GLOBALG.A.P.®

Integrated Farm Assurance

Guideline for Flowers and Ornamentals

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This guideline is a recommendation for consideration.

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1 CONTINUOUS IMPROVEMENT PLAN

1.1 Documentation of a continuous improvement plan

No process is perfect; there is always room for improvement. You as a producer are aware of the need to constantly have an eye on your products to achieve the best result. This also applies to the idea of the continuous improvement plan.

Continuous improvement means systematically identifying and mitigating waste of resources as quickly as possible and at the lowest possible cost, thus increasing efficiency. In short: continuous improvement is the consequent increase of productivity in small steps.

The process of continuous improvement includes monitoring and analyzing data. Only with relevant data can self-defined targets be planned, implemented, and verified. Such a target does not necessarily have to be a numerical value. A yes/no statement, for example on whether a particular goal has been reached, is also possible.

Within the context of the standard, the initial approach to continuous improvement is:

- Establishing a continuous improvement plan: Major Must
- Implementing the continuous improvement plan: Minor Must

The continuous improvement plan identifies relevant self-defined targets and describes how progress toward each target will be monitored. The plan may include:

- Topic
- Current status with date of initial establishment of target
- Planned activity
- Planned outcome with estimated date of achievement

Once the targets documented in the continuous improvement plan have been reached, new targets are established by the producer.

1.2 Implementation of a continuous improvement plan

It is up to you to choose the topics and activities for continuous improvement of your operation. Once a topic and activity are identified, you shall document this in your continuous improvement plan.

The continuous improvement plan shall be established for the first self-assessment and CB audit to IFA v6. The plan may cover a period of time, normally a period of three to four years, but is linked to the planned activities (can also be within one year). Within this set time, milestones (defined targets) can be defined to be able to verify whether the activities are having the intended effect.

For the first self-assessment, internal audit, and CB audit, the continuous improvement plan will be established.

During the second self-assessment and CB audit to IFA v6, the initial results of the continuous improvement plan shall be presented and discussed.

The implementation of the continuous improvement plan is supported by documents and/or other objective evidence. The evidence kept on file may include:

- Actual outcome of efforts, with date of evaluation
- Comments on why the effort was successful or not successful

Once the topics in the continuous improvement plan are implemented, new topic(s) shall be identified and a new continuous improvement plan shall be established.

If one or more of the goals identified in the continuous improvement plan are not reached, justification and description of further action shall be documented.

1.2.1 Implementation in Option 1 (individual certification)

An individual producer is allowed to implement one or more verifiable topics. These may differ per product, region, or any other factor.

1.2.2 Implementation in Option 2 (group certification)

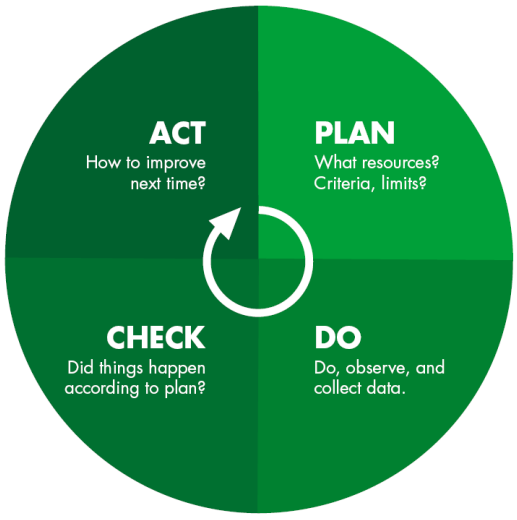
For a producer group there are different ways of implementing the continuous improvement plan. What is important is that all producer group members be involved.

- Implementation of one or more topics at producer group level
  - Not all producer group members may be doing the same activity.
  - Activities may differ per product, region, or any other factor.
- Implementation of one or more topics at producer group member level
  - All producer group members are involved.
  - Activities may differ per product, region, or any other factor.
- Implementation of one or more topics at producer group and producer group member levels
  - All producer group members are involved either at producer group or producer group member level.

1.2.3 Plan – Do – Check – Act cycle

Careful management of this process is essential. To make sure that the integration of data and reporting in the production process's day-to-day operations is working, having a good plan and the right tools is essential.

The Plan – Do – Check – Act (PDCA) cycle is a good tool for continuous improvement.



The four steps of the PDCA cycle are:

- **Plan**: Identify of an opportunity for continuous improvement in the production process. Plan how to implement the change. Write down the expected results once you have determined your course of action.
- **Do**: Implement the change on a small scale.
- **Check**: Analyze data on the results of the change and determine whether it made a difference.
- **Act**: If the change was successful, implement it on a wider scale and continuously assess the results. If this change did not work, identify another opportunity for continuous improvement and start the cycle again.

1.3 Examples

Continuous improvement can mean: *Responding, reducing, maintaining, achieving, completing, ensuring, enhancing, improving, etc.*

For example:

- Responding to complaints within a specified time frame
- Reducing the number of complaints/non-conforming products
- Improving a training program/traceability system

In the different sections of IFA v6 there is reference to topics that may be identified for the continuous improvement plan, for example the consumption of:

- Water
- Energy
- Fertilizer
- Plant protection products

For these or other topics targets can be defined, for example based on volumes. However, any other topic can be chosen. The list below is not exhaustive and only offers ideas. Other topics covered in the standard or related to the production process can also be used for the continuous improvement plan.

a) Workers' well-being
    - Support of professional development (training)
    - Social benefits
    - Childcare
    - Improvement of social surroundings
    - Incentives for good and safe working performance

b) Biodiversity
    - Buffer strips along watercourses
    - Planting trees
    - Retention of landscape features (walls, hedges, ponds, watercourses, or trees)
    - Building new structures (stones, wood) next to farm or production areas

- Conservation of wild birds (birdhouses for birds and bats)
- Stopping invasive alien species

c) Other

- Outcome of self-assessment
- Complaint management

2 SUBSTRATES – PEAT SUBSTITUTION

While it is acknowledged that different raw materials used in substrates may have different impacts on the environment, P&C FO 04.03.04 refers to peat obtained from moors or from *Sphagnum* spp. (peat moss). It does not refer to coconut peat.

10% of volume refers to the total volume (not weight) of raw materials used in substrates during one year in a single operation. Soil is excluded.

- A mass balance of raw materials used in substrates throughout the year (bought or created on-site)

versus

- Amount of raw materials used in substrates in products sold, in production, and in stock shall be used to determine the percentage

If 10% is not achieved, a documented justification shall be available. The justification may be technical or economic.

Peat is a raw material used in substrates and is not renewable, according to the definition of the Dutch Association of Substrate Producers (VPN, www.devpn.nl). The renewability threshold is below 50 years.

The overall purpose of P&C FO 04.03.04 is to reduce nonrenewable raw materials used in substrates.

A producer that has achieved 10% may start looking at future ways in which it will be possible to even further reduce both peat and other nonrenewable raw materials used in the substrates.

If using peat, the producer can also consider using peat derived from sources certified as responsible.

2.1 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

2.2 National interpretation

In addition to following national legislation, it is good practice to consider using nationally available renewable raw materials for substrates.

2.3 References

On substrates and the sustainability policies of substrate producers in the Netherlands: www.devpn.nl

On responsibly produced peat: www.responsiblyproducedpeat.org

2.4 Examples

Relevant if registrations and calculations are requested.

% = Volume of peat used in one year divided by total volume of raw materials in substrates used in one year

Units: e.g., liters or m^3

Volume of peat:

- Invoices for (amounts of) peat used in one year
- Estimated amount of peat present in product sold in one year
- Estimated amount of peat present on the farm (cultivation/stock).

