SUSTAINABLE PALM OIL

Good Agricultural Practice Guidelines

Unilever

Contents

Note
This document has been discussed with the members of the Unilever Sustainable Agriculture Advisory Board (SAAB). The SAAB is a group of individuals, specialists in agricultural practices or representatives of non-governmental organisations (NGOs), who have expertise in different aspects of sustainability. They have agreed to critically assist Unilever in the evolution of Sustainable Agriculture indicators and good practices for a range of raw material crops. The contents of this document and the choices made herein are, however, the responsibility of Unilever only.

Cover Design: Montage of Photos from Palm Oil Estates

The photographs in this publication illustrate sustainable agricultural good practice in the palm oil industry and show both Unilever owned and also non-Unilever plantations

Introduction

This guide has been developed under the Unilever Sustainable Agriculture Initiative to support sustainable management practices for palm oil production. Ten indicators of sustainability have been identified, each with specific good agricultural practice recommendations:

- Soil Fertility
- Nutrients
- Biodiversity
- Energy
- Social and Human Capital
- Soil Loss
- Pest Management
- Product Value
- Water
- Local Economy

Areas of potential opportunity for improvement have also been identified.

The development of these good agricultural practice guidelines has been based upon a thorough evaluation of potential agronomic practices and associated inputs. It has drawn upon the considerable oil palm research and practical cultivation experience in Malaysia, Indonesia and West Africa. The guidelines have been produced in consultation with relevant scientists and specialists, including members of the Unilever Sustainable Agriculture Advisory Board (SAAB).

There is a companion booklet, 'Palm Oil – A Sustainable Future', which describes the background to this sustainable agriculture initiative (see Bibliography). There is also a technical guide to the methodologies recommended for the measurement of sustainability indicators.

Contributions to the continuous improvement of these guidelines are welcome and can be sent to us via email: sustainable.agriculture@unilever.com.

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> Riparian reserves and wildlife corridors composed of natural forests should be maintained in palm oil plantations to provide habitats for indigenous plants and animals

1. Soil Fertility

Organic matter is important for maintaining soil health and soil structure, as well as reducing soil loss and increasing nutrient and water use efficiency. Organic matter levels should be maintained at, or improved to a satisfactory equilibrium value for the soil type. Organic matter will derive from cleared vegetation in new plantings, from the return of fronds, male inflorescences, shed leaf bases and old roots in existing stands and from felled palms in replants. Organic matter levels can be improved by adding waste biomass from palm oil processing, such as empty fruit bunches, mill effluent and decanter solids, palm shell and fibre.

Long term deterioration in soil structure and fertility may result from **compaction**, particularly with mechanisation and from changes in **soil pH** (especially in acid sulphate soils). **Salinity** can be a problem in coastal plantings due to sea water inundation or seepage and as a side effect of irrigation in low-rainfall areas.

Good Practice

Organic Matter

- During planting/replanting all vegetation to be cleared should be windrowed into a broad swathe, leaving only a cleared planting avenue. On slopes, windrow the old trunks along contours. On terraced slopes, place trunks on terrace edges where possible.
- There should be no burning unless serious pest and disease problems require it.
- During clearing, minimise the period of no ground cover. Ground cover slows the depletion of soil organic matter from the effects of sunlight and erosion. It also adds to the organic matter content through leaf and plant litters.
- Immediate ground cover can be provided by felled trunks (do not stack high) and trunk chippings and should be followed by rapid establishment of creeping legume covers.
- During harvesting or pruning, cut fronds should be cut into two and the petiole or frond base half stacked between palms in the palm row.
    - The upper or leafy half should be spread in the non-harvesting inter-row.

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> Empty fruit bunches (bunches stripped of their fruit) are returned to the soil to recycle nutrients and organic matter

- Where fronds are not cut into two, the petiole base or frond stalk end should be placed squarely in the windrow with the frond tip pointing outwards.
- On slopes, the frond stack should follow contours and on terraces they should be placed along the terrace edge.

- Recycle all organic materials - empty fruit bunches (EFB), mill effluent and decanter solids as well as surplus shell and fibre - to the field. The return should concentrate on fields where the organic matter needs increasing to equilibrium levels, taking transportation costs into consideration. Decanter solids and excess shell from the mill could be mixed with EFB to be returned to the field. Where feasible, the EFB can be composted and soaked with effluent before field spreading.

