APPLYING FERTILISER

1) APPLYING NITROGEN (N) FERTILISER

<table>
<thead>
<tr>
<th>Goal</th>
</tr>
</thead>
</table>
| • Provide oil palms with sufficient nitrogen to produce optimum yields;  
• Limit the loss of fertilisers to the environment. |

<table>
<thead>
<tr>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen fertiliser is applied according to the 4R principle: right type, right amount, right place, right time.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Timing</th>
</tr>
</thead>
</table>
| • After it rains, when the soil is still moist;  
• Not when the soil is water-logged;  
• Not in the dry season when no rain is expected;  
• **Note:** For urea, apply in the morning of a day when rain is expected soon (in the afternoon or on the next day). |

<table>
<thead>
<tr>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 2 doses per year (once every 6 months) and optimally 3 doses (once every 4 months) because less nutrients are lost.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labour time required</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–8 hours per hectare.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment and materials</th>
</tr>
</thead>
</table>
| • Bucket, bag or wheelbarrow  
• Kitchen scales  
• Black marker pen  
• Bowl (1.5–2 L)  
• Fertiliser |
Who

Farmers and their families or hired labourers.

How

Apply nitrogen fertiliser by following these steps:

| Step 1. Make sure the plantation is well maintained, noxious weeds have been removed and ground cover has been slashed to 50 cm height. |
| Step 2. In a bowl or cup weigh the amount of fertiliser to be applied with kitchen scales. |
| Step 3. Mark the bowl/cup at the right amount using a black marker pen. |
| Step 4. Break up any clumps of fertiliser into small pieces before application. |
| Step 5. Apply the N fertiliser in the following way: |
  - For palms less than 10 years after planting, apply fertiliser in the weeded circle; |
  - For palms greater than 10 years after planting, broadcast the fertiliser evenly in the circle or in the inter-row area, excluding harvesting paths. |

If palms are located on the edge of a river, road or ditch, avoid applying fertilisers on the side of the palm closest to the edge.

Note: A good (and cheaper) way to provide part of the N is by sowing legume cover crops.
Data recording

Every fertiliser application should be recorded in a log book as shown in the example below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Activity</th>
<th>Input type</th>
<th>Input amount</th>
<th>Input costs</th>
<th>Labour input</th>
<th>Labour costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/13</td>
<td></td>
<td>Field 3</td>
<td>Fertiliser: N</td>
<td>Urea</td>
<td>150 kg</td>
<td>360000</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

2) APPLYING PHOSPHORUS (P) FERTILISER

Goal

- Provide oil palms with sufficient phosphorus to produce optimum yields;
- Limit the loss of phosphorus to the environment.

Standard

Phosphorus fertiliser is applied according to the 4R principle: right type, right amount, right place, right time.

Timing

- When the soil is moist;
- **Not** during very strong rains or in the middle of the rainy season.

Frequency

1 or 2 doses per year (once per 6–12 months).

Labour time required

4–8 hours per hectare.

Equipment and materials

- Bucket, bag or wheelbarrow
- Kitchen scales
- Black marker
- Bowl of 1.5–2 L
- Fertiliser
Who

Farmers and their families or hired labourers.

How

Apply phosphorus fertiliser by following these steps:

**Step 1.** Before application, make sure that erosion control (i.e. terraces, dams) has been installed on sloping terrain because P fertiliser remains at the top of the soil for a long time and is therefore sensitive to loss by erosion or runoff.

**Step 2.** Make sure the plantation is well maintained, noxious weeds have been removed and ground cover has been slashed to 50 cm height.

**Step 3.** Weigh the amount of fertiliser to be applied in a bowl or cup, using kitchen scales.

**Step 4.** Mark the bowl/cup at the right amount using a black marker pen.

**Step 5.** Apply the fertiliser in the following way:

- For palms younger than 3 years after planting, P should be applied evenly in the weeded circle;
- For palms older than 4–10 years after planting, P should be applied in a band around the weeded circle;
- For palms more than 10 years after planting, P should be broadcast in the inter-row (excluding the harvesting paths), especially over the frond stack to prevent runoff.

If palms are on the edge of a river, road or ditch, avoid applying fertilisers on the side of the palm closest to the edge.

