

# Smallholder Oil Palm Handbook

## Module 2: Harvesting, Grading, Transport



**Lotte Suzanne Woittiez**  
**Haryono Sadikin**  
**Sri Turhina**  
**Hidayat Dani**  
**Tri Purba Dukan**  
**Hans Smit**



## **Smallholder Oil Palm Handbook Module 2: Harvesting, Grading, Transport**

Lotte Suzanne Woittiez  
Sadikin Haryono  
Sri Turhina  
Hidayat Dani  
Tri Purba Dukan  
Hans Smit

Photos and figures by Lotte Woittiez (unless otherwise indicated).

3<sup>rd</sup> Edition (English), August 2016

Published online by SNV International Development Organisation and Wageningen University in 2016.

Correct citation: Woittiez, L.S., Haryono, S., Turhina, S., Dani, H., Dukan, T.P., Smit, H. 2016. Smallholder Oil Palm Handbook Module 2: Harvesting, Grading, Transport. 3<sup>rd</sup> Edition. Wageningen University, Wageningen, and SNV International Development Organisation, The Hague. 25 pages.

All content of this document, including the figures, is licensed under the Creative Commons license BY-NC-SA 3.0.





## Module 2: Harvesting, Grading, Transport

### GOAL

**To ensure that the bunches are harvested at the correct ripeness and arrive at the mill in optimal condition.**

After this section, farmers should:

- Be able to implement good harvesting practices in their plantation.
- Understand the grading system and be able to determine the quality of their oil palm fruit bunches.

### Contents

1. BACKGROUND
2. GENERAL NOTES ON GRADING AND SORTING
4. BUNCH CATEGORIES FOR SORTING AND GRADING
4. HARVESTING
5. WEIGHING AND TRANSPORTATION
6. ROAD MAINTENANCE

### List of figures

- Figure 1: Bunches at the mill  
Figure 2: Bunch price published by the Indonesian government  
Figure 3: Sorting form  
Figure 4: Harvesting with a sickle  
Figure 5: Loose fruits that were not collected  
Figure 6: Correct stacking of harvested bunches  
Figure 7: Collected loose fruits  
Figure 8: Hanging scales for weighing the bunches  
Figure 9: A cooperative collection area  
Figure 10: Loaded truck  
Figure 11: Road in poor condition  
Figure 12: Road in good condition

## 1. BACKGROUND

### What determines the income of an oil palm farmer?

The income of an oil palm farmer is determined by a number of factors. These are:

- The amount of fresh fruit bunches (FFB) produced. Usually this is about 1–2 tonnes per hectare per month, or 15–25 tonnes per hectare per year.
- The ripeness and quality of the bunches. A lower price will be paid for unripe bunches, overripe bunches, damaged bunches, very small bunches, and bunches with a long stalk.
- The quality of the oil, in particular the concentration of ‘free fatty acids’ (FFAs) that make the oil go rancid. If the bunches are harvested too late, or if they are left by the roadside for more than 24 hours, the concentration of free fatty acids will increase beyond what is acceptable on the international market. The maximum concentration of free fatty acids in the oil is 5%.
- The oil extraction rate (OER) of the fresh fruit bunches, which is the quantity of oil that the mill can get out of the fruit bunches. The usual oil extraction rate for a ripe *tenera* bunch from a mature tree is between 22–24 percent, or 220–240 kg of oil per tonne of fresh fruit bunches. *Dura* bunches, unripe bunches, small bunches, and damaged bunches contain less oil. Long stalks soak up the oil and therefore reduce the oil extraction rate.
- Other factors beyond the direct control of the farmer, such as:
  - The fresh fruit bunch price as set monthly by the government;
  - The relationship between the farmer or co-operative and the mill;
  - The presence of traders or middlemen who take a share of the profit;
  - The distance between the plantation and the mill
  - The quality of the road;
  - How many fresh fruit bunches the mill receives (in peak season, the prices go down).