Soil Compaction

- Size tractors and trailers for in-field collection of fresh fruit bunches taking soil type and compaction potential into consideration.
- Ensure tractor and trailer tyres are always inflated to the correct pressure.
- Use tracked vehicles, low ground-pressure tyres or double tyres for soft soils.
- Use draught animals or wheelbarrows for very soft soils where machinery is frequently bogged down.
- Avoid use of heavy machines off-road during rainy periods or on very wet soils.
- Where slippage is not a problem, encourage ground cover of paths and tractorways.
- Apply excess shell in areas where it could stabilise road and path surfaces or help to reduce dust.
- Use cable systems for transportation where economically justified.
- At each replanting, alternate the frond pile row with the harvesting path of the previous planting. The new frond pile rows will therefore be where the harvesting paths were previously.

Soil pH and Salinity

- Where ammonium sulphate is applied to the weeded circle around the palm, alternate this with ammonium nitrate and/or urea if acidification is a potential problem. Broadcast application is usually preferable to circle application.
- For soils with pH>6.0, the use of ammonium sulphate is preferable to ammonium nitrate in order to lower the pH to an optimum for oil palms.
- Maintain the proper water-table over all acid sulphate layers. A lowering of the water-table and consequent oxidation of the sulphide results in sulphuric acid build-up.
- In coastal plantings, use bunds and proper water-table management to prevent seawater inundation or seawater seepage into ground water.

> Ground cover slows depletion of the organic matter in soil and also supplements it through the addition of plant and leaf litter

> Compaction is reduced on very soft soils by using draught animals instead of machinery

Potential Areas For Improvement

- Establish 'equilibrium organic matter levels' for local soils and conditions.
- Research in-field harvesting path design to reduce erosion, puddling and rutting.
- Efficiencies in recycling organic matter in respect of nutrients are discussed under Nutrients (page 07).
- Soil-borne pests and diseases (e.g. *Ganoderma*) are important to many crops. Cultural practices that reduce disease incidence by improving soil health are often imperfectly understood. The need for this research is covered in Pest Management (page 09).
- The soil has to be viewed as a complex living environment and the influence of ground vegetation, biomass return, pesticide and fertiliser use on its health must be further researched. Accurate and practical methods of measuring and monitoring soil health have to be developed.

2. Soil Loss

Soil erosion can be high in the tropics if steps are not taken to control it. Most important is to maintain some **ground cover** vegetation. Perennial tree cropping systems where the trees are established along with cover crops should cause much less **soil erosion** than annual crops. Nevertheless, heavy rainfall can still result in high erosion rates where soil is exposed and specific erosion control measures should be taken in vulnerable areas. Demand for **topsoil for nursery use** can result in degradation of extraction areas.

Good Practice

Ground Cover

- Plant appropriate legume cover crops as early as possible after clearing (or partial clearing with under-planting). This will also help to prevent *Oryctes* breeding in the felled palm trunk as well as improving the fertility of the soil.
- Encourage moss, soft grasses and ferns under older palms in place of competitive weeds. Do not blanket spray with herbicides; where necessary, spot spray to remove specific harmful weeds.
- If interline vegetation is too tall for agricultural operations on palms, use contact herbicides to spray it down especially before flowering and seed set.

Soil Erosion

- Spread or stack pruned fronds along contours, even on gently sloping land. Empty fruit bunches (EFB) should also be placed in such a way that erosion is reduced in vulnerable areas.
- During replanting of slopes, windrow old tree trunks along contours.
- Do not use heavy machinery where soil erosion is likely to result from such use.
- Recognise that erosion risks vary with climate and rainfall patterns, soil type, slope (length and gradient), ground cover (by crop and vegetation), drainage, road design and crop management. Take expert advice on the specific physical measures required to reduce slope length and hence erosion risk on slopes of more than 10 degrees and less if on sandy soils.

Top
> Soil conservation by terracing steep land and the use of creeping legume ground cover crops

- Measures to reduce erosion risk on sloping land include:
  - Soil erosion prevention terraces - with or without bunds,
  - Silt pits - along roads and in fields where erosion is likely,
  - Water diversion channels.
- Terrace all slopes above 10 degrees.
- Do not plant severely sloping land, which in most cases is where the slope is more than 25 degrees. In many cases, economic analysis will show that the cost of terracing such land and the crop obtainable is insufficient to make planting financially viable (see also Biodiversity, page 10).
- In some instances, erosion may merely displace topsoil within the fields (not removing it completely). This is still undesirable as palm growth will be affected by unequal soil fertility, moisture status and by tree bases being buried.