**Note:** For very acidic soils (pH < 4.0) and peat soils it is better to use rock phosphate than TSP.

Data recording

Every fertiliser application should be recorded in a log book as shown in the example below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Activity</th>
<th>Input type</th>
<th>Input amount</th>
<th>Input costs</th>
<th>Labour input</th>
<th>Labour costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/13</td>
<td></td>
<td>Field 3</td>
<td>Fertiliser: P</td>
<td>TSP</td>
<td>300 kg</td>
<td>300000</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>
3) APPLYING POTASSIUM (K) FERTILISER

Goal

- Provide oil palms with sufficient potassium to produce optimum yields;
- Limit the loss of potassium to the environment.

Standard

Potassium fertiliser is applied according to the 4R principle: right type, right amount, right place, right time.

Timing

Not during very wet periods.

Frequency

- Most soil types: 2–3 doses per year (once every 4–6 months);
- Very sandy soils and peat soils: 3–4 doses per year (once every 3–4 months).
Labour time required

4–8 hours per hectare.

Equipment and materials

- Bucket, bag or wheelbarrow
- Kitchen scales
- Black marker pen
- Bowl of 1.5–2 L
- Fertiliser

Who

Farmers and their families or hired labourers.

How

Apply potassium fertiliser by following these steps:

Step 1. Before application, remove noxious weeds and slash ground cover to 50 cm height.
Step 2. Weigh the amount of fertiliser to be applied in a bowl or cup, using kitchen scales.
Step 3. Mark the bowl/cup at the right amount using a black marker pen.
Step 4. Break up any fertiliser clumps into small pieces before application.
Step 5. Apply the fertiliser in the following way:
   - For palms younger than 7 years after planting, K should be applied evenly in the weeded circle;
   - For palms 7–10 years after planting, K should be applied in a band around the weeded circle;
   - For palms greater than 10 years after planting, K should be broadcast over the frond stack and in the inter-row, apart from the harvesting path;
   - Apply bunch ash in the weeded circle.
   If palms are on the edge of a river, road or ditch, avoid applying fertilisers on the side of the palm closest to the edge (if fertiliser is being broadcast).

Data recording

Every fertiliser application should be recorded in a log book as shown in the example below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Activity</th>
<th>Input type</th>
<th>Input amount</th>
<th>Input costs</th>
<th>Labour input</th>
<th>Labour costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/13</td>
<td></td>
<td>Field 3</td>
<td>Fertiliser: K</td>
<td>KCI</td>
<td>150 kg</td>
<td>840000</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>
4) APPLYING MAGNESIUM (Mg) FERTILISER

**Goal**

- Provide oil palms with sufficient magnesium to produce optimum yields;
- Limit the loss of magnesium to the environment.

**Standard**

Magnesium fertiliser is applied according to the 4R principle: right type, right amount, right place, right time.

**Timing**

- **Not** during very wet periods because magnesium is sensitive to leaching.
- If magnesium is applied, then urea should **not** be applied shortly after because this will increase leaching of nitrogen.
**Frequency**

1–2 doses per year, depending on the total quantity of magnesium fertiliser applied [1].

**Labour time required**

4–8 hours per hectare.

**Equipment and materials**

- Bucket, bag or wheelbarrow
- Kitchen scales
- Black marker pen
- Bowl of 1.5–2 L
- Fertiliser

**Who**

Farmers and their families or hired labourers.

**How**

Apply magnesium fertiliser by following these steps:

| Step 1. | Before application, remove noxious weeds are and slash ground cover to 50 cm height. |
| Step 2. | Weigh the amount to be applied in a bowl or cup, using kitchen scales. |
| Step 3. | Mark the bowl/cup at the right amount using a black marker pen. |
| Step 4. | Break up any clumps of fertiliser into small pieces before application. |
| Step 5. | Dolomite is best applied as follows: |

- For palms younger than 7 years after planting, dolomite should be applied in a band around the weeded circle;
- For palms older than 7 years after planting, dolomite should be broadcast over the frond stack and in the inter-row
- Kieserite is best applied as follows:
- For palms younger than 7 years after planting, kieserite should be applied evenly in the weeded circle;
- For palms older than 7 years after planting, kieserite should be applied in a band around the weeded circle.

If palms are on the edge of a river, road or ditch, avoid applying fertilisers on the side of the palm closest to the edge.
Data recording

Every fertiliser application should be recorded in a log book as shown in the example below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Activity</th>
<th>Input type</th>
<th>Input amount</th>
<th>Input costs</th>
<th>Labour input</th>
<th>Labour costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/13</td>
<td></td>
<td>Field 3</td>
<td>Fertiliser: Mg Dolomite</td>
<td>300 kg</td>
<td>300000</td>
<td>1</td>
<td>4</td>
<td>40000</td>
</tr>
</tbody>
</table>

*This dolomite was applied in the circle, but should have been spread over the frond stack*

5) APPLYING BORON (B) FERTILISER

Goal

- Provide oil palms with sufficient boron to produce optimum yields;
- Limit the loss of boron to the environment.

