

# RSPO Smallholder Best Management Practices Manual

for Existing Oil Palm  
Cultivation on Peat

## Chapter 5

Best Management  
Practices for Operation



The background of the page is a close-up photograph of oil palm fruit bunches. The fruits are in various stages of ripeness, showing colors from dark purple to bright orange. The image is slightly out of focus, with the foreground fruits being sharper than the background ones.

# DISCLAIMER

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The statements, technical information and recommendations contained in this Manual are based on best practice and experiences, and prepared by the members of the RSPO Peatland Working Group 2 (PLWG 2) and the RSPO Independent Smallholder (ISH)-PLWG subgroup. The guidance in this Manual does not necessarily reflect the views of the RSPO Secretariat or any of the individual contributors, sponsors and supporters of the process. The publication of this Manual does not constitute an endorsement by RSPO, the PLWG, or any participants or supporters of the development of new oil palm plantations in peatland areas. While every effort has been made to ensure the accuracy and completeness of the information in this Manual, no guarantee is given nor responsibility taken for any errors or omissions, in both typographical and content, and over time the contents may be superseded. Therefore, this Manual should be used as a guide and is not intended for the management of farms on peatlands. As the results of the implementation of these practices may vary according to local conditions, neither RSPO nor the PLWG or any contributors or supporters of the process can be held liable for the results of the application of the guidance in this Manual.

This handbook is applicable to smallholders in general (refer to RSPO ISH Standard).



# ACKNOWLEDGEMENT

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## HOW TO USE THIS BMP MANUAL

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**This BMP Manual was developed with seven Chapters that focus on topics relevant for existing oil palm cultivation on peat.**

**Along with this BMP, an extract from the RSPO ISH Standard Auditor Checklist is provided in Annex 1 as a guide for certification bodies and it may also be used by Group Managers (GM).**

**Non-compliances issued to an Independent Smallholder (ISH) group shall be for the non-compliance to the requirement of the RSPO ISH Standard and not against this BMP Manual.**

## HOW A GM CAN BENEFIT FROM THIS BMP MANUAL

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**(Across all chapters)**

The objective of this Manual is to provide a set of practical guidance on BMPs for GM and/or smallholders to manage existing oil palm cultivation on tropical peat in line with Criteria 4.4 and 4.5 of the 2019 RSPO ISH Standard.

## APPLICABILITY OF THIS BMP DURING AUDIT

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This BMP Manual was produced as a recommended guidance for ISH with existing oil palm cultivation on peat. This is not to be taken as a compulsory practice and used against certification since ground conditions may vary according to location. It is the role of the GM or smallholders to evaluate the condition of the farm before the implementation of these BMPs.

# CHAPTER 5: BEST MANAGEMENT PRACTICES FOR OPERATION

# 05

## 5.1 TREATMENT FOR EXISTING LEANING PALMS

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A major problem with oil palm cultivation on tropical peat is leaning palms. Random leaning and in severe cases, fallen palms, are mainly due to peat subsidence. The low bulk density of peat and the less extensive root system of oil palm planted on peat are also contributory factors to leaning and fallen palms.

About 40-50% of the palms planted on peat can lean at various angles and directions at the age of about 7-8 years. The number of fallen palms increases thereafter mainly due to excessive root exposure, desiccation, and breakage caused by the weight of the palms.

Depending on the severity of leaning and fallen palms, a yield reduction of 10-30% can occur due to root damage and poor interception of sunlight for photosynthesis. The different directions and degrees of leaning palms also interfere with harvesting due to differential palm height.



*Figure 1: Leaning palms mainly caused by peat subsidence*

A practical approach to rehabilitate leaning and fallen palms is to carry out soil mounding to minimise root desiccation and promote new root development (see Figure 1). The soil for mounding the exposed roots of leaning palms should be taken from outside the palm circles in order to prevent damage to the surface feeder roots (Lim and Herry, 2010).



*Figure 2: Rehabilitated leaning palm after two years of soil mounding carried out on exposed roots*

Good water management to maintain the water level at 50-70 cm (from water level in collection drains) or 40-60 cm (groundwater piezometer reading) is crucial to minimise peat subsidence and reduce leaning palms.

To avoid leaning palms, proper compaction should be done at the time of planting or replanting to increase the bulk density of the soil, which enhances its water holding capacity and is thought to reduce subsidence and leaning palms.

## 5.2

# REPLANTING PRACTICES TO MINIMISE INCIDENCE OF LEANING PALMS

Leaning palms is one of the major problems of planting oil palms on tropical peat. Random leaning (in severe cases, fallen palms) are mainly due to peat subsidence, which can be avoided with proper compaction at the time of replanting. Alternatively, hole-in-hole planting method can also be applied during replanting.