> Shade-tolerant herbaceous species and ferns are encouraged as ground cover under mature palms

Nursery Topsoil Use

- In some places, forest soil is used for nurseries. This is unacceptable, both from the point of view of forest biodiversity and soil conservation. Instead use:
  - Topsoil from disease free areas within the estate,
  - Composted EFB (which will be disease free from factory autoclaving) mixed with soil for bag filling,
  - Effluent solids mixed with soils taken from planting sites for bag filling,
  - Decanter solids mixed with soil,
  - Shell or fibre as mulch in polybags.

> During periods of heavy rainfall silt pits and roadside soakaways retain water and soil run-off

Potential Areas For Improvement

- *Calopogonium caeruleum* and *Mucuna bracteata* are reportedly shade-tolerant legume species (see also Nutrients, page 07). These could be tried for extended legume ground coverage.
- Follow the introduction of new legume species and investigate species mix and seeding rates to promote rapid cover, nitrogen fixation, organic matter build up (where appropriate) and shade tolerance.
- Develop a 'Whole Farm Plan' for erosion control to ensure that appropriate measures are applied for individual locations. Relate the practices adopted to expected erosion rates and, if practical, monitor soil losses at key sites to ensure that the results are as expected.
- When using compost, take nutrient content and Carbon:Nitrogen ratio into account when assessing fertiliser requirements.

> Shell is used as a mulch for nursery planting

3. Nutrients

Economic sustainability requires the use of fertilisers on most soils. Ideally, **total nutrient inputs** (including those from soil mineralisation and compost imported) **should be very similar to nutrients exported** in the harvested product plus that stored in vegetation and the soil and palm biomass. Loss of nutrients - in wastes, through volatilisation, to **surface and ground water** and through sediment erosion - must be minimised. The **proportion of nitrogen (N) input from biological fixation** should be maximised. Appropriate micronutrient additions will enhance the efficiency of use of nitrogen (N), phosphorus (P) and potassium (K) as well as meeting the crop's micro-nutrient needs.

Good Practice

Ratio of Exports to Inputs

- Return empty fruit bunches (EFB) to the field. A yield of 25 tonnes/year of fresh fruit bunches (FFB) per hectare will give approximately 6 tonnes of EFB, so the ideal will be to apply annually about six tonnes per hectare. The EFB contain about half the potassium (K) from the FFB. Although EFB distribution costs per unit of nutrient are generally substantially higher than for inorganic fertilisers, EFB have additional benefits in returning organic matter and conserving moisture.
- Effluent distribution to the entire estate would be optimal, but is unlikely to be economical or practical. The amount of effluent from a mill will vary, but a typical figure is about 16 tonnes from 25 tonnes FFB. Increasing the efficiency of factory water use will reduce this volume and the associated storage/ pumping costs (see also Water, page 14).
- Effluent sludge from digestion ponds and land application beds/furrows should be redistributed to fields that have not received effluent application directly. Application of effluent must be avoided where contamination of streams/groundwater could occur.
- Recycle trunk nutrients at replanting. The trunks contain up to 1000 kg per hectare of K and effective recycling of this and other nutrients is a challenge to research and management. Current options are:
  - Windrowing to give a slower breakdown, especially if the palms were not poisoned prior to felling. A slower breakdown is more favourable for nutrient release to the replant, except for K, which is immediately leached on cell death.

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> Windrowing old palm trunks helps maintain soil organic matter and fertility in newly planted fields (for best practice, trunks should be covered by vegetation to help control the rhinoceros beetle)

- Shredding gives a faster breakdown, with all nutrients released within 2-3 years. Economic considerations will require that chippings be cost effectively spread over a much greater area than that of the replant alone.

Maximise Nitrogen (N) Input from Biological Fixation

- Good legume covers should be maintained for as long as possible after planting. In some environments it will be possible to maintain legume cover throughout the life of the palms.

