed a 1 acre (hectare) farm?

4. What are some problems with using household or hired labour for weeding?

5. Why clean around the palm trees?

6. What other cultural practice do you think can help keep weeds down?

Field activities associated with this exercise

Weed the plot when necessary

Exercise 14: Intercropping an oil palm plantation

Learning objectives

- To help farmers improve their decision making about what to intercrop with oil palm
- To expose farmers to guidelines for intercropping oil palm with food crops and cover crops

Timing of exercise: At the start of the rainy season

Location: Newly planted farm

Materials

- Flip chart paper and stand
- Markers

Procedure

This exercise requires two sessions

A. Deciding which intercrop is best

Start a discussion on intercropping an oil palm plantation using the guide questions. Ask farmers to identify and discuss several crops that can be intercropped with oil palm. Ask them to develop criteria for evaluation these options. List the points on the flip chart. Evaluate the intercropping options proposed by farmers using their criteria by developing a table like the one below:

Note: do not include cassava or cereals

	Maize	**Xxx**		***Pueraria javanica***
Seed availability				
Shading of oil palm				
Food value				
Rooting systems??				
Weed suppression				
Etc.				

Guide questions for discussion

1. Do most farmers intercrop their oil palm plantations? How is this done and with which crops?

2. What are the advantages of intercropping oil palm? What are some disadvantages?

3. What things are important to consider when selecting an intercrop?

4. What are some possible food crops that grow well with oil palm?

5. What is a cover crop? What are some cover crops that you know?

6. Why are cover crops useful in oil palm plantations?

Draw conclusions about which intercrop the group would like to plant and agree on how to obtain seed. You may choose 1-2 options.

B. Intercropping oil palm

Materials

- Seed of selected crops
- Hoes

Procedure

Introduce the exercise. Demonstrate how and where to plant the crop(s) selected. Ask farmers to continue planting the agreed area.

C. Sowing a cover crop

Timing: At the beginning of the rainy season

Materials

Seed of Peuraria javanica

Procedure

Start a discussion about the advantages of sowing a cover crop. Demonstrate the steps for sowing Peuraria.

Field activity associated with this exercise

Weeding as often as necessary

Exercise 15: Improving soil fertility on oil palm plantations

Soils in oil palm plantations are usually degraded due to poor crop management, leading to low soil fertility. It is important to restore soil fertility to achieve high yield.

Learning objectives

- To explore options for improving soil fertility in oil palm plantations
- To demonstrate the correct way to apply chemical fertilisers to oil palms

Timing of exercise

At the beginning of the rainy season

Location: Mature plantation

Materials

- Flip chart paper and stand
- Markers
- Chemical fertiliser (enough for 1 acre)
- Water
- Bucket

Procedure

Discussion

Discuss the causes, symptoms and outcome of low soil fertility in oil palm plantations. Discuss options for improving soil fertility. List them on the flip chart, making sure to include chemical fertiliser, empty fruit bunches and any other options that farmers mention. List and discuss the requirements for each option in terms of the amount needed for 1 acre/hectare.

List criteria for evaluating each option, for example, cost, labour, availability effectiveness. Using a table, like the one below, evaluate each option as very good, good, not so good, poor. Draw conclusions about the different options.

	Chemical fertiliser	Organic fertiliser	Leguminous cover crop
Cost			
Labour			
Availability			

Guide questions for discussion

1. What are signs of poor soil fertility in oil palm plantations?

2. What causes poor soil fertility?

3. What effect does poor soil fertility have on oil palms?

4. What different methods can farmers use to maintain soil fertility in oil palm plantations?

5. What do we need to consider when deciding how to improve soil fertility?

6. What are the advantages and disadvantages of each method?

7. How often do you need to apply chemical fertilisers?

Applying chemical fertiliser

Show farmers how to apply fertiliser to oil palm. Divide participants into small groups to apply fertiliser to the learning plot.

Field activity associated with this exercise

Apply fertiliser a second time at the beginning of the rainy season and once at the end of the rainy season

Exercise 16: Recognizing Fusarium wilt in the field

Fusarium wilt is the most damaging disease of oil palm in Africa, causing huge yield losses. This exercise helps farmers recognize the symptoms in mature plantations and learn how to manage the disease.