Total volume of substrates (for all type of substrates, excluding soil):

- Invoices for (amounts of) other substrate used in one year
- Estimated amounts of homemade substrate
- Estimated amount of peat present in product sold in one year

Estimated amount of peat present on the farm (cultivation/stock)

3 WATER MANAGEMENT

This guideline is intended for producers seeking GLOBALG.A.P. certification. It is designed to help them carry out and comply with principles and criteria (P&Cs) concerning water use, such as performing a risk analysis and drafting a water management plan. This guideline attempts to identify all the relevant factors that need to be considered and/or the measures that need to be implemented to support effective water management on the farm.

3.1 Prevailing regulation

Most countries have prevailing regulations that govern the use of water, permits for water abstraction, restrictions on the amount allowed to be abstracted, storage facilities, and other considerations. Adherence to prevailing regulations is required by the standard, and where prevailing regulations have not been established, international guidelines (e.g., from the World Health Organization and/or European Union) may serve as references.

3.2 Responsible water management on the farm

Good practices for improving a farm's water management focus on:

- Reducing direct and indirect contamination of water bodies from agricultural fields
- Not depleting water sources
- Helping to improve the efficient and safe use of water resources to grow crops

Specifically, recommended good practices for water management at farm level mainly address:

- Irrigation and soil (e.g., avoiding overirrigation, leaching, excessive drainage, and agricultural runoff; reducing soil erosion; improving soil fertility; etc.)
- The use of plant protection products (PPPs)
- The application of fertilizers and organic soil amendments such as manure
- Waste management (e.g., the management of spray tank leftovers, the disposal of empty PPP containers, etc.)

The following points characterize sustainable and responsible water management at farm level:

- Farm management has an overview of all the water sources surrounding the farm. This includes identifying the sources that are used for abstraction, identifying how much water is abstracted and when, and having an overview of the farm water distribution system.
- Farm management is aware of any water sources considered to be in a critical state as per common knowledge, i.e., publications in the media, conflicts with a community or with civil society organizations.
- The farm uses water resources in an efficient and planned manner for irrigating crops.
- The irrigation water quality is controlled.
- There is control over the possible return of wastewater from the farm back into water bodies.
- There is proper handling and use of PPPs, fertilizers, and organic soil amendments (correct time, place, and amount of application).
- Good soil management practices are in place (to prevent soil erosion, improve the soil's water retention and as such prevent water pollution by surface runoff, subsurface runoff, and drainage).

3.2.1 Water quality

The three main sources of water contamination in agriculture are chemical (i.e., nitrates, phosphates, and agrochemicals), physical (e.g., soil, stones, glass), and microbial (e.g., nematodes, fungi, bacteria, viruses).

This can affect both the farm as well as the water sources and the surrounding environment, and in some cases, the health of workers or the community outside the farm.

If excessive quantities of organic and/or inorganic fertilizers build up in surface waters, this can cause eutrophication of water bodies.

It is important to handle and use *PPPs* and *fertilizers* according to their registered uses, while following recommended best practices to prevent such products from transferring to other parts of the environment, notably vulnerable areas such as drinking water sources.

Fertilizer applications may result in runoff that enters irrigation systems, particularly during times of heavy rainfall or flooding. The standard requires careful control of organic fertilizer. However, water quality may also be impacted by neighboring land through which irrigation water passes.

The application of PPPs shall be conducted in a manner that mitigates water contamination. In addition to evaluating the effect of practices on the production area under certification, consider risks associated with neighboring land and applications.

3.2.2 Direct and indirect contamination

Direct contamination (also known as point source contamination) refers to clearly identifiable sources of contamination, for example spills of PPPs made during mixing and loading of the sprayers or the disposal of tank leftovers in fields without properly diluting the mixture and/or without considering adjacent water bodies.

By contrast, *indirect contamination* (also known as diffuse source contamination) is distributed at various locations around the farm and fields. Transfer routes from indirect sources include runoff, drainage, leaching, and spray drift. The prevention of indirect source contamination is more

complicated than the prevention of direct contamination. Preventing indirect source contamination often involves changing agricultural practices in the field, for example by introducing:

- Vegetative buffers at the edges of cropped fields
- Crop rotation with more diverse crops
- Improvements in soil organic matter and erosion prevention
- Contour cropping
- Minimum tillage
- Modified irrigation scheduling and rates
- Use of low-drift spray nozzles
- Recalibration of spray equipment, etc.

It is important to assess whether direct contamination occurs on the farm and to identify the main areas of risk. This will enable plans to be put in place to ensure that risks are reduced.

Evaluating the risk and likelihood of indirect contamination to agricultural water may be more challenging. A careful assessment of the production area may reveal indicators that a risk is present. For example, visible erosion in the form of tramlines indicates the occurrence of surface runoff. This may be caused by poor infiltration capacity of the soil due to poor soil management practices (e.g., deep plowing, no crop rotation, and/or the absence of a proper farm traffic plan). It is more difficult to assess whether the fields are susceptible to leaching of agrochemicals. Local farm advisers or farm service providers can support producers in assessing the risk of agricultural runoff, leaching, drainage, and drift from agricultural fields.

According to the type and source of contamination, tailored mitigation measures and best management practices can be implemented. The most important mitigation measure is the correct management of PPP applications. It is important to keep track of the weather forecast. Applying PPPs before a heavy shower can increase the risk of agricultural runoff and leaching, leading to contamination of water bodies.

3.2.3 Water sources

There are four types of water source:

- Groundwater: Water that is captured and stored naturally under the soil. Renewable groundwater is stored in underground aquifers which are usually recharged in the short term by rainfall. Fossil groundwater is stored in deeper aquifers which are not recharged by rainfall.
- Surface water: Fresh water in lakes, rivers, natural and artificial ponds, canals, and ditches
- Municipal water or water from an aqueduct
- Captured water: Water stored in reservoirs, tanks, or artificial basins

Unsustainable (over)abstraction of water from *groundwater aquifers* can cause a drop in the groundwater table. Lower groundwater tables impact not only the producers, as they will have to drill deeper to abstract groundwater, but also the wider community. It can also cause the intrusion of salt water into freshwater aquifers in regions close to the sea.

A good practice for producers is to reduce their consumption of irrigation water through more *efficient use* (and thus less wasteful irrigation). This can be achieved by better irrigation management through timely applications of the correct amount of water the crops need. It can also be achieved through better soil management, for example, by increasing the organic matter content or investing in mulching, both of which improve the soil's water retention. Some crop

varieties also use water more optimally. Moreover, better retention of available water in the soil allows crops to consume more water, which can improve crop biomass and yields in rain-fed agriculture in arid and semiarid regions. Increasing soil organic matter content is critical in raising the soil's capacity for holding water. The efficient use of water for irrigation also does not reduce crop yields if planned properly, for example by avoiding water stress (e.g., by using soil moisture probes).

3.3 Good practices for water management

The following are examples of practices that may be implemented to ensure responsible on-farm water management:

3.3.1 Water quality

- At regular and frequent intervals, test the quality of irrigation water and monitor, where possible, the amount of effluent entering water bodies from agricultural fields.
- Preferably mix and load the PPP sprayer on a concrete/impermeable area at the farm within a safe distance from streams, ditches, wells, food and feed storage rooms, residential areas, and roads. Make sure that the area has a small depression that directs spills and wastewater from washing the sprayer and the nozzles into an artificial drain for collection and safe disposal. The collected effluent and any remnants, such as tank leftovers, can be sent off for disposal to authorized waste disposal companies or treated at the farm using an effluent management system.
- Never mix PPPs or load PPP sprayers in the vicinity of irrigation storage reservoirs.
- Use the correct irrigation method based on crop, soil, climate, and slope to prevent erosion, leaching, evaporative losses, and agricultural runoff.
- Reduce agricultural runoff by improving topsoil permeability. This can be done, for example, by preventing capping or compaction of the soil, introducing controlled farm traffic, and improving soil structure by applying minimum tillage or no tillage if the soil and other circumstances allow this.
- Install buffers next to streams to prevent agricultural runoff from directly entering surface water bodies. This will protect surface water bodies from agrochemicals or nutrients that may run off the fields due to precipitation or irrigation.
- Do not irrigate with surface or groundwater if it is contaminated (e.g., by microbes, heavy metals, industrial pollutants, etc.).
- If irrigation water is recycled through a drainage system, check that the crops receiving the recycled water are not sensitive to herbicides in water even at very low concentrations (this information is normally provided on the label about sensitivities of crops).
- Do not use PPPs with high leaching potential (the label will normally state this) if the groundwater table is very close to the surface and the soil is vulnerable to leaching (e.g., sandy soil or heavy clay with extensive cracks).
- Ensure that oil from tractors and equipment is not disposed of in ditches.
- Adhere to all local laws and bylaws regarding water quality management.