Standard

Boron fertiliser is applied according to the 4R principle: right type, right amount, right place, right time.
Timing

Not during very wet periods.

Frequency

Once per year.

Labour time required

2–4 hours per hectare.

Equipment and materials

- Bucket, bag or wheelbarrow
- Kitchen scales
- Black marker pen
- Cup or small bowl
- Fertiliser

Who

Farmers and their families or hired labourers.

How

Boron fertiliser is applied in small quantities and is toxic when applied in too large amounts.

Apply boron fertiliser by following these steps:

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Before application, remove all weeds from the weeded circle.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Weigh the amount to be applied in a bowl or cup, using kitchen scales.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Mark the bowl/cup at the right amount using a black marker pen.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Break any clumps into small pieces before application of fertiliser.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Apply boron fertiliser evenly in the weeded circle for palms of all ages.</td>
</tr>
</tbody>
</table>

Note: Boron fertiliser is mildly toxic, so it is best not to eat, drink or smoke during application and to wash hands immediately after application.
Data recording

Every fertiliser application should be recorded in a log book as shown in the example below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Activity</th>
<th>Input type</th>
<th>Input amount</th>
<th>Input costs</th>
<th>Labour input</th>
<th>Labour costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/13</td>
<td></td>
<td>Field 3</td>
<td>Fertiliser: B</td>
<td>Borax</td>
<td>15 kg</td>
<td>200000</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

6) APPLYING COPPER (Cu) AND ZINC (Zn) FERTILISER

Note: Copper and zinc fertiliser should be applied to peat soils only!

Goal

Correct copper or zinc deficiencies in oil palm plantations in peat soils in order to achieve optimum yields.

Standard

- Copper and zinc fertiliser are applied according to the 4R principle: right type, right amount, right place, right time.

Timing

- Usually when palms are still immature or young;
- Not during very wet periods.

Frequency

Once per year.

Labour time required

4–8 hours per hectare.

Equipment and materials

- Bucket, bag or wheelbarrow
- Kitchen scales
Black marker pen
• Cup or small bowl
• Knapsack sprayer with long lance (for aerial application)
• Fertiliser

Who

Farmers and their families or hired labourers.

How

Application of copper and zinc fertilisers is usually necessary on peat soils only and not on mineral soils. When applying copper and zinc directly onto the soil, quite large amounts are needed because much of the fertiliser will be bound by the soil. An alternative in immature plantations is to apply copper and/or zinc fertilisers directly onto the leaves [7].

Copper / zinc application to the soil:

<table>
<thead>
<tr>
<th>Step 1.</th>
<th>Before application, remove all weeds from the weeded circle.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2.</td>
<td>Weigh the amount to be applied in a small bowl or cup, using kitchen scales.</td>
</tr>
<tr>
<td>Step 3.</td>
<td>Mark the bowl/cup at the right amount using the black marker pen.</td>
</tr>
<tr>
<td>Step 4.</td>
<td>Apply the fertiliser evenly in the weeded circle.</td>
</tr>
</tbody>
</table>

Copper / zinc application to the leaves:

<table>
<thead>
<tr>
<th>Step 1.</th>
<th>Make sure the knapsack sprayer is clean and works correctly.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2.</td>
<td>Fill the knapsack sprayer with water (4-5 L per palm).</td>
</tr>
<tr>
<td>Step 3.</td>
<td>Weigh the amount to be applied in a small cup, using precise kitchen scales.</td>
</tr>
<tr>
<td>Step 4.</td>
<td>Add the fertiliser to the sprayer and make sure it is dissolved well</td>
</tr>
<tr>
<td>Step 5.</td>
<td>Spray the palms with the fertiliser solution. Considerations when spraying fertiliser to the crown:</td>
</tr>
<tr>
<td></td>
<td>• Much smaller quantities are needed;</td>
</tr>
<tr>
<td></td>
<td>• Spraying is cheaper, and the nutrients are taken up faster compared with applying to the soil because the soil cannot bind the nutrients;</td>
</tr>
<tr>
<td></td>
<td>• However, copper and zinc can be toxic if applied in too large quantities, especially when sprayed onto the leaves;</td>
</tr>
<tr>
<td></td>
<td>• It is a good idea to try out the spraying and the application on the soil with a few palms (at least four for each treatment) to see if nutrient deficiency symptoms disappear.</td>
</tr>
<tr>
<td></td>
<td>Symptoms should disappear in 3–12 months.</td>
</tr>
</tbody>
</table>