### What are good harvesting practices?

Good harvesting practices are practices that result in large quantities of fresh fruit bunches harvested, high oil extraction rates, and good quality oil. Good harvesting practices include:

- Harvesting using correct procedures (frond cutting, bunch cutting);
- Harvesting only ripe bunches;
- Good and fast transport of the bunches to the mill;

- Limited loss of loose fruits in the field or during transport (loose fruits have an oil content of more than 40 percent)!

The free fatty acid content will be less than 5% if harvesting standards are followed; in particular it is important to ensure fast transportation to the mill and harvesting fruit at the correct ripeness.

For good transportation, the roads need to be maintained. While road maintenance can require large investments, bad conditions can make transportation of the harvest slow and more expensive. To avoid loss of fruit bunches or oil quality during its transport to the mill, the cooperatives, farmer groups or traders should set clear rules which include:

- Quality of the truck;
- Speed of transportation;
- Covering of full trucks with a net.



*Figure 1: Delivered bunches, ready to be processed in the mill.*

## How does the government calculate the price for fresh fruit bunches?

The Indonesian government uses the following formula to calculate the oil palm fresh fruit bunch price:

$$P_{FFB} = k \times ((P_{CPO} \times OER) + (P_{PKO} \times OER_K))$$

Where:

- $P_{FFB}$  = Price of fresh fruit bunches at the mill gate;
- $k$  = Percentage of returns given to fresh fruit bunch producers (farmers, plantations);
- $P_{CPO}$  = CPO price;
- $OER$  = Oil extraction rate for CPO;
- $P_{PKO}$  = PKO price;
- $OER_K$  = Palm kernel oil extraction rate.

The price is different for bunches from plantations of different age, because bunches from older palms contain more oil (so the OER is higher) than bunches from younger palms.

### Example of how the price of a fresh fruit bunch is calculated.

If we assume that:

- CPO price is 775 dollar per tonne;
- OER is 23%;
- PKO price is 850 US\$;
- PKO extraction rate is 4 percent;
- $k$  is 0.5 (i.e. 50% of the selling price of the oil goes to the farmers).

Then the fresh fruit bunch price is:

$$0.5 \times ((775 \times 0.23) + (850 \times 0.04)) = 106 \text{ US\$/tonne, or: } \sim 1.3 \text{ million IDR/tonne}$$

If  $k$  would be 0.75, then the fresh fruit bunch price is 159 US\$/tonne, or ~1.9 million IDR/tonne.



## 2. GENERAL NOTES ON GRADING AND SORTING

In the palm oil supply chain, farmers or plantation companies sell oil palm fruit to mills, and mills extract the oil (CPO) and sell it to a national or international buyer.

**Note!** Everyone will get a better price if the harvested fruit bunches are according to standard. Good bunches are of correct ripeness, correct size, not damaged by pest or insects, without long stalks, and delivered to the mill within 24 hours of harvesting.

In Indonesia, the government decides every month what price the mills should pay for fresh fruit bunches. The official oil palm fresh fruit bunch price depends on the following factors (see **Figure 2**):

- The crude palm oil price;
- The palm kernel oil price;
- The age of the bunches (due to its influence on the oil extraction rate)
- The percentage of the selling price that goes to the farmers (also known as 'k').

Mills have two systems to compensate for low oil content or poor oil quality, namely grading and sorting. **Grading** is usually done once a month while **sorting** is done for every truck that arrives at the mill. Grading and sorting of oil palm fruit bunches normally follow the procedure below:

- Specialised staff from the mill take a sample of fruit bunches (for example, 10% of the bunches).
- The fruit are examined to assess the quality of the fruit bunches .
- Poor quality fruit bunches, for example bunches that are unripe or very small, are given a *deduction* (usually in kilograms) because they produce less oil. Empty bunches are rejected.

Grading is done once a month to decide on a *general deduction* that is given to everyone who delivers to the mill (including the companies)! Sorting is done for every truck to determine the deduction for that truck, only.