### Replanting flow:

1	Prior Replanting Assessment	<ul style="list-style-type: none"><li>• To identify risk of long-term flooding/saline intrusion and peat soil profiling (depth of peat, underlying parent materials: potential acid sulphate/acid sulphate soil, sandy soil, etc.).</li><li>• Key aspect is to identify problematic areas and avoid replanting on those that are less productive (flood prone, etc.).</li></ul>
2	Plan out drainage system, water management structure, road system, planting density, etc.	<ul style="list-style-type: none"><li>• If assessment determines that the area is suitable for replanting and done at the same planting density as before, basic drainage can be used and replanting cost will be lower. If additional water management structures are required, it is best to plan before replanting.</li><li>• A planting density of 160 palms per ha on medium to deep peat is recommended, with 148 palms/ha on shallow peat. High density 180 palms/ha is also practiced by some in anticipation of the potential loss by pests and diseases.</li></ul>
3	Replanting (mechanical felling, chipping, compaction and hole-in-hole planting)	<ul style="list-style-type: none"><li>• During replanting, mechanically fell and chip the trunks to about 10 cm thick and heap on stacked rows every 4 palm rows.</li><li>• Excavate palm boles and root tissue of Ganoderma infected palms. The size of excavation needs to be 2 m x 2 m x 1 m. Excavated boles and root tissues are cut into small pieces and heap on top of the stacked rows to desiccate. The excavated holes are to be filled by spoil from collection drains, levelled and compacted.</li></ul>

## Replanting flow:

<p>3 Replanting (mechanical felling, chipping, compaction and hole-in-hole planting)</p> <p>(Continued)</p>	<ul style="list-style-type: none"><li>• Removal or chain-sawing of protruding stumps along mechanisation paths is important to minimise risk of puncturing of low ground pressure (LGP) tyres and snapping of rubber tracks.</li><li>• Surface compaction prior to planting and/or hole-in-hole planting of seedlings is important to minimise future palm leaning.</li><li>• For hole-in-hole planting, the seedling bole needs to be 15 cm below the compacted peat surface after planting. It is also important to ensure that the base of the planting hole is levelled and compacted by the worker before putting in the seedling for planting.</li><li>• To facilitate deep planting, it is useful to lower the water level in the collection drains to about 90 cm from the peat surface.</li><li>• About 1 month after planting is completed, increase the water level in the fields back to 35 cm from the peat surface.</li></ul>
<p>4 Construction of harvesting path</p>	<ul style="list-style-type: none"><li>• After lining of planting rows, collection drains and stacking rows, now wait longer than 18 months after planting.</li><li>• Elevated mechanisation path of about 3.5 m width and 50 cm height with a slight camber can be constructed using residual woody materials less than 15 cm diameter.</li><li>• In areas where there are insufficient woody materials, non-elevated but compacted paths of about 3 m width can be constructed. They are constructed by removing protruding stumps, filling surface cavities followed by 1-2 rounds of compaction using a tracked excavator.</li></ul>

### Info Box:

1. Replanting is normally carried out when the yield is below economic level and may be accelerated in the event of low productive stands caused by *Ganoderma* infections or other disease problems. Yield of second-generation palms on peat is generally better than the first-generation palms as peat is more compact and better decomposed.
2. When replanting, care must be taken to minimise, where possible, disturbance of the soil as this may increase greenhouse gas (GHG) emissions. Palm trunks should be chipped or applied directly to the plantations as surface mulch for reducing the direct impacts of rainfall and sunlight on the peat. Zero burning must be applied, and measures are taken to encourage rapid establishment of soft vegetation. In view of the new insights on optimal drainage levels, excessive deepening of drainage ditches should be avoided.
3. The elevated paths are useful for future mechanisation for in-field fresh fruit bunch (FFB) evacuation and to minimise the effect of subsidence on harvesting paths.
4. *Fimbristylis acuminata*, a common weed on peat areas with extensive surface root systems, should be encouraged or planted on peat roads or mechanisation paths to further strengthen the peat surface against rutting by moving vehicles.



Figure 3: Hole-in-hole planting on compacted peat surface.

## 5.3

# GROUND COVER MANAGEMENT/WEEDING AND MAINTENANCE OF HARVESTING PATH

It is recommended to maintain a natural cover of soft vegetation (grasses, ferns, mosses, or leguminous cover crop):

- For soil moisture conservation and to improve soil fertility.
- To reduce direct exposure of the peat surface to sunlight, thus reducing the risk of peat fire.