Nitrate and Phosphate losses to Surface/Ground Water

- Loss of nitrate and phosphate by surface run-off and to ground water must be avoided. This is a particular concern on shallow soils or where heavy rainfall causes surface run-off/soil erosion. Elsewhere, losses will be small provided inputs can be maintained at a level close to exports in the crop.
- Take steps to minimise run-off losses by applying fertiliser when heavy rains are unlikely. Use frond placement and silt traps to contain run-off.
- Avoid applying fertilisers within 3-4 metres of watercourses.
- Algal blooms in ponds should be investigated. Blooms indicate nutrient run-off with surface water.

Potential Areas For Improvement

- A site-specific nutrients recycling plan should be drawn up: this will involve recycling EFB and effluent, each to the maximum area possible, whilst ensuring that the nutrients returned do not greatly exceed the amounts taken out in FFB. As noted under Soil Fertility (page 02), EFB should be applied preferentially in areas with low soil organic matter. To avoid over-application of K, EFB and effluent should not be applied to the same areas.
- There is some evidence that nitrogen is lost during anaerobic digestion. If this is confirmed, it would be better to recycle raw or less digested effluent, but the rate per hectare should not be so high as to clog up distribution systems, cause intolerable smell pollution, breed flies or induce soil anaerobic conditions. The rate per hectare will also require economic considerations. Effluent ponds should be regularly de-sludged and the sludge applied to fields with low soil organic matter.
- Work is needed to find ways to enhance efficiency of nitrogen fixation by legumes and other species as part of the crop cycle, including:
  - Researching legume species which persist longer (and continue to fix N) under shade e.g. *Calopogonium caeruleum* and *Mucuna bracteata* (see also page 05).
  - Investigating variation in N fixation rates among legumes and other species.

> Legume species planted under palms to provide nitrogen and ground cover

> Effluent irrigation channel to recycle nutrients from palm oil processing waste

  - Understanding inhibitory effects of N fertiliser application (to palms) on legume N fixation, to optimise the levels of N fertiliser if shade-tolerant legumes are used. In young palms this should not be a problem because the fertiliser is applied to the weeded circles close to the palms, whereas legumes grow in the interlines.
- More research on the nutrient cycle is needed. Establish a catchment study area, in which:
  - Application rates are varied for EFB, effluent and trunk chippings (from replants).
  - Palm yields, palm and soil nutrient levels and nutrients and sediments in streams leaving the catchment area are monitored.
- Investigate trunk pulverisation and use of the pulverised material in other fields during replanting.
- Investigate leaching losses from slow release fertiliser compounds.

4. Pest Management

Integrated Pest Management (IPM) is the key to sustainable pest control. The objective is to **adopt cultural, biological, mechanical, physical** or other less-hazardous strategies **to minimise the use of pesticides**. IPM is therefore the **careful consideration** of all these available pest control techniques and their subsequent **integrated use to improve biological balance**. This should discourage the development of pest populations whilst keeping pesticide and other interventions to economic levels and will also minimise risks to health and the environment.

Good Practice

Arthropod Pests and Fungal or Bacterial Diseases

- Local estate field manuals must include detailed methodologies for management of the pests and diseases in the area with emphasis on cultural controls.
- Procedures and protocols that mandate good supervision must be in place.
- Chemical application may kill natural enemies of pests and allow an epidemic to develop and hence should only be used where unavoidable and in the context of a well managed IPM programme.
- Key requirements for an IPM system include:
  - No prophylactic use of pesticides.
  - Routine cultural controls (such as destruction of breeding sites and maintaining good and varied ground cover).
  - Development of census systems for the main pests, founded on knowledge of life cycles and natural enemies.
  - Establishment of action thresholds for the main pests, based on economic damage levels.
  - If pesticide use is necessary, selectivity and good supervision are important to reduce eco-balance disruption and ensure operator safety.

Mammalian Pests

- The main problems in oil palm estates arise from rats (occasionally squirrels), elephants, porcupines and wild boar causing damage to new plantings adjacent to unplanted land, forests and riparian reserves.
- For rats, establish and maintain owl nest boxes and monitor occupancy. If socially acceptable locally, snakes and large reptiles may also be encouraged.

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> Checking owl boxes for occupancy. Owls are actively encouraged on estates as they are predators of rats - an important pest of palm oil fruit

- Monitor rat population and degree of damage to establish appropriate economic control levels, recognising that with biological intervention 100% control will not be achieved.
- Where adequate control cannot be achieved with owls and other predators alone, seek the more environmentally friendly baits and poisons.
- Use warfarin baiting only where necessary, strictly following the 4-day replacement round regime. Any deviation from this is likely to result in poor control and increase the risk of warfarin resistance developing. Second generation anticoagulants are more harmful to owls and should only be used if there is local evidence of warfarin resistance.
- For other mammals, prevent entry into plantings with the use of appropriate fencing.