So, each delivery gets two deductions: the one from the grading AND the one from the sorting!

Hasil Rapat Tim Pengkaji dan Kesepakatan Penetapan Harga TBS Kelapa Sawit Produksi Petani BULAN : AGUSTUS 2013	
Harga Per Kilogram TBS Kelapa Sawit Produksi Petani Kalbar Sebagai Berikut :	
Umur tanaman 3 Tahun	: Rp. 1.011.10
Umur tanaman 4 Tahun	: Rp. 1.096.81
Umur tanaman 5 Tahun	: Rp. 1.179.31
Umur tanaman 6 Tahun	: Rp. 1.211.98
Umur tanaman 7 Tahun	: Rp. 1.255.90
Umur tanaman 8 Tahun	: Rp. 1.295.53
Umur tanaman 9 Tahun	: Rp. 1.329.79
Umur tanaman 10 - 20 Tahun	: Rp. 1.375.11
HARGA CPO/KG	: Rp. 6.768.05 (tidak termasuk PPN)
HARGA KERNEL/KG	: Rp. 2.924.12 (tidak termasuk PPN)
INDEKS "K"	: 86.09 %

Figure 2: Bunch price set by the Indonesian government.

### Example of deductions given by sorting

Figure 3 shows a sorting form from a mill, on which the quality of the different bunches is recorded, and the deductions have been calculated.

Tgl. /Jam Masuk	Tgl. /Jam Keluar	Products	Supplier	B. Kotor (kg)	B. Tarra (kg)	B. Bersih (kg)	Jumlah Tandan	Bjr (kg)	
05-09-13 10:45	05-09-13 12:36	001	071	11.840	3.410	8.430	525	16,06	
GRADING									
Grade/Fraksi	F-00	F-0	F-1 s/d 4	F-5	F-6	BP	G. Pjg	Brondolan	Jumlah
Jumlah (%)	1	1	96	2	0	0	85	0	100
Jumlah (Kg)	42	42	0	0	0	0	72	0	156
Jumlah (%)									1,85
Fresh = 2 Hr								Bjr < 3 kg :	0
Berat bersih sesudah grading (Kg)									8.274





Figure 3: A sorting form from a mill.

### Understanding the sorting form

- The total weight of the fruit bunches in the truck is 8430 kg (column 'B. Bersih (kg)').
- 96% of the bunches are 'good' (column 'F-1 s/d 4').
- 1% of the bunches are unripe (column 'F-00'), therefore a deduction of 42 kg has been given.

- 1% of the bunches are underripe (column 'F-0'), therefore, a deduction of 42 kg has been given.
- 2% of the bunches are overripe (column 'F-5') but no deduction has been given.
- For the presence of long stalks a deduction of 72 kg has been given (column 'G. Pjg').
- There are no small bunches weighing less than 3 kg (line 'Bjr < 3 kg') so no additional deduction has been given.
- The total deduction is 156 kg, or 1.85 percent of the total weight.
- With an fresh fruit bunch price of 1.6 million IDR per tonne, **IDR 249600 has been lost**, mostly due to harvesting bunches too soon or not cutting the frond stalk short enough.