### Weeding flow:

1	Chemical weeding, only palm circles (2.5-metre radius) and harvesting path	<ul style="list-style-type: none"><li>• Without delay to ensure good accessibility and crop recovery especially loose fruit collection.</li></ul>
2	Choice of spray equipment and herbicides.	<ul style="list-style-type: none"><li>• Based on cost-effectiveness and labour productivity. Herbicides used must be relatively safe for workers and have minimal impact on the environment. Herbicides that are quick acting and do not destroy the root system of soft weeds should be used.</li></ul>
3	Frequency.	<ul style="list-style-type: none"><li>• Any delay or neglect in weed control will lead to rapid deterioration of field conditions, especially in immature areas. Six to nine rounds of weeding per year are recommended for immature peat plantations due to the fast weed growth in peat areas (compared to 4-5 rounds for oil palm plantations on mineral soils).</li></ul>
4	Woody growth/tree seedlings	<ul style="list-style-type: none"><li>• Woody growths (tree seedlings) on the inter-rows or harvesting path can be controlled by brushing with Garlon: Diesel mixture (at a ratio of 1:19) on a 30 cm band on the basal stems.</li><li>• Alternatively, woody growth can be mechanically flattened using a tracked excavator, followed by 1-2 rounds of herbicide spraying.</li><li>• Where appropriate, rather than spraying the tree seedlings, they can be harvested and transferred to a nursery for rehabilitating any degraded conservation areas within or adjacent to the plantation.</li></ul>



### Info Box:

1. With zero-burning, most of the early weed species are indigenous, mainly ferns (especially *Nephrolepis biserrata*, *Stenochlaena palustris*, *Dicranopteris linearis*), sedges (e.g. *Fimbristylis acuminata*, *Cyperus rotundus*), and woody species (e.g. *Uncaria spp.*, *Macaranga spp.*, *Melastoma malabathricum*) (Lim, 2003). Subsequently, other species are brought in by agricultural activities, road materials, wind and water, e.g. *Mikania micrantha*, *Merremia spp.*, *Mimosa pudica*, *Asystasia intrusa*, *Digitaria spp.*, *Ischaemum muticum*, *Imperata cylindrica*, *Eleusine indica*, etc.
2. *Uncaria spp.* or “pancingan” is a fast spreading woody creeper in many peat estates. Slashing will lead to more rapid proliferation. If not properly managed, this noxious weed can cover an entire estate within a short time. The control is by uprooting the weeds. High water table (less than 25 cm from the peat surface) and periodic flooding should be minimised as such conditions expedite the proliferation of several weed species on peat especially *Uncaria spp.*
3. *Fimbristylis acuminata* with extensive surface root system is either encouraged or planted on peat roads to reduce erosion and peat degradation (Lim, 2002).

## Do's

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- ✓ Zero burning
- ✓ Maintain weeding at palm circles. Palm avenue, allow light vegetation to grow.
- ✓ Timely spraying of noxious weeds with selective herbicides to promote the growth of desirable ground cover is advocated to minimise the weed succession problem. The strategy is to keep the palm circles clean and inter- rows devoid of noxious weeds. (especially *Lalang*, *Mikania micrantha*, *Ischaemum muticum*, etc.).

## Don'ts

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- ✗ Burning for ground clearing
- ✗ Blanket Weeding – can lead to irreversible drying and increase the risk of peat fire.



## ANNEX 1: RSPO ISH STANDARD AUDITOR CHECKLIST

Criteria	Indicators	Checklist
4.4 Where smallholder plots exist on peat, subsidence and degradation of peat soils is minimised by use of best management practices.  <b>Do any smallholders within the group have existing plots on peat? If no, SKIP</b>	<b>4.4 E</b> Group manager confirms presence of peat on existing plots within the group and smallholders on peat commit to using best management practices and minimizing subsidence and degradation of peat soils (Reference 1.1 E, Annex 2).	<ol style="list-style-type: none"> <li>1. Has the group manager identified the existence of peat within the group members existing plots?</li> <li>2. How many of the group members have peat on their existing plots?</li> <li>3. Have the smallholders signed a declaration to commit to using best management practices and minimizing subsidence and degradation of peat soils?</li> <li>4. Is the group manager aware of best management practices for peat?</li> </ol>
	<b>4.4 MS A</b> Smallholders complete training on best management practices (BMPs) for peat. The group has an action plan to minimise risk of fire, to apply BMPs for plantings on peat and manage a water system in the certification unit.	<ol style="list-style-type: none"> <li>1. Have smallholders participated in training on best management practices (BMPs) for peat?</li> <li>2. What are the evidence of training conducted?</li> <li>3. Who provided the training?</li> <li>4. When was the training provided?</li> <li>5. Has the group developed an action plan to minimise risk of fire, to apply BMPs for plantings on peat and manage a water system in the certification unit?</li> <li>6. What are the fire fighting system available?</li> <li>7. Can the smallholder demonstrate understanding on the best management practices (BMPs) for peat including the action plan to minimise risk of fire and, manage water system?</li> </ol>