3.3.1.1 Surface irrigation systems

- For crops treated with agrochemicals, ensure that border, basin, or furrow irrigation is delayed for a few days after applications. In the case of furrow irrigation or if the borders are relatively small, surge irrigation can be applied to allow for better infiltration of water into the soil, avoiding runoff at the tail ends.

- Avoid irrigating with water that contains a high level of industrial effluents or with greywater. The use of untreated sewage of human origin is not permitted by the standard, even if the sewage is diluted into irrigation water.

3.3.1.2 Sprinkler and drip irrigation systems

- If PPPs are applied through chemigation, routinely inspect and maintain delivery systems to ensure nozzles are functioning without drips or obstructions.
- Use delivery mechanisms (e.g., nozzles, lines, pumps) designed to accommodate and be compatible with chemigation. Ensure that permanent drip irrigation systems (such as in orchards) are equipped with back-flow prevention devices.
- Implement water applications in accordance with root volume and depth in an effort to minimize leaching.

3.3.2 Water quantity

- Maintain the correct irrigation rate and intervals depending on crop needs, soil type, and water availability. The latter is important because in the case of serious water shortages or water scarcity, one can choose to apply deficit irrigation, i.e., applying water during the most critical growth stages of the crops, such as flowering, to prevent yield loss.
- Avoid overirrigation to prevent leaching, agricultural runoff, and drainage.
- Minimize evaporative losses, for example from open water surfaces.
- When using groundwater for irrigation, use it sustainably. This means not abstracting more than the yearly recharge rate to avoid a drop in the groundwater table.
- Maintain an appropriate irrigation application rate depending on the crop, the growth stage, the availability of water, and the crop water requirements, which also depend on the weather conditions (heat and amount of precipitation).
- Obtain and follow advice on the correct irrigation application rates during the season from water user associations, local water management authorities, or private service providers. Producers can also estimate correct irrigation application rates themselves if tools such as soil moisture probes are available.
- Engage in timely maintenance of the irrigation system to reduce leaks and improve irrigation efficiency and water use efficiency.
- Increase the soil's water retention, reduce agricultural runoff and leaching, and prevent soil erosion. The soil's water retention can be improved by increasing soil organic matter. Conservation agriculture, which includes minimum tillage or no tillage, helps improve soil organic matter depending on the local circumstances, e.g., soil type, climate, etc.
- Monitor and document water use.
- In the case of rain-fed agriculture, tools can be put into place to store excess precipitation, which can be used in periods of water stress and improve water quantity management. Precipitation can be stored by collecting water from roofs or by storing water in reservoirs built in areas that are not cultivated. It is recommended to assess the economic investment against the benefits in terms of water volumes captured.

3.3.2.1 Surface irrigation systems

- Improve conveyance and application efficiencies where needed and possible. If return flows have clearly proven to be useful for downstream users and this does not financially impact the producer, allow these return flows to occur and avoid recapturing these flows for reuse in the irrigation system.
- Properly maintain irrigation systems, considering efficiency and water quality when designing updates or new system installations.

3.3.2.2 Sprinkler and drip irrigation systems

- Use quality drip lines to decrease damage and leaks.
- Optimize irrigation efficiency by monitoring the application pattern, avoiding unintended overlap of sprinklers.
- Drip irrigation: Use correctly sized pipes or tubes and maintain the appropriate level of pressure.

3.4 Guideline on the GLOBALG.A.P. principles and criteria to water management on the farm

This section provides guidance on what to consider for supporting the sustainable and responsible management of water and fulfilling the requirements of the standard. This is particularly important in regions where water resources are scarce.

3.4.1 Predicting irrigation requirements

Producers who use a groundwater well or abstract water directly from bordering streams or ditches can use tools, such as weather data and soil moisture probes, to best decide when crops need to be irrigated. Proper planning of an irrigation schedule is strongly recommended. Different tools can be used to do so, and local agronomists and farm advisers can support farm management in training, scheduling, and in properly calculating the crop water requirements.

Also, data from the on-farm water management plan can support the producer in estimating how much water would be needed to irrigate the crops and assess whether there are/will be water shortages and water needs to be stored.

If water is allocated by a water user association, producers may receive advice from the water user association on when and when not to irrigate the crops.

The water management plan may include a reference to how the crop water requirements have been calculated, and how the irrigation schedule has been agreed.

3.4.2 Water risk assessment

A documented risk assessment may include an identification of the relevant environmental impacts and risks to workers' health, of off-farm impacts on water sources, or of on-farm water use. This includes risks concerning the potential contamination of water (water quality) as well as the overuse of water (water quantity).

For this purpose, it is important to assess the way in which water is used and to identify any activities that could result in the inefficient and wasteful use of water, as well as opportunities for more efficient water use. Issues such as overirrigation and the use of wastewater for irrigation shall be addressed.

Farm water sources and distribution systems may be described to help identify potential sources and opportunities for contamination. The risk assessment will provide guidance on how to best

manage possible direct and indirect sources of contamination. The risk assessment shall be reviewed, updated, and approved annually by farm management and shall be farm-specific.

3.4.3 Water source

The risk assessment may address the water sources on and surrounding the farm and the specific use of the water.

- Describe the sources and distribution systems of water used on the farm.
- Identify which sources of water are under pressure or considered critical by stakeholders.
- Describe any natural or man-made water bodies on the farm.
- Determine whether the water source contains nitrogen and phosphorus, and consider these amounts, if significant, in fertilization programs.
- Determine whether the water source contains debris and/or sediment.
- Identify any national legislation stipulating maximum allowed residue levels of PPPs, nitrogen, and/or phosphorus in groundwater and surface water.

3.4.4 Permits and licenses

- Determine whether permits or licenses are needed to abstract and store groundwater or surface water.
- Quantities of water within legal limitations: Determine whether local authorities or irrigation schemes to which the producer belongs have set any water use restrictions.
- Permits for all installations: Determine whether permits are needed for wells, pumping stations, storage basins, and/or distribution systems.

3.4.5 Water use

- Identify all uses of water on the farm.
- Identify activities that could result in wastage and overuse of water (e.g., leakage from water distribution systems, poorly maintained irrigation equipment, inefficient irrigation).

3.4.6 Water quality

- Determine whether the use of water could result in runoff containing PPPs, phosphorus, nitrogen, and/or hazardous contaminants.
- Identify activities that could be potential sources of contamination of water bodies (streams, ponds, etc.) and water sources. This includes the disposal of wastewater, spray-tank washings and leftovers as well as the use of agrochemicals (pesticides, organic/inorganic fertilizers).
- Identify locations where wastewater and spray-tank leftovers are disposed of, and these locations' proximity to water sources.
- Identify locations where the use of PPPs could contaminate water bodies and sources through runoff or spray drift.
- Identify locations where the storage or use of organic or inorganic manure could contaminate water bodies and sources through runoff (e.g., where there is close proximity to water or where land is steep).

3.4.7 Water management plan

A written on-farm water management plan will help identify practices that may need to be changed or optimized to improve overall on-farm water use and water quality management. Such a plan can be better implemented if approved by the farm manager.

An on-farm water management plan can provide a description of which measures are in place or will be put into place. These measures address the efficient use of water resources as well as the prevention of contamination of water bodies. The plan can be formulated based on the risk assessment. It can include factors to mitigate the risks identified in the risk assessment and include training for producers and workers to ensure proper implementation.