Learning objective

Develop farmers' ability to recognise oil palm *Fusarium* wilt in the field and familiarize them with preventive measures

Timing of exercise: rainy season

Location: Mature plantation with *Fusarium* affected palms

Materials

- Sample of a frond affected by *Fusarium* wilt
- Machete

Procedure

Introduce the exercise. Showing the sample of an infected frond, discuss farmers' knowledge of *Fusarium* wilt using the guide questions.

Walk through the farm with participants, asking them to point out differences between fronds on a healthy palms and palms affected by Fusarium wilt, to indicate which fronds are first affected, and how the disease spreads.

Using a machete to cross section petioles from leaves to show symptoms, identify palms infected by the chronic form of the disease and discuss what should be done with those trees.

Guide questions for discussion

1. Do you know what is affecting this frond? What is the local name?
2. Do you have this problem on your farm?
3. How does it affect your oil palms?
4. On which plant part are you able to see *Fusarium* symptoms most?
5. How is an affected palm different from a healthy palm?
6. What is the appearance of the trunk or stem towards the crown?
7. Which fronds are first affected? The inner or the outer ones?

8. How does the disease spread?

9. Based on how *Fusarium* wilt spread, what is the best place for getting oil palm seeds from?

10. What should be done with palms badly affected by the disease?

Field activity associated with this exercise

Monitor the learning plot regularly for *Fusarium* wilt

Exercise 17: Identifying oil palm leaf miners and the damage they cause

Most farmers notice damage on palms caused by insect pests and may not know which insect caused the damage. Being able to distinguish between different insect pests and the damage each causes will encourage farmers to carry out control measures. This exercise can be adapted for other insect pests.

Learning objectives

- To enable farmers to recognize oil palm leaf miners and the damage they cause
- To train farmers to recognize the critical level of infestation for using pesticides

Timing of exercise: Dry season

Location: Any mature plantation affected by leaf miners or the mature FLG plot

Materials

- Samples of oil palm leaf miners at different stages (you will need samples in case you cannot find the insect in the field at the time of the exercise)
- 10 small jar/bottles (for insect collection)
- 10 bottles with screwed caps
- 1 liter alcohol
- 1 pole
- 5 forceps
- 1 packet of elastic bands
- 4-5 record sheets
- Flip chart, stand and markers

Procedure

Explain the purpose of the exercise. Cut some healthy leaves and some leaves damaged by leaf miners. Ask participants to examine the two types of leaves and discuss differences between healthy and damaged leaves.

Show participants the leaf miner samples. Explain the procedure for carrying out farm inspection. Using the flip chart, calculate the infestation index. Explain how it helps to decide on when to use insecticides.

Divide farmers into small groups and ask them to look for leaf miners and collect those they find. Using the record sheet, they should record the number of:

- Small gallery larvae
- Small larvae,
- Large larvae,
- Internal adults
- External adults
- Larvae
- Pupae

Ask each group to add up the number of insects and make a decision about what to do based on the infestation index. Have each small group present their findings and conclusions to the larger group.

Procedure for farm inspection and calculating the infestation index:

- Randomly select 30-40 trees per area with 143 trees or 1 hectare (select15-20 trees if the exercise is done in the FLG plot). Inspect 2 to 4 leaves of each selected tree as follows:
- Examine the underside of the leaves and count living adults
- Turn the frond over, open the burrows and count the number of small larvae, large larvae, pupae, and adults inside.
- Calculate the average number of large and small larvae on the plot by dividing the number of larvae by the number of trees inspected.

Decision guide

- If the average number of larvae is less than 5 (10 or less per 143 trees), continue to check your farm every two months.
- If you find an average of 5 to 20 larvae (10-40 per 143 trees) larvae, inspect your farm once a month.
- If you find an average of 20-50 larvae (40-99 per 143 trees), inspect your farm twice a month
- If you find more than 50 larvae (100 per 143 trees) and there is serious damage on lower leaves, you will need to use an insecticide.