Criteria	Indicators	Checklist
<p>4.4 Where smallholder plots exist on peat, subsidence and degradation of peat soils is minimised by use of best management practices.</p> <p><b>Do any smallholders within the group have existing plots on peat? If no, SKIP</b></p> <p>(Continued)</p>	<p><b>4.4 MS B</b> Smallholders implement the group's action plan based on best management practices, including fire and water management and monitoring of subsidence rate for existing plantings on peat.</p>	<ol style="list-style-type: none"> <li>1. Have the smallholders implemented the action plan to minimise risk of fire, to apply BMPs for plantings on peat and manage a water system in the certification unit?</li> <li>2. What are the evidence of implementation of the action plan ?</li> <li>3. What are the fire prevention and control systems available ?</li> <li>4. How are the smallholders monitoring subsidence rate for existing plantings on peat ?</li> <li>5. How are the smallholders monitoring the water levels for existing plantings on peat ?</li> </ol>
<p>4.5 Plots on peat are replanted only on areas with low risk of flooding, saline intrusion as demonstrated by a risk assessment.</p> <p><b>Do any smallholders within the group have plans for replanting plots that are located on peat? If no, SKIP</b></p>	<p><b>4.5 E</b> Smallholders commit to provide information on all plans for replanting and commit that replanting will only be in areas with low risk of flooding and saline intrusion (Reference 1.1.E, Annex 2).</p>	<ol style="list-style-type: none"> <li>1. Have the smallholders signed a declaration to commit: <ul style="list-style-type: none"> <li>• to provide information on all plans for replanting and</li> <li>• that replanting will only be in areas with low risk of flooding and saline intrusion.</li> </ul> </li> <li>2. Has the group manager collected and compiled information on replanting by group members?</li> </ol>

Criteria	Indicators	Checklist
<p>4.5 Plots on peat are replanted only on areas with low risk of flooding, saline intrusion as demonstrated by a risk assessment.</p> <p><b>Do any smallholders within the group have plans for replanting plots that are located on peat? If no, SKIP</b></p> <p>(Continued)</p>	<p>4.5 MS A Smallholders with plots on peat complete training on identification of future risks of flooding associated with subsidence and alternate land development strategies.</p>	<ol style="list-style-type: none"> <li>1. Have smallholders with plots on peat participated in training on identification of future risks of flooding and alternate land development strategies?</li> <li>2. What are the evidence of training conducted?</li> <li>3. Who provided the training?</li> <li>4. When was the training provided?</li> <li>5. Are the smallholders aware of the risk associated with subsidence? What are the identified risk associated with subsidence?</li> <li>6. Have alternate land development strategies been identified?</li> </ol>
	<p>4.5 MS B Prior to replanting on peat smallholders complete a risk assessment related to flooding associated with subsidence and, where there is high risk, present a plan that includes alternate land development strategies, preferencing alternative livelihood planning.</p>	<ol style="list-style-type: none"> <li>1. Is there replanting on peat by the smallholders in the group?</li> <li>2. Has a risk assesement related to flooding associated with subsidence been carried out prior to replanting ?</li> <li>3. What was the risks identified in the risk assesement ?</li> <li>4. For high risk area, is there a plan that includes alternate land development strategies, preferencing alternative livelihood planning ?</li> <li>5. Is the group manager aware of replanting activities (on peat) by group members ?</li> </ol>

## ANNEX 2: RECOMMENDED SOP FOR FIRE PREVENTION AND CONTROL PLAN

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(Adapted version courtesy of Standard Operasional Prosedur Pemadaman Kebakaran Lahan, KUD Makarti No.23/SOP-KUD-MKRSM/IV/2019)

When encountered the risk of fire, there are several steps that can be taken towards fire prevention and control:

1. Should there be fire hotspot detected, the flames should be stopped immediately with basic equipment.
2. The group members shall report to the Internal Control System of the group or Fire Emergency Unit should the basic equipment is not enough to quench the flames.
3. The Fire Emergency Unit will immediately report to the Fire Agency or related agency.
4. All group members are responsible to quench the flames and conduct the evaluation.