Short and long-term plans for improvement, with timescales where appropriate, shall be included. This plan can either be an individual plan or a regional activity that the farm may be participating in or be covered by such activities.

The plan shall take note of the fact that untreated sewage shall not be used for fertigation or irrigation.

3.4.8 Sustainable soil and crop management practices

- Implement practices such as conservation agriculture, mulching, controlled traffic, crop rotation and planting of cover crops. These can reduce agricultural runoff and thus possible contamination of surface water bodies.
- Raise the soil's organic matter content.
- Choose crop varieties that use water optimally (perhaps with specific features to optimize water use).

Losses

- Prevent water loss in the irrigation system, such as application of excessive volumes .
- Prevent leaks through effective maintenance of the irrigation system.
- Use well-designed basins, pipes, and pumps to avoid losses.

Evaporative losses

- Prevent substantial evaporative losses in the irrigation.
- Attempt to avoid such losses by measuring or estimating them.

Irrigation interval

- Ensure irrigation intervals are managed to ensure efficiency.
- Consider precipitation events and the soil moisture content to calculate the required irrigation interval and irrigation application rate.
- Be flexible and reactive in adjusting the irrigation interval according to changing crop water requirements.

Pressure management in hydrants

- In the case of pressurized irrigation systems (i.e., sprinkler and drip irrigation systems), ensure the correct pressure is maintained in all hydrants and on all plots to optimize the distribution of irrigation and thus avoid too much or too little irrigation.

Downstream shortages

- Consider whether the use of water by the farm could cause water shortages downstream.

It is recommended to include the following aspects in the on-farm water management plan:

a) Measure the water use for all on-farm water abstraction and distribution infrastructure, such as:
   - All groundwater wells used for irrigation (m^3/month, m^3/year)
   - All intakes from streams or ditches (m3/month, m3/year)
   - All irrigation infrastructures, such as water distribution pipes or channels
   - Main, secondary, and tertiary irrigation channels and gates in the case of surface irrigation water pumps (capacity m^3/ha)
   - All hydrants in the case of a pressurized irrigation system
   - All reservoirs either used for irrigation or used to capture precipitation
   - All water-harvesting constructions

b) Make a map of all fixed constructions on the farm. The map may also include larger water bodies outside the farm if any are close to the fields.

c) Identify instances where the distribution of water is centrally managed. This may include water distribution through associations or governmental organizations. Identify production areas irrigated by private wells or by pumping from adjacent waterways.

d) Include data on crops and water use: Measure/Estimate how much water has been applied on the field (m3/ha/month/crop, m3/ha/year/crop). Review and explain the methods used to calculate this.

e) If possible and relevant to the irrigation method used (e.g., drip irrigation systems, etc.), include irrigation system efficiency data, such as the conveyance, which will help in assessing and improving the efficiency of the irrigation infrastructure. Conveyance is the efficiency of water transport in irrigation canals or through irrigation pipes. This efficiency is a function of canal/pipe length, canal characteristics (e.g., earthen or lined canals), soil type, and system maintenance and can be determined using widely available estimation tables (measured in percentage) and application efficiencies (the volume of water added to the root zone divided by the volume of water applied to the field (measured in percentage).

f) Indicate how crop water requirements are calculated. Also include the irrigation intervals and length of irrigation cycles. Optimal intervals and cycle lengths shall be maintained. For example, in the case of furrow-irrigated fields, surge flow can significantly improve irrigation uniformity and beneficial uptake of the water by crops. Temperature can also trigger differences in intervals (e.g., lower temperatures allow longer intervals and thus a reduced need for crop evapotranspiration).

g) Maintenance: It is important to have a plan in place for the maintenance of the irrigation system and of farm machinery:
   - Indicate how often the fixed water abstraction and distribution infrastructure are maintained and/or repaired and who is responsible for maintenance/repairs.
   - Address whether there is proper pressure management for optimal design flow through the drip and sprinkler irrigation systems.
   - There shall be a plan in place in case emergency maintenance is required.

- The persons who carry out the maintenance shall be properly trained to do so.
- Maintenance records shall be available and include a description of the repairs, the name(s) of individual(s) who completed the repairs, and the date.

h) Surface irrigation systems: Address whether the design of surface irrigation systems makes optimal use of gravity to minimize the use of pumps and consequent energy use.

i) Direct and indirect sources of contamination: Outline any measures put in place to mitigate the risks related to direct and indirect sources of water contamination identified in the risk assessment. The plan needs to address issues such as potential spillage from the PPP mixing area and the sprayer loading and cleaning area, as well as contamination due to agricultural runoff, leaching, and/or drainage.

j) Fertigation and/or chemigation: If fertigation and/or chemigation activities are maintained, outline the details of the process (e.g., amounts applied, whether drip irrigation systems are used for fertigation/chemigation, etc.). Measures to mitigate any risks of contamination of water bodies and/or sources identified in the risk assessment shall also be outlined (e.g., avoiding applications on or near water, especially on sloping land; use of runoff-reducing techniques such as contour planting).

k) Climate data: Add information concerning the precipitation and temperature and, if available, the reference evapotranspiration throughout the year to make informed decisions on irrigated agriculture. Indicate whether this information is easily accessible.

l) Training: Assess who needs training and in which topics. Drafting/Implementing a comprehensive water management plan may require training on matters, including logbooks and record keeping. Producers, technicians, and farm workers may also need basic training in on-farm water quality management; the management, maintenance, and operation of irrigation systems; and water quantity management. Producers, technicians, and farm workers shall be aware of the water management plan and its goals.

   Basic training on the following is recommended to assist the farm in implementing good water management practices:

   - The control of water quality
   - Safe use of pesticides on the farm and how to handle the sprayer and spray solutions/remnants
   - Management of the soil to maintain soil organic matter, improve infiltration capacity, improve soil water retention, and prevent erosion
   - Calculating the crop water requirements to make informed decisions about when to irrigate, what the irrigation interval shall be, whether deficit irrigation can be applied in times of need, etc.

m) Record keeping: The guidance on record keeping is provided under the guidelines of metrics.

n) Water use permits and licenses: Indicate all prevailing regulations and irrigation scheme rules concerning water abstraction and use. The plan shall aim to ensure that all necessary licenses and permits have been obtained, are up to date, and are complied with. It shall include details on all records that need to be kept to demonstrate how all relevant licenses, bylaws, and regulations are complied with.

   Permits may be required for installing water storage infrastructure and for the on-farm use of the captured or stored water. For example, local water harvesting and storing of precipitation shall not impact users elsewhere in the catchment area.

o) In the plan, indicate the fact that untreated sewage shall not be used for fertigation or irrigation.

3.5 Example – risks summary

How to use the table below:

- In the column "status/risk," identify whether the related issue is applicable to the situation on the farm. The questions aim to provide guidance. Use short sentences or answer "yes/no".
- In the column "action," include a short sentence describing an action which can be referenced in the water management plan.

Type of risk	Issue		Status/Risk	Action
Physical	**Water scarcity**	Does the river basin or area face water scarcity due to the overexploitation of water resources? Might water scarcity affect the current or planned water usage by the producer? Does the producer contribute significantly to water scarcity in the river basin or area, or might the producer do so in future?		
	Drought events	Does the river basin or area face droughts due to irregular rainfall? Would droughts affect the producer's water use? How flexible is the farm's water use? Might droughts affect environmental, social, and/or cultural issues?		
	Flood events	Does the river basin or area face floods due to irregular rainfall or water management? Might floods affect the producer? Might this variability affect environmental, social, and/or cultural issues?		
	Water pollution	Does the river basin or area face water pollution? Are current or potential pollution sources upstream or located in the same groundwater area as the producer? Might pollution affect the product or production? Might pollution affect environmental, social, and/or cultural issues?		