Fungal Diseases

- Measures to minimise losses from known fungal diseases should be taken. These include:
  - *Ganoderma* (Malaysia, Indonesia, Thailand, India and Papua New Guinea) – practise high standards of field sanitation, especially where disease is detected.
  - *Fusarium* (Africa, Latin America) – plant tolerant material.
  - Fatal yellowing (Latin America) – ensure good drainage, avoid soil compaction and maintain good potassium status.

Weed Control

- Ensure that ecologically and medically safe compounds are used, applied in accordance with industry and extension services' best practice and using low volume spraying methods.
- To achieve sustainable weed control and reduce the risk of developing herbicide resistance, a planned programme of changing active ingredients may be introduced.
- Restrict spraying to the minimum areas necessary (palm circles, harvesting paths).
- Maintain interline vegetation mechanically if possible; if the use of herbicides is considered necessary, do not 'blanket' spray or eliminate all ground cover.
- Do not remove the soft epiphytes from palm trunks, which provide a habitat for predators of the main foliage pests. Only woody species need be removed.

Pesticide Use

- PESTICIDES MUST NOT BE USED if workers are not trained, proper use procedures are not in place, or appropriate application equipment and protective clothing is not available.
- Do not use pesticides that are not approved under local legislation.
- Pesticides should be selected with regard to terrestrial and aquatic ecosystem toxicity, to reduce the risk to operators and the environment. Management must be able to justify the use of each pesticide. Pesticide choice must take into account the effect on beneficial flora, fauna and micro-organisms.
- Purchasing decisions for pesticides should take account of quality (low cost generics may contain toxic by-products) and the quantity ordered must not exceed that which can be used before expiry dates. Purchase from suppliers who will take back empty containers for proper disposal.
- Pesticides must be stored safely and securely and usage procedures, including action to be taken in the case of spillage incidents, should be clearly defined and enforced.
- Spray equipment must be designed and maintained to use as little pesticide as possible, targeted effectively. It is important to minimise spraydrift, especially where drains, ditches or larger watercourses could be contaminated, or near accommodation.
- Accurate records must be kept of pesticide use.
- There must be careful attention to operator safety:
  - Training and retraining.
  - Provision of suitable protective clothing with regular checking and replacement.
  - Personal washing facilities must be available and used after working with pesticides. All clothing and equipment must be appropriately washed/cleaned.
  - Routine health checks for operators and appropriate measures should be in place for first aid and poisoning incidents, including access to antidotes.

> Spot spraying with proper targeting of weeds requires access to appropriate herbicides, application equipment, protective clothing and training

Potential Areas For Improvement

- Investigate the use of empty fruit bunch mulch (or trunk chippings or other mulch 'sheets') for circles in mature and immature areas to reduce herbicide requirement. Fertiliser application to circles could help weed control, but may give less efficient nutrient recycling than more widespread application.
- Further research into effective methods for the management of key pests and diseases (*Ganoderma*, *Fusarium*, fatal yellowing, *Oryctes*), concentrating on cultural practices, defining action thresholds and improving the safety and effectiveness of chemical methods of control.
- Promote research on bio-control agents (predators, parasites, bio-fungicides and pheromones) as IPM tools. Where results are encouraging, incorporate their systems into management practices and evaluate their effectiveness and consequences for pest management and the wider environment.

5. Biodiversity

Maintenance of **genetically diverse germplasm** of the crop is essential for the crop to meet changing needs of the future. **Conservation of biodiversity** in the estate and its surroundings is important, particularly where plantations are located in areas of high conservation value.

Good Practice

Crop Genetic Diversity

- Ensure that company plant breeding programmes include conservation projects for important breeding stocks.
- Support and/or participate in industry efforts to conserve crop germplasm.

Biodiversity Within and Around the Estate

- Abandon oil palm growing in unprofitable areas and convert such areas into wildlife reserves.
- Enhance the farm environment for locally important, rare or endangered species by providing appropriate habitats and adopting the right cultural practices, including the avoidance of pesticide damage to beneficial flora and fauna.
- Before any extension of the plantation into new areas, carry out a full environmental impact assessment and follow the resultant recommendations.
  - Extension into areas of 'primary' forest is NEVER acceptable.
  - Extension into degraded lands and areas previously used for other crops (or grassland), where available, is to be preferred over extension into areas such as forests or wetlands – even if partially degraded.
- Maintain riparian reserves along watercourses populated by native species. Plant native trees where they are absent. The size (width) of the reserve should at least equal the width of the watercourse if no national or regional requirements are in place.