## 4. BUNCH CATEGORIES FOR SORTING AND GRADING

<i>Bunch category</i>	<i>Bunch characteristics</i>	<i>Deduction</i>	<i>Explanation</i>
<p><b>Good</b></p> 	<ul style="list-style-type: none"> <li>• Full of fruits</li> <li>• Yellow/orange/red colour</li> <li>• Several loose fruits</li> <li>• Fruits are soft</li> <li>• Oil drips out when fruit is cut</li> <li>• Undamaged and clean bunch</li> <li>• Bunch larger than 3 kg</li> <li>• Stalks are less than 2 cm long</li> </ul>	No	Optimum oil extraction and quality
<p><b>Unripe</b></p> 	<ul style="list-style-type: none"> <li>• Fruits mostly black in colour</li> <li>• Fruits are hard</li> <li>• No loose fruits</li> <li>• Inside is yellow</li> <li>• No oil comes out when fruits are cut</li> </ul>	Yes	Unripe fruit has very little oil
<p><b>Underripe</b></p> 	<ul style="list-style-type: none"> <li>• Fruits mostly reddish black in colour</li> <li>• Hard fruits</li> <li>• No loose fruits</li> <li>• Yellow inside</li> <li>• No oil comes out when a fruit is cut</li> </ul>	Yes	Underripe fruit has less oil than ripe fruit
<p><b>Overripe</b></p> 	<ul style="list-style-type: none"> <li>• Many loose fruits</li> <li>• Bright orange-yellow in colour</li> <li>• Fruits are soft</li> <li>• Oil easily comes dripping out</li> </ul>	Yes	Many fruits have already fallen out of the bunch. The oil quality in overripe fruits is less good.

**Empty**



- Few or no fruits left on the bunch

Rejected immediately

Little or no oil

**Small**



- Bunch weighs less than 3 kg
- Usually from very young palms

Yes

Small bunches from young palms have little oil

**Damaged**



- Damaged by rats or other pests
- Damaged during harvesting or in transport

Yes

Damaged fruit contains less oil

**Long stalk**



- Bunch stalk is more than 2 cm long

Yes

Stalks add weight without oil and suck up oil during processing

## 4. HARVESTING

### Goal

- Be able to cut and collect all ripe fruit bunches in a plantation;
- Be able to harvest fresh fruit bunches without damaging the fruit and the palm;
- Be able to get fresh fruit bunches with excellent oil content and quality;
- Be able to get maximum profit from harvested fresh fruit bunches.

### Standard

- All ripe fruit bunches are harvested at every harvesting round;
- Harvesting is done at least once every 10 days;
- Bunches are harvested at the right time and ripeness and in the right way, without causing damage to the bunch and the palm;
- The minimum ripeness standard of 1–4 loose fruits per bunch is followed (only if harvesting is done at least every ten days);
- Stalks are cut to less than 2 cm in length;
- The quantity of harvested fresh fruit bunches is correctly recorded at each harvest.



*Figure 4: Harvesting a ripe bunch with a sickle.*

### Timing

- All year round.

### Frequency

- Once every 7–10 days;
- **Note:** Many farmers harvest once every two weeks, but this will not give the maximum bunch yield. Some bunches will get overripe during the waiting period, and loose fruits are more likely to get scattered on the ground, so they take more time to collect and some will be lost amongst the weeds. Harvesting more frequently is the fastest and easiest way to improve the yield [1].

### Labour time required

- Harvesters work most efficiently in teams organised into the following roles:
  - One person for harvesting and frond stacking;
  - One person for collecting the fresh fruit bunches, cutting off long stalks, stacking bunches by the roadside and marking them (if necessary);
  - One person for collecting loose fruits (can be the same person as the one who collected the fresh fruit bunches).
- The speed of harvesting depends on the palm age [2]:
  - Palms less than 5 years after planting: around 300 bunches per harvesting team per day;
  - Palms between 6–12 years after planting: 150 to 200 bunches per harvesting team per day;
  - Palms more than 12 years after planting: 100 to 150 bunches per harvesting team per day.
- In the low season less bunches per day can be harvested because it takes more time to walk and search for bunches.

### Materials and equipment

- Long pole with harvesting sickle, or chisel (for palms up to 2–3 m tall);
- Axe or bush knife to chop the frond and the stalk;
- Wheelbarrow or bicycle with buckets to transport the fresh fruit bunches;
- Hook or stake to pick up and move the fresh fruit bunches;
- Crayon (or similar) to mark the fresh fruit bunch stalks;
- Empty fertiliser bags to collect the loose fruit.

## Who

- Farmers and their families or specialist hired labourers.