Type of risk	Issue		Status/Risk	Action
	Alternative water sources	Do alternative, non-overexploited and/or nonpolluted water sources exist? Can this water be allocated to the producer on a regular basis? Can this water be allocated to the producer in extreme situations (drought, pollution, etc.)? Are there (new) storage mechanisms in order to address temporary extreme situations? What are the environmental effects of the alternative sources or water storage systems?		
Regulatory	**Water allocation and management scheme**	Is the river basin or area managed according to a plan or scheme? Have interested parties and the public been consulted on this plan or scheme, and hast it been approved by the corresponding water authority? Is the plan being implemented and updated on a regular basis? Is the producer's water usage included in the plan or scheme? If not, is the producer's water usage consistent with the plan's allocation and management scheme? Does this plan adequately consider environmental, social, and/or cultural issues?		
	Water use permit	Is there a procedure for acquiring a water use permit? Does the producer hold a water use permit adequate to their actual water use? Does this permit interact with other (water use) permits?		
	Unauthorized use of water	Does the producer use any water without a corresponding permit? Do other users use water without a corresponding permit? Might such unauthorized use of water affect the producer's water use permit or the use of water? Might such unauthorized use of water affect environmental, social, and/or cultural issues?		

Type of risk	Issue		Status/Risk	Action
	Priority use	Is the use of water prioritized in the river basin or area? What is the ranking of the producer in relation to other water users? Are specific regulations foreseen for extreme situations (drought, pollution, etc.)? In trend scenarios of priority water users and extreme situations, is the producer's water use at risk? Can the permit be derogated in order to supply water to priority water users?		
Reputational	**Water conflict**	Does the river basin or groundwater area cross national, regional, local, or cultural/ethnic borders? Are there conflicts over water in the river basin or area? What are the reasons for these conflicts? Are these conflicts addressed by conflict-resolution dialogue processes? Is the producer involved in water conflicts in this particular area or in any other geographical area in which the producer operates? Are similar water users involved in water conflicts in the river basin or area or adjacent areas?		
	Environmental issues	What is the current situation of the freshwater environment in the river basin or area? What are the environmental and biodiversity trends for the river basin or area? Might these environmental trends negatively affect the farm's operations? Does the farm's water usage significantly impact, directly or indirectly, key environmental or biodiversity features? Has the producer developed a (public) environmental statement and/or plan? Does this plan respond to any water-related environmental conflicts or concerns that have arisen? Is this plan implemented, audited and updated on a regular basis?		

Type of risk	Issue		Status/Risk	Action
	Social issues	What is the current social situation regarding water issues (access to drinking water and adequate sanitation, etc.) in the river basin or area? What are the social trends for those aspects? Might social requirements or claims negatively affect the farm's operations? Does the farm's water use significantly impact, directly or indirectly, access to drinking water and sanitation for the inhabitants of the river basin or area? Has the producer developed a (public) statement and/or plan in this regard? Does this plan respond to any conflicts or concerns that have arisen on the water usage? Is this plan implemented audited, and updated on a regular basis? Is this plan publicly accessible?		
	Cultural issues	What are the key cultural issues related to water in the river basin or area? What has been their evolution? Might cultural trends, requirements, or claims negatively affect the farm's operations? Does the farm's water use significantly impact, directly or indirectly, the cultural heritage of the river basin or area? Has the producer developed a (public) statement and/or plan in this regard? Does this plan respond to any conflicts or concerns that have arisen on the water usage? Is this plan implemented, audited, and updated on a regular basis?		

Type of risk	Issue		Status/Risk	Action
	Farm's water management	Is water on the farm managed according to a plan? Does this plan include keeping records of historical, current, and future use of water? Does this plan include provisions for the sustainable and efficient use of water? Does this plan respond to any conflicts or concerns that have arisen regarding the farm's water management? Is this plan implemented, audited, and updated on a regular basis?		
Financial	**Financing**	Does the producer require regular or irregular external financing? Do the (current and potential) investors consider water-related criteria in their funding evaluation? Are there any specific aspects (e.g., water management plan, water use permits) required by the investors? Do the investors establish thresholds for compliance with their water-related criteria?		
	Insurance	Has the producer insured their operations? Do the (current and potential) insurance operators consider water-related criteria in their evaluation? Are there any specific aspects (e.g., water management plan, water use permits) required by the insurance operators? Do the insurance operators establish risk thresholds for compliance with their water-related criteria?		
	Water pricing	Does the producer pay for water use? How is this price/tax/tariff fixed? Does it include operational costs and (environmental) externalities? Is the pricing system stable, foreseeable, and transparent? How likely is it that water prices will be increased on a regular or irregular basis?		

4 INTEGRATED PEST MANAGEMENT – DEVELOPMENT/RETENTION OF BASIC KNOWLEDGE

To be successful with IPM, it is important to have a basic knowledge of:

- The key pests, diseases, and weeds that can affect a crop
- The potential strategies, methods, and products to control them

For this purpose, producers shall gather information on:

a) Pests, diseases, and weeds relevant to their production. Producers shall have the following basic information: list of relevant pests, diseases, and weeds in the target crop for that specific area, region, or country. A pest is considered relevant once it has a significant effect on a registered or relevant crop. Relevance to a particular crop can be based on one or more of the following:

   - When a crop occupies a significant area
   - When the pest management costs of the crops are significant
   - When the crop value is significant

   Basic information (e.g., fact sheets) about the biology of the relevant pests, diseases, and weeds and about their natural enemies, including:

   - Information about their life cycle
     - Different life stages and their approximate dates of appearance
   - Development requirements (minimum temperature threshold for development, number of flights per season, season of the year when they attack or develop, etc.)
     - Overwintering places (in the case of pests)
   - Photo guides to relevant pests (different stages), diseases, and weeds and their typical damage
   - Photo guides to relevant natural enemies (different stages)
   - Economic injury levels and action thresholds
   - Knowledge about organisms that have a quarantine status in target/export markets

b) Plant protection products. Producers shall have the following basic information: list of plant protection products (PPPs) that can be legally applied against the relevant pests, diseases, and weeds in the target crop. Basic information (fact sheets) about:

   - Mode of action
   - Contact route (systemic, translaminar, vapor activity, contact, stomach)
   - Dose rates
   - Persistence
     - Re-entry (interval) time
   - Optimal application technique
   - Optimal timing of application
   - Maximum number of applications per season
   - Selectivity for natural enemies and for pollinators

c) Other protection methods. Similar information shall be available for other protection methods.

d) Training. Training of relevant workers (own workers or specialized consultant) in the following topics:

- IPM principles, techniques, methods, and strategies
- Recognition of pests, diseases, weeds, and relevant natural enemies
- Scouting and monitoring techniques, including record keeping
- Knowledge about PPPs and application techniques

4.1.1 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

4.1.2 National interpretation

Local legislation or industry specific information may be added to a national interpretation guideline.

4.1.3 References

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IOBC-OILB, 2004, Guidelines for Integrated Production: Principles and Technical Guidelines. 3rd ed. Switzerland.

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FAO, 2002, International Code of Conduct on the Distribution and Use of Pesticides.

EISA, Code on Integrated Farming

5 INTEGRATED PEST MANAGEMENT PLAN

The IPM plan is a document in which the producer lists/describes the strategies they plan to use, or already use, to manage the relevant pests, diseases, and weeds for each specific crop (individually or per group of crops).

The document can, for example, be organized around a specific crop (or group of crops), describing for this crop the following:

- Relevant pests, diseases, and weeds
- Intended strategies for the pests, diseases, and weeds (listed, or ideally also briefly described)

- Possible interactions between strategies (e.g., the use of plant protection products (PPPs) may affect a natural enemy)

Strategies may include monitoring activities (identify), a threshold (if applicable), and/or preventative and control measures.

A pest, disease, or weed is considered relevant if it needs to be managed (costly to control).