Guide questions for discussion

- What is inside the leaves?
- Do you know this insect? What is the local name?
- Does the leaf miner attack any other palm part than the leaves?
- Which stage of the insects (adult? larvae? pupae?) is responsible for the observed damage?
- What are the damage symptoms?
- What is the breeding site of the insects?
- How can the information about feeding and breeding/reproducing sites help in managing the insects?
- Based on the number of leaf miner lavae, what should we do?

Field exercise: Inspect the field based on the decision guide recommended frequency

SHEET FOR RECORDING OIL PALM PESTS

Date……. **Week……..** **Year of Planting……**

Leaf Miner						**Observation**
SG.L	S.L.	L.L	Pupa	Int.A	Ext.A	

SG.L: Small Gallery Larvae

S.L: Small Larvae

L.L: Large Larvae

Int.A: Internal Adult

Ext.A: External Adult

L: Larvae

P: Pupae

Exercise 18: Pruning oil palm

Pruning mature oil palms makes it easier to harvest, limits the spread of pests and increases the amount of detached fruit harvested. However, many farmers in West and Central Africa do not prune, prune incorrectly or remove too many leaves. This exercise shows farmers how to prune properly.

Learning objectives

- To increase awareness of the importance of pruning
- To demonstrate which leaves to remove
- To create awareness of the correct tools for pruning
- To show how to arrange cut leaves in the wind rows and inter rows

Timing

After the peak harvesting period when bunch production is low *(*July- October)

Location

A farm with palms of less than 9 years and the mature FLG farm with palms of more than 9 years

NOTE: You may need to cover this topic in two sessions if the mature and young farms are far from each other

Materials

- 2 harvesting knives
- 2 poles
- Machetes
- 1 file (to sharpen machetes and harvesting knifes)

Procedures

A. Existing pruning practices

Discuss how and when farmers prune oil palm and the reasons for pruning using the guide questions. Discuss pruning tools. Demonstrate how to attach a knife to a pole.

Guide questions for discussion

1. Do most farmers prune oil palms? At what age do they start pruning?
2. At what time of the year do farmers prune?
3. Which leaves do they remove? Which do they leave?
4. What tools do they use to prune?
5. What are some disadvantages of climbing tall trees to prune?
6. At what age should you start pruning oil palms? Why should you not prune young palms?
7. What happens if you don't prune oil palms?
8. What tool is best for pruning palms or more than 9 years old? Why?
9. Does the tool used for pruning affect the tree?
10. What do you need to consider when attaching a knife to a pole?

B. Good pruning practices

On the young farm (palms of less than 9 years) show which leaves to remove and which to leave and demonstrate how to use a machete to prune

On the mature farm (palms of more than 9 years), show which leaves to remove and which to leave. Explain the correct distance for cutting off leaves petioles. Demonstrate how to prune using the pole.

Demonstrate how to arrange entire cut leaves or after leaves cut into two sections longitudinally in the wind rows. Demonstrate how to arrange cut leaves in the inter-row after sectioning them into three parts, the upper part of the leaves facing the slope.

Guide questions for discussion

1. At what distance from the trunk should the leaf petiole be cut?
2. What happens when petioles are cut to close to the trunk with a machete during pruning?
3. What should be done with pruned leaves? Why?
4. Why should you not remove pruned leaves from the farm?
5. How often and when should you prune oil palms?

Exercise 19: Harvesting oil palm bunches at the right time

Farmers can increase their productivity and income from oil palm by improving their harvesting techniques. Many farmers have the wrong idea about bunch ripeness, the right period to harvest oil palm bunches, some use the wrong tools when harvesting and few harvest at regular intervals.

Learning objectives

- To improve farmers' decision making about when to harvest oil palm
- Show farmers the advantages of using the correct harvesting tools

Timing: Anytime when there are ripe bunches

Location: Mature plantation with ripe bunches (but can also be done on a young farm)

Materials

- 3-4 poles
- 3-4 baskets to collect lose fruits
- Machetes (for 6-7 year-old oil palms use a chisel)
- 2 sharpening files
- 1 wheel barrow

Procedure

1. Deciding when to harvest oil palm bunches

- Introduce the exercise. Discuss how farmers harvest using the guide questions. Identify the signs to look for before harvesting oil palm bunches.
- Walk through the plantation and inspect the weeded ring around the palm for detached /loose fruits. If one detached fruit is found in the ring, make the decision to harvest as other detached fruits may be hanging in the crown or on the bunch itself.
- Discuss the difference between harvesting a mature plantation (7 years old and above) and a young plantation (3-4 years old).