## How

Harvesting should be done according to the following guidelines using the proper tools:

**Step 1.** Identify ripe bunches ready for harvesting based on the loose fruits that are lying in the weeded circle around the palm trunk or are stuck behind frond butts on the trunk. **Just looking at the colour of the bunches is not a good way to harvest tall palms because the bunch may look red but they could still be unripe.**

A bunch should only be harvested if there is at least one loose fruit on the ground or stuck behind the frond butts on the trunk (minimum ripeness standard) for mature palms.

If the bunch looks ripe but there are no loose fruits, shake it with the harvesting pole (without damaging it) to check if any loose fruits fall out.

When there are one or several loose fruits, it is certain that the bunch is ripe enough for harvesting. Using the 'minimum ripeness standard' of one or two loose fruit will help prevent deductions at the mill for unripe or underripe bunches.

**Note:** When harvesting only twice per month, the minimum ripeness standard will result in many overripe bunches. In this case it is better to harvest based on bunch colour!

**Step 2.** Harvest the bunch by first cutting a frond according to the following rule of thumb:

- Palms more than six years after planting: Cut a frond below the bunch so that the bunch becomes visible and easy to harvest;
- Palms less than six years after planting: **Do not** cut fronds but 'steal' the bunch with a narrow chisel.

**Step 3.** Chop the frond into two pieces. Place the spiny, thick bottom part behind the palm, on the frond stack between the rows, and place the thin bottom part between the palm and its neighbour to the right or left (see [Module 3, Figure 23](#)).

**Step 4.** Cut the bunch stalk so that the bunch falls to the ground (see [Figure 4](#)). Cut the bunch stalk as shortly as possible (maximum 2 cm).

**Step 5.** Collect the harvested bunches with a wheelbarrow after one or two rows of palms have been harvested. Ensure all loose fruits are collected, including the loose fruits that are stuck behind the frond butts and those that are lying outside the weeded circle.



Remember:

- Loose fruits contain **40 percent oil**.
- The fruits are what earn the money in oil palm plantations: not collecting them is like leaving money lying around!
- Also, uncollected fruits will grow into weeds, which need to be removed later (see [Figure 5](#)).

**Step 6.** Move collected fresh fruit bunches and loose fruit to the collection area at the roadside.

**Step 7.** Stack the fresh fruit bunches into rows. The stack should have only one layer so the bunches can be counted and sorted immediately (see [Figure 6](#)).

**Step 8.** Collect loose fruit separately and place beside the fruit bunches (see [Figure 7](#)).

**Step 9.** **Tentative:** Label fresh fruit bunches on the cut edge of the stalk with carpenter's pencils or crayons to indicate their origin. It is best to use a different one-letter code for each field. Every bunch should be marked, and also the fertiliser bags with loose fruit.



*Figure 5: Loose fruits that were left behind have grown into weeds.*



*Figure 6: Correct bunch stacking at the roadside.*



*Figure 7: Loose fruit collection in an empty fertiliser bag.*

**Data recording**

Proper yield recording is discussed and demonstrated in the next section. In addition, to keep track of the labour costs, every harvesting activity should be recorded in a log book as shown in the example below.

Date	Time	Location	Activity	Input type	Input amount	Input costs	Labour input		Labour costs
							People	Hours	
16/01/13	07.00 16.00	Field 3	Harvesting				2	8	120000

## 5. WEIGHING AND TRANSPORTATION

### Goal

- Be able to keep good track of the production per plantation;
- Know exactly how much is produced, and of what quality;
- Be able to effectively transport the fresh fruit bunches and loose fruits from the field to the mill as soon as possible;
- Be able to get optimum oil quantity and quality.

### Standard

- The yield of each plantation is recorded separately and clearly;
- The number of poor-quality bunches is recorded clearly and precisely;
- Fresh fruit bunches are transported to the mill on the same day as harvesting and no more than 24 hours after harvesting;
- All fresh fruit bunches arrive at the mill in good condition;
- No fresh fruit bunches or loose fruits are lost in transport.