The following can be included:

- A stepwise approach to managing pests
    - Preventive measures, including the planning phase of the crop, and hygiene measures to avoid spread of pests, diseases, or weeds
    - Successive measures compatible with introduced natural enemies, if applicable
    - Between each step or strategy, thresholds as defined by the producer based on own experience, external advice, or training
    - Introduction of the use of more toxic or less compatible PPPs if and only if the previously mentioned thresholds are passed

Note: By default, the order of the strategies in the stepwise approach is expected to follow the above-described gradual increase of measures; however, it is up to the producer/advisor to judge whether the situation requires, e.g., the initial use of a PPP to make manageable the growth conditions of the crop, and aim to re-establish the path of a stepwise approach as described above.

- Growing conditions which could promote the development of the relevant pests, diseases, and/or weeds
- Measures to avoid the build-up of resistance to PPPs in the relevant pests, pathogens, diseases, and/or weeds

Producers shall critically evaluate, at least every year, their current crop protection practices and systematically evaluate the potential outcome of different IPM practices for their crop.

5.1 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

5.2 National interpretation

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6 INTEGRATED PEST MANAGEMENT – PREVENTATIVE MEASURES

Efforts shall be made to mitigate problems with pests, diseases, and/or weeds to avoid the need for intervention. This includes the adoption of cultivation techniques and management actions at farm level to prevent the incidence and reduce the intensity of pests, diseases, and weeds. In the case of some chronic pests (see reference below), this may include preventative pest management options, including spraying or seed treatments.

6.1 Potential integrated pest management (IPM) measures before planting

6.1.1 Risk assessment

Make a risk assessment of the site.

6.1.1.1 History of the site

- Which crops have been grown on this site in the last three years?
- What were the main problems with pests, diseases, and/or weeds on this site?
- Which plant protection products (PPPs) were used?
- Has the PPP use:
    - Created problems with residues on your crop (e.g., because of pesticide accumulation in the soil)?
    - Caused pest or disease outbreaks during the following cropping season (e.g., because pests' natural enemies were exterminated in perennial crops such as trees and vines)?

6.1.1.2 Context of the site

- What are the IPM practices on neighboring crops?
- What PPPs are used on neighboring crops, and what is the risk of drift?
- What potential pest or disease problems could be created by surrounding crops and vegetation?

6.1.1.3 Soil and water samples

Take and analyze soil and water samples to check for:

- Presence of diseases and pests (including nematodes)
- If relevant, presence of PPP residues, heavy metals, and/or other toxins
- The nutritional level of the soil

6.1.2 Prevention

Where relevant, the following preventive measures shall be considered for new sites.

6.1.2.1 Soil

For the prevention of (soil) pests, nematodes, (root) diseases, and weeds, the following measures can be taken:

- Crop rotation according to a crop rotation program and depending on the crop
- Year of rest/fallow, depending on the crop
- Disinfection of the soil or of the growing substrate (e.g., solarization, fumigation, inundation, steaming, hot water)
- Promotion and/or augmentation of beneficial macrobial and microbial soil organisms
- Clean tillage or sanitation of crop residues (including fruits in the case of tree crops) to reduce overwintering populations of certain pests or diseases

6.1.2.2 Water

Preventive measures shall be taken to ensure:

- Clean water (meeting local regulations about pests, diseases, and chemical residues or reducing their content, if applicable)
- Optimal irrigation methods and/or use of fertigation

6.1.2.3 Plants

Preventive measures that can be taken to reduce problems with pests, nematodes, and diseases include:

- Choice of optimal, resistant varieties
- Use of resistant rootstock (grafting)
- Use of pest- and disease-free starting material (seeds or plants), possibly by testing for pests and pathogens in the rhizosphere
- Optimal plant spacing or plant density

6.1.2.4 Climate

Climatic conditions can have a big influence on the development of diseases, as well as on pests and weeds. Therefore, consider:

- Cultural measures to prevent or reduce the development of pests and/or diseases
- The establishment of a climatological monitoring station or subscription to an information or warning service

6.1.2.5 Timing

With respect to the (first) appearance of key pests, diseases, and weeds during the cropping season, consider:

- The choice of an optimal planting date to reduce or avoid problems with key pest, diseases, and weeds
- The choice of early-maturing or short-season varieties to avoid periods with high infestation pressure from certain pests or diseases

6.1.2.6 Location and site selection

Assess risks from neighboring crops as potential source of especially problematic harmful pests or diseases.

6.2 Potential preventive measures during cropping

Cleanliness of the farm (hygiene and sanitation)

Hygienic measures are aimed at preventing pest, diseases, and weeds from entering the field and from further spreading or dispersing in the crop.

Prevent transmission of pests, diseases, and weeds by *vectors* by:

- Identifying vectors, such as insects, animals, pets, rodents
- Identifying actions to keep these vectors out of the crop
- Identifying whether weeds in the borders or adjacent areas might be hosting pests

Prevent transmission of pests, diseases, and weeds by *people* by:

- Working from healthy to diseased plants and areas
- Wearing suitable clothing, gloves, shoes, hairnets (depending on the crop)
- Disinfecting hands, shoes, clothes before entering the field, especially after visiting other producers' plots (depending on the crop)

Prevent transmission of pests, diseases, and weeds by *equipment* or materials by:

- Cleaning all equipment (including machines) and materials after working and before entering a new field
- Using different, dedicated equipment and materials in different fields (if possible) depending on the crops
- Using clean harvesting boxes and crates

Prevent transmission of pests, diseases, and weeds through crop residues by:

- Cleaning the orchard after pruning, harvest, leaf-picking, and any other task that produces organic residues
- Not keeping any crop residues near the field

Prevent drift of PPPs from neighboring plots by:

Making agreements and communicating with neighboring producers to eliminate the risk of undesired drift

6.3 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

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7 INTEGRATED PEST MANAGEMENT – MONITORING, SCOUTING, AND DECISION-MAKING

Monitoring is the systematic inspection of the crop and its surroundings for the presence, developmental stage (eggs, larvae, etc.), intensity (population level, infestation level), and location of pests, diseases, and weeds.

It is one of the most critical activities of integrated pest management (IPM), as it will alert the producer to the presence and level of pests, diseases, and weeds in the crop. This will allow the producer to choose the most appropriate intervention.

Monitoring and decision support tools are major instruments for reducing the number of interventions with chemical plant protection products. As such, these instruments are fundamental for a reliable and sustainable IPM plan. Monitoring is preferably used in combination with the decision support tools.

7.1 Organization

7.1.1 Responsible person

- Nominate a person responsible for scouting and monitoring.
- This person shall receive training in:
  - Recognizing pests, diseases, and weeds
  - Scouting and monitoring techniques
  - Record keeping
- This training shall be refreshed on a regular basis.

7.1.2 Observation

Organize a monitoring and scouting program for the farm:

- Identify which pests, diseases, and/or weeds shall be monitored and why.
- Establish how they shall be monitored (direct observation in the crop on key plant parts, traps, indicator plants, etc.).

- Establish during which period of the year and at which life stages of the pest monitoring shall occur.
- Participate in existing area-wide monitoring/warning systems.
- Identify the monitoring frequency.
- Establish the area that constitutes a monitoring unit.
- Establish the amount of sampling points per unit area.

7.1.3 Record keeping

- Establish record sheets (computer- or paper-based) which can include the following information:
  - Identification of the plot and crop being monitored
  - Name of the monitor
  - Date of monitoring
  - Name of the pest, disease, or weed being monitored
  - Number of samples
  - Number of findings
  - Life-cycle stage of the findings (in the case of pests)
  - Comparison with thresholds
  - Location inside the plot
  - Decision taken
- Record sheets shall be archived in order to allow comparison of records from different years and different plots.

7.1.4 Warning systems and decision support tools

- Use of predictive models and decision support systems (e.g., temperature-driven phenological computer models, degree-day models) in combination with information from monitoring and weather forecasts
- Use of area-wide warning systems
- Other type of forecast-supporting information, such as historical graphs (trends) on pest incidence, quality reports, client complaints, productivity losses

7.1.5 Evaluation/Decision-making

- Use action thresholds for the relevant pests, diseases, and/or weeds to decide whether an intervention is needed.
- Document the decisions that were taken to perform a certain intervention.
- Review records at the end of the season, draw conclusions, and plan adaptations of the IPM plan for the following season.