Guide questions for discussion

1. How do you know when to harvest oil palm bunches?

2. What happens if you harvest bunches too late or too early?

3. Why wait for 5-15 fruits to detach before harvesting?

4. How often should you harvest oil palm bunches each month? Why conduct two to three rounds of harvesting each month

5. What is the difference between harvesting from a young and mature palm?

6. Why should you avoid cutting leaves from a four years old palm tree when harvesting ripe bunches?

7. Why should you cut fronds or the branches 15 to 20 cm during harvesting?

2. Harvesting oil palm bunches

- Discuss the tools farmers use to harvesting oil palm bunches and how they affect the oil palm life span and/or development

- Demonstrate how to harvest a bunch using a pole.

- Discuss the right time to take the harvested bunches to the processing mill and what happens it there is a delay.

- Ask participants to harvest the rest of the bunches in groups and to collect loose fruits from the ground and put them into a basket.

- Transport the bunches using a wheel barrow.

Guide questions for discussion

1. How do farmers harvest oil palm bunches? Which tools do they use?

2. Are there any problems with the harvesting methods farmers use?

3. Are there any advantages and disadvantage with the harvesting tools farmers normally use?

4. How long do farmers leave harvested bunches before taking them to the processing mill?

5. What happens when harvested bunches are taken late to the processing mills?

Field activity associated with this exercise

Harvest bunches throughout the course of the training

Exercise 20: Deciding when to replant oil palm

Farmers in many parts of West and Central Africa have old oil palm trees which have little economic value but have no systematic basis to decide when to replant. Farmers may also not be familiar with the most cost effective way to replant oil palm.

Learning objectives

- Increase farmers' awareness of the criteria for deciding when to replant oil palm
- Teach farmers the spatial arrangement for oil palm replanting

Location: A farm with oil palms between 30-40 years with heights of at least 12 m

Materials

- Flip chart stand and paper
- Calculator (if available)

Procedure

A. Identifying trees that need to be replaced

Start a discussion about tree age and productivity using the guide questions. Clarify the relationship between age, number of fresh fruit bunches and bunch weight. Inform farmers of the expected yield per tree (less than 20 years old) per year for that area if good quality planting materials and good agricultural practices are used. Discuss the average age of participants' trees.

Guide questions for discussion

1. What should you look at to know whether an oil palm has good yields?

2. What is considered good yield in a year for oil palm grown by small farmers in this area? What is considered a bad yield in a year?

3. Is there a relationship between the age of the palm, number of fresh fruit bunches and bunch weight? What is the relationship?

4. How old are most of your oil palms?

Divide participants into groups of 4-5. Assign each group to one row of palms. Ask the group to go down the row observing and recording the following information:

- Total number of trees in the row
- Number of trees 12 m and above that cannot be harvested

Ask participants to meet again and ask each group to report on their observations. Write the information on the flip chart and calculate the percent of tall trees that cannot be harvested.

	Number of palms in row	Number of palms 12+ m that cannot be harvested	Percent of palms 12+ m that cannot be harvested
Group 1			
Group 2			
Group 3			
Group 4			
Total			

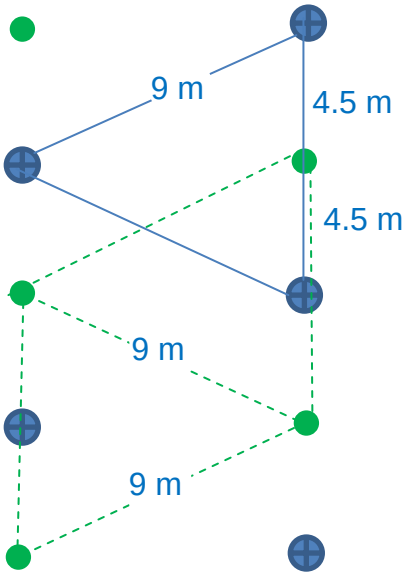
If the total percent of tall trees is more than 15%, the farm should be replanted.