### Timing

- Usually on the same day as harvesting.
- Sometimes on the morning after harvesting - but **the bunches must arrive at the mill within 24 hours after harvesting!**

### Frequency

- Once every 7–10 days, depending on the harvesting frequency.

### Labour time required

- Weighing individually: 30 minutes per field;
- Weighing as cooperative: one morning or afternoon per kelompok;
- Transport time (and therefore labour requirement) depends on the distance to the mill and the road condition.

### Equipment and materials

- Weighing and yield recording:
  - Tripod with hanging scales (see [Figure 8](#));
  - Tray or net to hold the fresh fruit bunches and the loose fruits;
  - Notebooks and stationary.
- Transport from the field to the collection place:
  - Car or motorbike with carrying baskets.

- Transport from the collection place to the mill:
  - Good truck;
  - Net to cover the truck;
  - Loading hooks or stakes;
  - Buckets or empty fertiliser bags for loose fruits (see [Figure 7](#)).



*Figure 8: Hanging scales for weighing the bunches. If available, strong digital scales are more precise!*

## Who

- Weighing and yield recording:
  - Farmers and their family; or
  - Assigned members of the co-operative; or
  - Trader/middleman, closely supervised by the farmer.
- Transport from the field to the collection place (if necessary):
  - Farmers and their family or hired labourers.
- Transport from the collection place to the mill:
  - Truck crew;
  - Trader/middleman.

## How

### Sorting and weighing harvested fresh fruit bunches

Sorting and weighing can be done at the roadside before collection by a middleman or cooperative truck, or at the cooperative collection area.

- Step 1.** Count the total number of bunches.
- Step 2.** Check each bunch to make sure it is good quality and note the number of 'bad bunches' according to the categories below (see [Section 3](#)):
- Unripe
  - Underripe
  - Overripe
  - Empty
  - Damaged (e.g. by rats, fungus, etc.)
  - Too small
  - *Dura* (if present)
- Cut off any remaining long stalks (a waste of money!) and remove fresh fruit bunches that are too bad to sell (e.g. empty, very unripe).
- Step 3.** Weigh all the fresh fruit bunches harvested in the plantation (including the bad bunches that can still be sold) and write down the total weight of the bunches.
- Step 4.** Weigh the loose fruits and record the total weight.
- Step 5.** Record in a notebook:
- Total number of fresh fruit bunches (Step 1);
  - Number of 'bad bunches' per category (Step 2);
  - Total weight of fresh fruit bunches (Step 3);
  - Total weight of loose fruit (Step 4).
- Ensure the record includes farmer name, date, time, and the field that was harvested.

### Operating co-operative collection areas

If the cooperative sells the fresh fruit bunches directly to the mill, it may establish 'collection areas' where member farmers with nearby plantations can deliver their fresh fruit bunches once every 10 days (see [Figure 9](#)). In the collection area, bunches are sorted and weighed.

The cooperative should assign members who are responsible for the activities in the collection area and should provide all the tools required for the weighing and recording activities (such as scales and notebooks).

Transport of fresh fruit bunches from the plantation to the cooperative collection area is usually by car or motorbike. It can be useful if farmers mark their fresh fruit bunches before transporting them to the collection area.



*Figure 9: A cooperative collection area.*

### Selling to traders or middlemen

When selling directly to traders or middlemen it is important to:

- Keep clear personal records of the total number of fresh fruit bunches, the number of 'bad' bunches, the total bunch weight and the loose fruit weight;
- Be present when the weighing and sorting takes place in order to be sure about the results.

Just relying on the records of the trader or middleman is not a good idea, because it is important to know exactly how much was produced and earned.

### Transporting fresh fruit bunches from the collection area to the mill

Transport to the mill is generally arranged through the cooperative or the middleman. If transport is arranged individually, then the farmer needs to carry out all activities which are usually the responsibility of the cooperative. If transport is arranged by a middleman, then it is not the responsibility of the farmer.