7.2 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

7.3 National interpretation

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8 INTEGRATED PEST MANAGEMENT – INTERVENTION

Different IPM techniques can be used when monitoring results indicate that at least one action threshold has been reached and that intervention is required to prevent economic impacts on the crop's value or the spread of the disease/pest to other crops.

Within an IPM plan , priority is given to nonchemical methods that reduce the risk to people and the environment if these methods effectively control pests, diseases, and weeds.

These methods may be mostly preventative.

In cases where chemical plant protection products (PPPs) are considered, selective PPPs shall be compatible with an IPM approach (i.e., consider whether natural enemies can be used). The selection of IPM-compatible PPPs is especially important at the beginning of a season, and the products shall be applied selectively.

8.1 Cultural and technical measures

8.1.1 Optimal crop care (fertilization, irrigation, etc.)

Too much fertilization and too little fertilization can be equally detrimental to pest management because overfertilization can result in free amino acids in the phloem and xylem, increasing the breeding potential of pests such as aphids. Optimal crop care results in a healthier crop, which is better able to resist pests and disease attacks.

8.1.2 Canopy management and micro-climate

Cultural measures, such as pruning, canopy management, and leaf picking, can be used to assure an optimal micro-climate (humidity, temperature, light, air) and prevent or reduce the development of pests and diseases.

8.1.3 Cropping systems

Different cropping systems can be used to prevent or reduce problems with pests, diseases, and weeds:

- Covering crops to prevent weeds and to stimulate natural enemies
- Special types of cropping systems (e.g., mixed crops, strip cropping, strip harvesting, and permaculture)
- Other practices related to the cropping system (e.g., fallow field margins to prevent intrusion of pests such as slugs and snails)

8.1.4 Exclusion techniques (in protected crops)

Especially in protected crops, different techniques can be used to exclude harmful pests from the crop, such as air locks, double-entry doors, and insect-proof netting or UV-cut foils in plastic tunnels to reduce immigration of certain pests.

8.1.5 Mulching

In certain circumstances, mulches (plastic mulches, reflective mulches, straw mulches, etc.) can help minimize problems with certain pests, diseases, and weeds.

8.1.6 Other technical measures

- Analysis of which other preventive technical measures could be undertaken
- Prevention of mechanical plant and product damage
- Evaluation of mechanical and physical techniques to kill or remove harmful pests, diseases, and weeds. Such techniques may include:
    - Pests:
        - Rouging and isolating infested leaves, fruits, or plants (sanitation)
        - Vacuuming of pests (e.g., *Lygus* spp.)
    - Diseases:
        - Rouging and isolating damaged and infected leaves, fruits, or plants (sanitation)
    - Weeds:
        - Mowing
        - Hand removal of weeds
        - Mechanical weeding

8.2 Conservation biological control

8.2.1 Measures to increase populations of natural enemies and pollinators in and around the crop

- Use of different cropping systems: strip cropping, strip harvesting, mixed crops, permaculture, etc.
- Use of border crops (including hedgerows): pollen-producing plants, nectar-producing plants, plants that harbor alternative hosts for natural enemies (banker plants)

- Use cover crops inside the field: pollen-producing plants, nectar-producing plants, banker plants
- Use of attractants for natural enemies
- Providing hiding and nesting places for natural enemies and pollinators
- Use of selective chemicals, selective placement and/or timing of sprays where and when chemical control is necessary
- Use of push-pull technology: attract and kill, use of repellents
- Providing nesting places for predatory birds to control rodents

8.2.2 Measures to prevent population reduction of natural enemies through PPP use

- Use of selective PPPs that are compatible with natural enemies
- Use of selective application techniques: seed treatments, spot treatments, soil application of systemic products, etc.

8.2.3 Other semiochemicals

Semiochemicals can be used in different ways to control pests:

- Attract and kill (also known as lure-and-kill):
  - Mass-trapping with semiochemicals
  - Trap crops
  - Bait-spraying techniques
- Chemosterilization (possible alternative to the sterile insect technique listed below): attracting the males of a wild population of a pest to bait that is laced with a chemosterilant
- Repellents
- Mating disruption (mating confusion)

8.2.4 Augmentative biological control

Different natural enemies and microbial products can be released or applied to manage populations of pests and diseases:

- Seasonal inoculative or inundative applications of mass-reared natural enemies to control harmful insects and mites
- Use of insect-pathogenic viruses (Nuclear Polyhedrosis Virus - NPV or baculoviruses), fungi, bacteria, or nematodes to control harmful insects and mites
- Use of antagonistic fungi and bacteria to control root and leaf diseases

8.2.5 Sterile insect technique

This area-wide technique is successfully used in many regions of the world to manage populations by frequently releasing mass-reared sterile insects of the target pest.

8.2.6 Use of natural products

Different natural products can be used, provided they are compatible with the IPM plan.

- Oils (mineral oils and vegetable oils)
- Botanicals (e.g., natural pyrethrum, azadirachtin, etc.)

- Soaps
- Diatomaceous earth
- Others

8.3 Chemical PPPs

If an intervention with a chemical PPP is needed, consider the following:

8.3.1 Decision-making

The following information supports optimal decision-making on timing and targeting:

- Application timing which maximizes the effect on the target pest, disease, or weed
- Information about the re-entry interval
- Information about the correct application frequency
- A weather forecast with information about:
  - Wind and temperature conditions to avoid problems during the applications
  - The possibility of rain during the post-intervention period (not applicable for greenhouses)
- The use of predictive models and field observations to determine whether the pest is in a sensitive stage of its life cycle

8.3.2 Action threshold

Where feasible, the action threshold for the relevant pests, diseases, and weeds can be documented.

8.3.3 Product selection

- Before application of a chemical PPP, identification of the goal – total cleanup, spot treatments, population correction, compatibility with natural enemies, etc. – and selection of a product according to the goal
- In the case of tank mixes, identification of any known negative cocktail effects that shall be avoided

8.3.4 Anti-resistance management

Development of resistance to chemical PPPs reduces the number of available PPPs and often leads to more frequent application of higher doses. It is important to have in place an anti-resistance management plan to prevent pests/diseases/weeds from developing resistance to chemical PPPs. For additional details, see the separate guideline on this topic.

8.3.5 Application

Optimal application of chemical PPPs can drastically reduce PPP use while maximizing the effect of an application.

- Identification and use of the optimal spraying equipment (including type and size of nozzles) and technique:
  - Pressure
  - Amount of water

- Water pH, if relevant to the PPP
- Use of adjuvants (effective stickers and spreaders)

- Periodic calibration of the spraying equipment
- Use of application techniques that are selective for natural enemies such as:
  - Electrostatic applications with lower rates
  - Spot treatments
  - Strip applications
  - Treatment of only a part of the plants
  - Timing of applications when the natural enemy or enemies are not active in the crop
  - Bait spraying
  - Use of bait and traps
- Nomination of a person who is responsible for the application of PPPs and will:
  - Receive periodic training in chemical PPP application
  - Have knowledge in calibration of the equipment

8.4 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

8.5 National interpretation

Local legislation or industry-specific information may be added to a national interpretation guideline.

8.6 References

Fundación para el Desarrollo Frutícola, 2004, Guía para el Monitoreo de Plagas. 2nd ed. Santiago de Chile. 50 pp.

IOBC-OILB, 2004, Guidelines for Integrated Production: Principles and Technical Guidelines. 3rd ed. Switzerland.

Pimentel, D. (ed.), 1997, Techniques for Reducing Pesticide Use: Economic and Environmental Benefits. John Wiley & Sons. 444 pp.

Pimentel, D. (ed.), 1991, Handbook of Pest Management in Agriculture. Vol. II. 2nd ed. CRC Press, Boca Raton.