B. Replanting an oil palm farm

Start a discussion on how farmers normally replant oil palm. Discuss the advantages and disadvantages of methods used by farmers.

Draw the following diagram to show how to plant oil palm in an existing field. Introduce the use of idea of killing old palms by using chemicals (e.g. Roundup, active matter: Glyphosate) or traditional methods/

Scheme for replanting oil palm



Young palms

Old palms

iscussion

replant oil palm?

2. What are some advantages and disadvantages of these practices?

3. What are some advantages of planting oil palm in between old trees?

4. What are some traditional ways of killing old palms? What are some disadvantages of these methods?

Exercise 21: Calculating the profitability of improved oil palm production

Farmers will only adopt practices that benefit them economically. This exercise allows farmers to compare the profitability of growing oil palm the way they normally do with recommended ICM practices learned in the FLG and to draw their own conclusions about the differences in costs and returns.

Learning objective

To enable participant to draw conclusions about the difference in cost and returns between existing and new crop and pest management practices.

Timing: at the end of all the training exercises

Materials

- Completed input and harvest record sheets
- Flip chart paper
- Markers
- Calculators (if available)

Procedure

Explain the objectives of this exercise and the step involved.

A. Farmer practice profitability

Step 1: Estimate labour use, labour cost, input use and costs for farmers' *normal practice*

Use information from the following table filled out at the start of the training.

1-Activity	2-Number of times done in one year	3-Hours per activity	4-Total days of labor = ((col. 2 x col. 3)/6 h/day))	Labour cost	Quantity of inputs purchased & output sold	Input /output price	Input/ output value
Labor Costs							
Variable Input Costs							
Sales							
Profits=(Sales-labor costs – variable input costs)							

Step 2: Calculate yield and the value of yield for farmer practice

Ask participants to estimate the average number of bunches a farmer usually harvests in one year from 1 hectare (acre) using the method agreed on by the group (selecting one farmer's farm or getting an average). It is easier to get the average number of bunches sold per month and multiply this number by 12 to get annual yield.

Multiply the number of bunches by the price for per bunch.

Calculate the gross revenue per ha by multiplying yield by price per bunch.

Step 3: Calculate net return per ha of farmer practice

Net return$_{FP}$ =gross revenue$_{FP}$ – (cost of inputs$_{FP}$ + labour cost$_{fP}$)

B. Recommended practice profitability

Step 1: Estimate labour, cost and inputs used when applying recommended practices *on the FLG plot*

Use the information collected and registered on the input sheets from the FLG activities to fill in the following table. You will need to convert the FLG figures to the amounts needed for 1 hectare. For activities related to nursery, multiply labour and input amounts by 2.9 to obtain quantities for 1 ha. (50 plants were used; 1 ha contains 143 trees). For activities related to planting, establishment and management of the mature farm, multiply the amount of labour and inputs on the FLG plots used by 2 to get the amount required for 1 ha.

Two stage nursery following recommended practices

1-Activity	2-Number of times done in one year	3-Hours per activity	4-Total days of labor = ((col. 2 x col. 3)/6 h/day))	Labour cost	Quantity of inputs purchased & output sold	Input /output price
Building a shelter for the nursery						
Sowing germinated seed						
Transferring seedlings from pre-nursery to nursery						
Applying fertilizer in nursery						
Total						

Establishment following recommended practices

1-Activity	2-Number of times done in one year	3-Hours per activity	4-Total days of labor = ((col. 2 x col. 3)/6 h/day))	Labour cost	Quantity of inputs purchased & output sold	Input /output price	Input/ output value
Lining and pegging							
Planting							
Protecting young plants							
Weeding a young farm							
Total							

Mature farm

1-Activity	2-Number of times done in one year	3-Hours per activity	4-Total days of labor = ((col. 2 x col. 3)/6 h/day))	Labour cost	Quantity of inputs purchased & output sold	Input /output price	Input/ output value
Slashing of inter rows							
Cleaning of rings							
Use of herbicide (or manual weeding)							
Applying chemical fertilizer							
Pruning							
Inspecting farm for leaf miner							
Applying insecticide against leaf miner							
Harvesting							
Transporting bunches to the processing mill?							
Total							

Step 3: Calculate yield and the value of yield from the FLG plot

Use yield records from the FLG plot. Multiply the number of bunches harvested from the FLG plot (0.50 ha) by 2 to get the yield per ha. Multiply the number of bunches by the price for per bunch.