## ANNEX 3: RECOMMENDED TABLE/SOP FOR WATER LEVEL MONITORING

(Adapted version courtesy of ISH Group 1 Asosiasi Petani Sawit Swadaya Amanah No.022/ DOK/ SOP/ APSSA/2020 dated 12 February 2020)

1. Maintain the water level by establishing drainage channels and installing modest dams to monitor the water level.
2. Modest dam is established at specific points; specifically, main outlet and the cost will be borne by the smallholder group.
3. The high point of water level on the modest dam will be monitored every one month.
4. In order to monitor the water level, the drainage channel will be set as a water level measurement tool, which is made by PVC pipe. The length of the PVC pipe shall be 2 m (1.5 m above the collecting channel surface and the rest (50 cm) should be rooted in the soil.
5. The measurement on the modest dam will be set as 0 from the soil surface.
6. The measurements in the PVC pipe (0 cm, 10 cm, 30 cm, ...150 cm) should be marked in red with a white base color and the optimum measurements (60 cm and 80 cm) should be marked in black.
7. The material of the modest dam should be waterproofed and used as a cantilever (such as bamboo) and placed in a sand sack.
8. The High Conservation Value (HCV) team identifies the location points to establish the modest dam.
9. The modest dam will be constructed once the request has been approved by the group manager.
10. Once the modest dam has been constructed, the HCV team will evaluate the effectiveness of the dam and monitor the water level every month.
11. Install the subsidence stake from the iron pipe to monitor the decrease of water level.
12. The HCV team identifies the location points from the installed subsidence stack.
13. The result shall be reported to the group manager to get approval for establishing the modest dam.
14. The subsidence stack will be constructed once the request has been approved by the group manager.
15. Once the subsidence stack has been constructed, the HCV team will evaluate the effectiveness of the dam and monitor the water level every month.

## REFERENCE

- Community Engagement in Peatland Restoration: Free, Prior, and Informed Consent (FPIC), News from the Landscape, USAID. Retrieved from <https://www.lestari indonesia.org/en/community-engagement-peatland-restoration-free-prior-informed-consent-fpic/>
- Clause 6.1, ISO Quality Management System 9001:2015
- International Society of Soil Science – IUSS. 1930. Report to The Subcommittee for Peat Soils of The International Society of Soil Science. Washington D.C., USA, U.S. Bureau of Chemistry and Soils
- Lim, K. H. (2002). R & D Focus: Oil palm planting on deep peat in Sarawak. MPOA Seminar 2002 – R & D for Competitive Edge in the Malaysian Oil Palm Industry. 19-20 March 2002, Bangi, Selangor, Malaysia.
- Lim, K.H. (2003). Agronomic management of oil palm planted on deep peat in Sarawak. MOSTA Seminar on Recent Advances in the Oil Palm Sector: Agriculture, Plantation Management, End Uses and Nutrition, 8-9 May 2003, Sandakan, Sabah, Malaysia.
- Mandych, A. F. (2009). Classification of floods. Water Interactions with Energy, Environment, Food and Agriculture-Volume II, 218.
- Paramanathan, S. 2016. Organic Soils of Malaysia: Their characteristics, mapping, classification and management for oil palm cultivation. MPOC, 156 pp.
- Parish, F., Lew, S.Y., Faizuddin, M. and Giesen, W. (Eds.). 2019. RSPO Manual on Best Management Practices (BMPs) for Management and Rehabilitation of Peatlands. 2nd Edition, RSPO, Kuala Lumpur.
- Sideman, B. (2016). Growing Vegetables: Tomatoes. UNH Cooperative Extensions.
- Singh, P. K., & Hiremath, B. N. (2010). Sustainable livelihood security index in a developing country: a tool for development planning. Ecological Indicators, 10, 442e451.
- Ritzema, H.P., Mutalib Mat Hassan, A. and Moens, R.P. 1998. A New Approach to Water management of Tropical Peatlands: A Case Study from Malaysia. Irrigation and Drainage Systems 12 (1998) 2, p.123-139
- Wüst, R. A., & Bustin, R. M. 2004. Late Pleistocene and Holocene development of the interior peat-accumulating basin of tropical Tasek Bera, Peninsular Malaysia. Palaeogeography, Palaeoclimatology, Palaeoecology, 211(3-4), 241- 270.

RSPO is an international non-profit organisation formed in 2004 with the objective to promote the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders.

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