Top
> Increasing biodiversity by providing a habitat for indigenous flora and fauna. A combination of forest and riverine conservation areas within a palm oil estate

- Link riparian and other reserve areas within the estate and neighbourhood wherever possible to form wildlife corridors and refuges.
- Plant more native trees in areas where they do not interfere with plantation operations. There are frequently opportunities in housing and recreation areas, along roadsides and in otherwise vacant land.

Potential Areas For Improvement

- Join efforts on a broader ('landscape') scale, to develop or conserve areas of forest or similar reserves, where needed to support stable populations of desirable species. Achieving larger reserves to support biodiversity will usually require working with other estates/land owners and public sector bodies.
- Work with international and local initiatives to encourage biodiversity, minimise use of ecotoxic pesticides and put in place Integrated Pest Management and conservation measures for rare or endangered species, within the farm (see also Pest Management, page 08).
- Co-operate with national museums and biodiversity research programmes to assess and document biodiversity of plantations and surrounding areas.
- Clearly establish the economics of the cultivation of marginal areas. Do they cost more than they are worth, with or without the ensuing damage being taken into account?
- Do not allow hunting within the estate.
- Enlist the appropriate Wildlife Department to assist in managing endangered animals that damage palms or threaten livelihoods.

> Areas of natural forest should be maintained on land unsuitable for cultivation

> Forest conservation is critical to management of water catchment areas

> Preserving the diversity of oil palm types will help producing regions provide palm oil for future generations

6. Product Value

> Laboratory measurement of palm oil quality including free fatty acid content and oxidation level

Sustainable agriculture must be **profitable**. On the output side, this will involve producing the optimum amount of high **quality** product, minimising costs/waste and adding value wherever possible. Consumer concerns about food safety, environmental performance and social responsibility must be satisfied.

Good Practice

Profitability

- Optimise yield, taking into account costs, to maximise margins.
- High yields, harvesting efficiency and the right harvesting standards are important in maximising product value, as are factory extraction efficiency and maintaining a high oil extraction ratio.

Product Quality

- FFA (free fatty acid) content and oxidation must be kept to acceptable levels to maintain access to the market. Fruit must be collected from the field soon after harvest and be processed quickly.
- All potential contamination sources in the product stream should be covered by strict quality control.

Potential Areas For Improvement

- Site specific precision agriculture to optimise inputs, thus reducing costs and enhancing productivity.
- Seek value addition wherever possible and profitable. For example, price premiums may be obtained for consistent quality produce, identity preservation and special quality oils.
- Plant breeding research for higher efficiency and value addition.

> Timely harvesting of fruit from the field to maximise quality

> In-field quality assessment of fresh fruit bunches

> Plant breeding programmes to improve quality and yield

7. Energy

> Reduce fuel use with careful planning and management of the logistics of harvesting and transportation and by keeping vehicles well-maintained

> A system of feeder and main roads provides for efficient crop harvesting and agricultural processes

> Emissions from palm oil mills should be regularly audited and reduction measures implemented where shown to be necessary

> Shells and fibre are used as a renewable energy source to power factory operations

The **efficient use of renewable energy resources** should be targeted since the use of non-renewable sources, such as fossil fuel, is not sustainable in the long term. **Greenhouse gases** and **polluting gaseous emissions** must be minimised.

Good Practice

Efficiency and the Use of Renewable Resources

- The use of shell and fibre (biomass) as fuel in palm oil factories ensures that non-renewable fuel consumption is low compared with the production of other vegetable oils. A high oil yield per hectare and processing factory locations within growing areas support relatively efficient fossil fuel use for field operations, as compared with other oil crops. There is nevertheless room for improvement:
  - Boiler and mill efficiency should be optimised. Invest in new, more efficient boilers if necessary.
  - The use of fossil fuel for vehicles, factory start-up and other activities should be minimised.
  - Wherever possible, surplus shell and fibre should be used to generate power for offices and housing.