Calculate the gross returns per ha by multiplying yield by price per bunch.

Calculate net return per ha of recommended practice

$\text{Net return}_{RP} = \text{gross revenue}_{RP} - (\text{cost of inputs}_{RP} + \text{labour cost}_{RP})$

C. Compare farmer practice results with recommended practice results

Compare the net returns from the two sets of practices. This tells you the profitability of implementing or not implementing ICM practices. Discuss whether it is profitable to produce oil palm following farmers' current practices.

Calculate the average rate of return (ARR)

The average rate of return expresses profitability to the costs in terms of percentage.

ARR = (net returns) / (inputs plus labour costs)

An ARR of 40% or higher is considered good.

Guide questions for discussion

1. What are the advantages of ICM practices over farmer practice? What are the disadvantages?

2. Which management practices do you think helped to increase profitability? Which practices caused profitability to decline? Why?

Exercise 22: FLG evaluation

At the end of the training cycle, it is important for participants to identify the strengths and weaknesses of the FLG. Where farmers have applied practices and knowledge learned during the FLG training to their own farm, a participatory monitoring exercise allows them to draw their own conclusions about how they have benefited from attending the training. Farmers may also need help with planning activities that they can do after the FLG ends.

Learning objectives

- Identify the strengths and weaknesses of the FLG
- Allows farmers to share which new practices and knowledge they have applied on their own farms
- Plan activities that will be done after the end of the FLG

Materials

- Flip chart paper and stand
- Markers

Procedure

1. FLG evaluation

Lead a discussion about how participants benefited from the FLG training process using the guide questions to lead the discussion. The discussion should cover the following broad topics and provide the following information:

- Topics of most interest (number of participants)
- Topics that were new to participants (number of participants)
- Most important knowledge and skill learned (number of participants)
- Practices being implemented on own farm (number of participants) (use the form who is practicing oil palm ICM practices)
- Sharing knowledge and skills with other farmers (list those shared with non-FFS farmers)
- Shared new knowledge/skills (number of participants)
- Reason for non-attendance of FLG sessions

- Suggestions to improve the FLG

Write up the results of the discussion on a flip chart.

Guide questions for discussion

1. Which topics in the FLG did you find interesting and which did you find uninteresting?
2. What is the most important thing you have learned in the FLG?
3. What skills have you learned or improved during the FLG?
4. What practices learned in the FLG have you already implemented on your own farm?

   Which practices do you plan to implement on your farm in future?
5. Have you shared knowledge or skills learned in the FLG with other farmers? What have you shared?
6. What were the reasons for the absence of participants during certain meetings?
7. What suggestions do you have to improve the FLG?

2. Planning FLG follow-up activities

Facilitate a discussion on what activities participants would like to carry out as a group or in sub-groups after the end of the FL. Some suggestions include

- Learning about topics not covered during the FLG
- Group marketing of palm oil
- Forming work groups to support other FLG members or non-members

Guide questions for discussion

1. Have we defined exactly what we want to do?
2. What is the purpose of the activity? How will it benefit us?
3. For how long do we want to work together (a month, a year)?
4. Do we need a facilitator or resource people or can we work on our own? If we need others, how do we contact them?
5. How often should the group meet? Where should we meet?

6. How should we organize ourselves (do we need to appoint Officers)?
7. What do we need to get started?

Who is or plans to practice oil palm integrated crop management (ICM) practices?

Name	Obtained seed from known seed source	Two stage nursery	Correct spacing	Use of chemical fertiliser in nursery	Protected young plants	Frequency of weeding (immature/ mature farm)	Inspected plantation for leaf miner	Harvested at right time	Use appropriate harvesting tool
	Yes/no/plan to	Yes/no/plan to							
	Yes/no/plan to	Yes/no/plan to							

NOTE: Participants together with the facilitator should decide on the practices to include in the table.