Note: If not enough potassium is applied, the palms will still be yellow because of potassium deficiency, even if the copper and the zinc are effective.
Data recording

Every fertiliser application should be recorded in a log book as shown in the example below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Activity</th>
<th>Input type</th>
<th>Input amount</th>
<th>Input costs</th>
<th>Labour input</th>
<th>Labour costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/13</td>
<td></td>
<td>Field 3</td>
<td>Fertiliser: Cu</td>
<td>CuSO₄</td>
<td>25kg</td>
<td>700000</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

7) APPLYING EMPTY FRUIT BUNCHES AS FERTILISER

Background

Empty fruit bunches (EFB) are what remains of the fresh fruit bunches after the fruit has been removed for oil pressing. Empty fruit bunches are a type of mill waste which is very valuable for farmers because:

- It provides nutrients;
- It increases the soil organic matter content of the soil.

Empty fruit bunches can replace fertilisers at the following rate:

1 tonne EFB =
3.8 kg Urea (N)
3.9 kg Rock Phosphate (P)
18.0 kg KCl (K)
9.2 kg kieserite (Mg) [17]
Empty fruit bunches can be bought at the mill, if available. The empty bunches can be transported to the field by the empty trucks that come back to pick up more harvested fresh fruit bunches.

**Goal**

- To provide the oil palms with nutrients;
- To reduce fertiliser costs;
- To increase organic matter content in the soil.

**Standard**

- Empty fruit bunches are applied at least once in every 5–8 years.
- Empty fruit bunches are applied in the right way and the right place.

**Timing**

Whenever empty fruit bunches become available.

**Frequency**

Every 5 years, if enough empty fruit bunches are available.

**Labour time required**

- Transport: depends on distance to the mill.
- Application: 2–3 days per hectare.

**Equipment and materials**

- Wheelbarrow
- Shovel
- Truck (returning empty from the mill)

Note: Empty fruit bunches can be purchased at the mill if they are not all bought up by large plantations. Availability may depend on the smallholder’s relation with the mill and/or competition with other buyers (large companies often get priority). It helps to purchase empty fruit bunches as a cooperative or farmers’ group.
Dosage

- Optimum rate: 30 to 40 t/ha.
- When EFB are applied at the optimum rate there it is enough to replace mineral K, P, Mg and B fertilisers for one year.
- It is recommended to keep applying N fertilisers, because the N in the EFB is mostly not available to the palm.
- **Note:** 25 tonne FFB produces 5 tonne EFB, so the amount of available EFB is limited [9].

Who

- Transport: Workers who normally transport the fresh fruit bunches to the mill.
- Application: Farmers and their families or hired labourers.

How

Apply empty fruit bunches as fertiliser by following these steps:

**Step 1.** Once the truck has delivered the empty fruit bunches to the roadside, transport the empty fruit bunches into the plantation by wheelbarrow.

**Step 2.** Apply the empty fruit bunches as follows:

- In a band (line) next to the frond stack, or;
- In a patch of 2–4 square meters between the palms.
- In immature plantations, empty fruit bunches can be applied in the weeded circle. In mature plantations, empty fruit bunches should not be applied in or around the weeded circle, because this will make access into the plantation and collection of the loose fruits more difficult.

  **Note:** The layer of empty fruit bunches should always be **only one bunch thick** because it makes the decomposition go faster and also prevents rhinoceros beetles from using the empty fruit bunches as a breeding place.

**Step 3.** Check patches of empty fruit bunches regularly to see if there are any breeding rhinoceros beetles. This can be done by turning the empty fruit bunches upside down. Remove any rhinoceros beetle larvae that are found in, or under, the bunches and spread the bunches more widely if necessary.
Correct application of empty fruit bunches in a patch

Incorrect application of empty fruit bunches around the weeded circle
Every fertiliser application should be recorded in a log book as shown in the example below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Activity</th>
<th>Input type</th>
<th>Input amount</th>
<th>Input costs</th>
<th>Labour input</th>
<th>Labour costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/13</td>
<td></td>
<td>Field 3</td>
<td>EFB application</td>
<td>EFB</td>
<td>40 tonne</td>
<td>3000000</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>