Greenhouse Gas Emissions

- Minimise fossil fuel consumption (see above) and hence CO_2 emissions.
- The ponding of effluent to allow breakdown of its organic waste releases methane, which is more damaging as a greenhouse gas than the atmospheric CO_2 fixed in the waste. Field application of raw or partially digested effluent should reduce methane emissions.

Polluting Gaseous Emissions

- Install scrubbers in factory chimneys to reduce particulate and other polluting emissions significantly.
- If urea is used as a fertiliser, the release of ammonia may contribute to atmospheric nitric acid (a component of acid rain), but this is generally not a problem under high rainfall conditions.
- Controlled broadcast application and good drainage to avoid water logged conditions can help minimise the release of ammonia from nitrogen fertilisation.

Potential Areas For Improvement

- If effluent is digested, collection of biogas for use as a fuel (for vehicles, electricity generation, cooking or lighting) is possible but not normally economical. Government may need to be consulted to achieve changes in selling structures for electrical power or appropriate tax incentives. Renewable energy funding and emissions trading may provide mechanisms to finance the necessary research for reductions in greenhouse gas production.
- Further research is needed to understand the optimal use of co-products. There is potential as both a fuel source and a source of nutrients, and a need to minimise pollution risk. Hydrogen sulphide and ammonia produced in effluent ponds are pollutants and represent a net loss of nutrients from the system. There are, therefore, benefits from the field spreading of undigested effluent but these must be managed in the context of the risk of creating offensive smells, polluting nearby watercourses and potential phytotoxicity to palms.

8. Water

> Conserving areas of natural habitat along watercourses is critical to supporting stable populations of wildlife

> Water reservoir and treatment to provide domestic water supplies for employees

>Silt pits intercept run-off during periods of heavy rain, conserving water and soil in new and mature palm fields

Water may be used for **irrigation** of oil palms and is also used in the oil extraction process. The **volume used** and extraction from **sustainable sources** need to be considered, together with preventing potential **pollution from factory effluent** or discharge from factory washdowns.

Good Practice

Irrigation

- Use appropriate irrigation for nurseries. Drip systems use less water but require it to be very clean. Perforated tubes are more portable but do not provide uniform watering (unless raised) when seedlings are more than eight months. Overhead sprinklers are more wasteful of water but are a cheaper option for permanent nurseries where water is readily available.
- Monitor the quality of irrigation water. Water that is harvested from agricultural or industrial areas may have effects on soil nutrient retention and release equilibria. There may also be toxicity effects from pollutants.
- Apply irrigation where it is most cost-efficient to do so. It may be better to apply more water to a smaller area to achieve maximum return on capital and labour.
- If significant quantities of irrigation take place over a long term consider possible salinity build-up in the topsoil.

Factory Process Water

- Minimise process water use in the factory.
- Keep clean and dirty water separate. Do not send rainwater and washing water into the factory effluent stream. Check that flows do not mix during heavy rain.
- Ensure that any water harvesting is not at the expense of other users further downstream.
- Construct, maintain and tap from in-field dams and water catchments.
- Ensure that refuelling and lubrication operations for pumping equipment do not pollute watercourses.
- Monitor output from effluent ponds carefully to ensure that oxygen demand is not a problem.
- Where digested effluent is recycled, it is important to ensure that run-off does not enter watercourses.
- Buildings with appropriate roofing can feed water tanks to collect rainwater for non-potable domestic use and factory cleaning operations.

Potential Areas For Improvement

- Investigate differences in process water use between factories, and implement best practice on process water utilisation and handling of factory effluents.
- If effluent ponds result in loss of nitrogen (N), and thus less efficient nutrient recycling, field application of less digested effluent should be considered. The pollution aspects of this will need attention (see also Nutrients, page 07 and Product Value, page 12).

9. Social and Human Capital

> Palm oil estates have a very close relationship with employees who rely on the company for much of their social and economic needs including housing, healthcare and education

> Infrastructure for religious and cultural community support

> Housing and clean water supplies for employees

Good relationships with the **workforce** and their dependants, **local community**, suppliers, customers, district/regional and national **Government** and responsible **non-governmental organisations** (NGOs) are vital for long-term sustainability of a business. **Healthy, well educated people** are assets to the enterprise and vital for the sustainable development of the nation.