- Step 1.** Purchase or hire good trucks. Check trucks regularly for issues that need repair. Hire truck staff along with the truck or arrange in the cooperative.
- Step 2.** Stack fruit bunches into the truck carefully and neatly (see . Place loose fruits in the middle of the truck so they are not lost during transport.
- Step 3.** Discard fresh fruit bunches that cannot be sold (e.g. empty, rotten). Cut remaining long stalks to less than 2 cm before loading.
- Step 4.** When the truck is full, place a cover net over the load to ensure safety and prevent loss of fresh fruit bunches. Note: net covers are mandatory by law in Indonesia.
- Step 5.** Ensure the fresh fruit bunches are transported to the mill on the same day, or at the latest at the beginning of the following day (within 24 hours from harvest to mill).



*Figure 10: Neatly loaded truck, but the load is too high and should have been covered with a net!*



## Data recording

Each harvest should be recorded carefully in a notebook or on a mobile phone or tablet. The table below can be used as an example.

Date	Farmer	Field	Total bunch number	Total weight	Loose fruit weight	Number of bad bunches						
						Damaged	Un-ripe	Under-ripe	Over-ripe	Empty	Small	Dura
16/01/13	2	1	60	900	20	5	3	1	1	1	0	0

## 6. ROAD MAINTENANCE

### Goal

- Ensure fast and efficient transport of fresh fruit bunches to the mill;
- Ensure good access to the plantations for farmers and labourers;
- Reduce damage to trucks.

### Standard

- Road surface is flat, compacted and without holes;
- Road is passable 365 days per year;
- Drainage ditches are free from weeds and rubbish.

### Timing

- Before the peak production season;
- Before and after the rainy season.

### Frequency

- Small repairs undertaken as needed;
- Large check/repairs completed yearly.

### Labour time required

- Depends on the activities and equipment available;
- Local construction workers can be asked for help.

### Equipment and materials

- Depends on the repairs required and on available machinery and materials.
- Standard maintenance requires:
  - Gravel or oil palm kernel shells;
  - Excavator (if available).

### Who

- A special department in the co-operative;
- Selected co-operative members;
- If necessary, hired construction workers.



*Figure 11: This road is in very poor condition and needs to be improved!*



*Figure 12: This road is in excellent condition.*

## How

If roads are in bad condition, transport of the fresh fruit bunches will be slower and therefore more expensive (see [Figure 11](#)). Regular maintenance of roads also prevents damage from becoming too large to repair.

Road maintenance can be the responsibility of (local) governments or plantation companies. If no-one else takes responsibility, then road maintenance should be arranged by the co-operative.

Routine maintenance of roads should include [2]:

- Graveling of roads;
- Filling in potholes;
- Cleaning weeds from roadsides and ditches.

Roads should be checked regularly, especially for potholes and for collapse of the road surface at the sides of the road:

- Inform the co-operative immediately if the road needs repair work.
- If the damage is too large, consider hiring local construction workers to carry out the repairs.

## Data recording

Every road maintenance activity should be recorded in a log book as shown in the example below.

Date	Time	Location	Activity	Input type	Input amount	Input costs	Labour input		Labour costs
							People	Hours	
16/01/13	Whole day		Repair village road	Gravel	5 trucks		6	8	400000
16/01/13	Whole day		Repair village road	Truck rent	1 truck				

## References and further reading

- [1] C.R. Donough, J. Cock, T. Oberthür, K. Indrasuara, A.R. Gatot, T. Dolong, Estimating oil content of commercially harvested oil palm fresh fruit bunches - A step towards increasing palm oil yields, Poster presented at the PIPOC 2013 International Palm Oil Congress and Exhibition, 19-21 November 2013, Kuala Lumpur, Malaysian Palm Oil Board (MPOB), 2013, pages.
- [2] I.R. Rankine, T.H. Fairhurst, Field Handbook: Oil Palm Series, Volume 3 – Mature, second ed., Potash & Phosphate Institute (PPI), Singapore, 1999.