Good Practice

Relationships Within the Company

- All employers should adhere to legislation on employment benefits and conditions, child labour and social security. Where there is no such legislation institute nationally acceptable in-house standards. Terms and conditions should be such that the turnover rate amongst permanent employees and seasonal labour is low enough to ensure skill levels are maintained.
- Ensure employee grievance procedures are fair and transparent and that employees are confident to use them should the need arise.
- Institute regular channels for dialogue between management and employees.
- Provide housing, medical, educational and welfare amenities to national standards or above.

Relationships with the External Community

- Maintain dialogue with relevant national/local authorities, either directly or through industry bodies, and seek active influence in national Government/ industry/NGO partnerships and similar bodies.
- Maintain good relationships with the local community, encouraging responsible use of the land and company facilities for amenity, social or traditional purposes.
- Be a good customer, citizen and supplier – pay and supply on time and at the agreed price. Ensure that contracts with suppliers are fair, and that weak stakeholders are fully represented in the decisions that affect them.
- Ensure that all transactions have legal standing.
- Group together with other neighbouring industry members to develop local supply-chains.
- Use Annual Reports and other means to enhance the company image through communicating the company's high standards of social, human and environmental care.

Human Capital

- Ensure workers and their families have access to medical, educational and recreational facilities. Health and welfare programmes should include clean water provision, vaccination programmes, HIV awareness, nutrition information and education in the advantages of having smaller families.
- Encourage social programmes that enhance literacy, health, safety and environmental awareness. Rural literacy can be improved by "starting them young" i.e. rural child care centres or crèches should include learning programmes besides physical care.
- Safety and environmental awareness should be part of communications with local communities.
- Make training and re-training a permanent feature of employment.

Potential Areas For Improvement

- Farmer groups and larger plantations may consider developing partnerships with Government to address shared threats and support public services.
- Develop methods of 'Social Impact Assessment' for new plantation projects.

10.Local Economy

> Training events for local smallholders encourage growers to share experiences of good agricultural practice leading to improvements throughout the growing community. This benefits both farmers and the local economy

> Sustainable agriculture visitor centres can help to educate employees and the local community about the importance of sustainable growing practices

Rural communities are dependent on sustainable local agriculture. Farmers and estates can help **build and sustain** these communities, to **mutual benefit,** by buying and resourcing locally.

Good Practice

- Use competitive local goods and service suppliers wherever practical.
- Provide maximum employment opportunities for local people.
- Encourage employees to spend their money in support of their families, maximising longer-term community benefit through improving standards of living and infrastructures.
- Contribute to and/or encourage savings.

Potential Areas For Improvement

- Work with local suppliers and national institutes to develop or find competitive local alternatives to imported goods and services.
- Seek multiplier effects in contributing to the local economy. Prefer suppliers who source locally and who are not mere intermediaries, supplying materials from outside the local economy.

> Prize winning smallholder. Local growers can be encouraged to adopt more sustainable practices through award schemes

Bibliography

Sustainable Palm Oil Publications from Unilever

- **Palm Oil: A Sustainable Future.** Providing background to our approach to palm oil and sustainable agriculture.
- **Sustainable Palm Oil: Good Agricultural Practice for Farmers.** A practical guide for the smallholder farmer.
- **Sustainable Palm-Oil: Methods for Sustainable Agriculture Indicator Assessment.** A detailed technical guide to the methodologies recommended for the measurement of sustainability indicators.

Other Sustainable Crop Publications from Unilever

- **Tea: A Popular Beverage - Journey to a Sustainable Future.**
- **Sustainable Tea: Good Agricultural Practice Guidelines.**
- **Sustainable Tea: Methods for Sustainable Agriculture Indicator Assessment.**
- **In Pursuit of the Sustainable Pea: Forum for the Future and Birds Eye Wall's (Unilever).**

Sustainability Initiative Publications from Unilever

Agriculture

- **Growing for the Future: Unilever and Sustainable Agriculture.**
- **Growing for the Future II: Unilever and Sustainable Agriculture.**

Fish

- **Fishing for the Future: Unilever's Sustainable Fisheries Initiative.**

Water

- **Our Everyday Needs: Unilever's Water Care Initiative.**

Copies of these booklets can be obtained from www.unilever.com or can be requested by e-mail from sustainable.agriculture@unilever.com.

For more general background on Unilever and Sustainability, the Environment and Social Responsibility visit www.unilever.com (click link for environment & society) or visit www.growingforthefuture.com for specific information on the Unilever Sustainable Agriculture Initiative.

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