Pringle, K.L., 2006, The Use of Economic Thresholds in Pest Management: Apples in South Africa. *South African Journal of Science* 102: 201–204.

Stern, V.M., Smith, R.F., Van Den Bosch, R. & Hagen, K.S., 1959, The Integrated Control Concept. *Hilgardia* 29, 81–101.

FAO, 2002, International Code of Conduct on the Distribution and Use of Pesticides. EISA, Code on Integrated Farming.

9 INTEGRATED PEST MANAGEMENT – ANTI-RESISTANCE MANAGEMENT

Anti-Resistance Management

Development of resistance to chemical plant protection products (PPPs):

- Reduces the number of available PPPs
- Often leads to more frequent application of higher doses, increasing the risk of exceeding the maximum residue limit (MRL).

Therefore, it is very important to have in place an anti-resistance management strategy to prevent pests/diseases/weeds from developing resistance to chemical PPPs.

PPPs shall be used as part of an anti-resistance management strategy. The resistance management strategy shall consider the holistic approach of integrated pest management (IPM), including the following points:

- Monitor and know the life cycle of pests/diseases/weeds and apply PPPs accordingly.
- To keep pest/disease/weed pressure low, incorporate non-chemical methods for crop protection such as mechanical and biological control, planting tolerant varieties, implementing good agronomic practices, maintaining plant hygiene/sanitation, etc.
- Refer to the websites of FRAC, IRAC, and HRAC (see “References”) for more specific recommendations.

9.1 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

9.2 National interpretation

Local legislation or industry-specific information may be added to a national interpretation g uideline.

9.3 References

Fungicide Resistance Action Committee (FRAC): https://www.frac.info/fungicide-resistance-management/background

Insecticide Resistance Action Committee (IRAC): https://irac-online.org/

Herbicide Resistance Action Committee (HRAC): https://www.hracglobal.com/

Fundación para el Desarrollo Frutícola. 2004, Guía para el Monitoreo de Plagas. 2nd ed. Santiago de Chile. 50 pp.

IOBC-OILB, 2004, Guidelines for Integrated Production: Principles and Technical Guidelines. 3rd ed. Switzerland.

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Pringle, K.L., 2006, The Use of Economic Thresholds in Pest Management: Apples in South Africa. *South African Journal of Science* 102: 201–204.

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FAO, 2002, International Code of Conduct on the Distribution and Use of Pesticides. EISA, Code on Integrated Farming.

10 PLANT PROTECTION PRODUCT EXTRAPOLATION

Registration scheme in country of use	Safe use criteria (operator and environment)	Authorization of PPP for use on individual crops
No registration scheme exists: Some control over PPP imports may be in place.	PPPs that are used shall have clear user guidance to enable the safe use of the PPP in accordance with the "International Code of Conduct on the Distribution and Use of Pesticides" of the Food and Agriculture Organization (FAO).	Extrapolated uses are permitted.
A registration scheme exists: Imported PPPs are permitted for sale with the label of the country of origin. This may be in addition to the national labels for the PPPs.	If the PPP is a direct import, it shall be provided to the user with clear guidance to enable safe use. This guidance can be in the form of label translations or notes provided by the distributor.	1. The imported PPP carries a label that matches the nationally approved label.
		2. The imported PPP carries a label that is different from the current nationally approved label. In this case, use of the PPP is permitted on only those crop(s) listed on the nationally approved label.
		3. The crop is not covered on the nationally approved label. Extrapolated uses are permitted if the prevailing regulations explicitly allow this practice.

Exception

Where producers participate in field trials conducted in accordance with prevailing regulation in support of regulatory approval and research of PPPs, the producer can still achieve IFA

certification, even though part of the crop will be destroyed or used for further analyses. There shall be clear traceability and information on the area (size) used for the trials. The producer shall also have available meaningful documents indicating that the producer is taking part in a legal field trial in full conformance with the legislation of the country of crop production. Furthermore, clear procedures shall exist on the management of these trials. The PPPs being tested are not allowed for use on the crop to be registered for certification, and residue testing shall show no residues of these PPPs.

11 WASTE MANAGEMENT SYSTEM

A written waste management plan is not required. As documentation, invoices from disposal or recycling entities may be supportive.

Documentation is only required to describe methods used to minimize any contamination risks associated with waste management.

Other possible documentation that producers may have to support the functionality of their system includes invoices for recycling or disposal services, if applicable.

It is important that waste is separated and disposed of according to intended or existing disposal pathways.

Waste management opportunities differ from place to place. It makes sense that waste separation categories correspond to those which are used in the region, based on the available disposal/recycling options.

The newly introduced elements in the principles and criteria (P&Cs) in relation to plastics call for evidence on the awareness of types of plastics used, where they are used, and where there is potential to substitute plastics for more renewable materials. It also calls for evidence that plastic (waste) is not released to the environment and awareness of workers to accomplish this.

Different (new) efforts can be made at farm level. This will depend on the reality of each producer, but could include, for example:

- Identifying the different types of plastics used, where these are used, and whether they can be replaced by renewable materials
- Establishing rules, providing tools to collect waste, and assigning places to keep the different waste categories.

In general, for all waste, workers and management shall be made aware of the destination of the specific waste, especially for temporary storage prior to disposal, so that waste is kept orderly.

11.1 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

11.2 National interpretation

Local legislation or industry-specific information may be added to a national interpretation guideline.

12 BIODIVERSITY

This guideline focuses on the two P&Cs on land conversion and restoration.

12.1 No conversion of relevant areas into agricultural use

Land use and land conversion are often highly regulated.

The implementation of P&C FO 10.05 starts with the on-farm identification of areas where legal protection prevents land conversions.

The definitions can be taken from prevailing regulation or from other locally relevant sources. An indicative definition is provided in the glossary of IFA v6:

Regarding the documentation of on-farm land use before 2014, it will often suffice to obtain documentation once and keep it for future certification body (CB) audits, unless new information requires updating the of on-farm land use prior to 2014.

12.1.1 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

12.1.2 National interpretation

It is possible to indicate specific definitions and examples for natural or seminatural ecosystems and habitats, areas where legal protection prevents land conversions, and areas recognized as HCV areas.

12.1.3 References

While references linked to locally prevailing regulations and practices will be crucial, global references include the online libraries and resources of:

- The International Union for Conservation of Nature (IUCN)
- The United Nations Food and Agriculture Organization (FAO)
- The Accountability Framework
- The High Conservation Value Areas Network
- The United Nations Convention on Biological Diversity
- The World Wide Fund for Nature (WWF)
- The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC)
- The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)
- The Global Nature Fund (GNF)
- The Intergovernmental Panel on Climate Change (IPCC)

12.2 Restoration of relevant areas converted into agricultural use

Restoration of ecosystems and habitats is as important as it is challenging. Obtaining results can often take years, depending on local conditions. P&C FO 10.06 on restoration of converted areas can for example be used in connection with the P&C FO 01.03.03 on continuous improvement.

The current decade, 2021–2030, is the United Nations Decade on Ecosystem Restoration, which includes calls to award flagship restoration projects.

It is highly recommended that a restoration project include, for example:

- Identification of the area to be restored
- Engagement with relevant stakeholders, e.g., local land-use authority, other stakeholders active in restoration, etc.

- Baseline description of the area to be restored
- Expected results of the restoration process
- Adaptation measures for the restoration project in case results differ from the results originally expected

12.2.1 Applicable legislation

Relevant (local) legislation may be referenced; together with information on which norm (GLOBALG.A.P. and/or legislation) overrules/becomes mandatory.

12.2.2 National interpretation

It is possible to indicate specific definitions and examples for restoration.

12.2.3 References

While references linked to locally prevailing regulations and practices will be crucial, global references are expected to be increasingly accessible in connection with, for example:

- The Unites Nations Decade on Ecosystem Restoration 2021–2030
- The World Wide Fund for Nature (WWF)
- The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

13 METRICS

This guideline addresses the metrics for the product category flowers and ornamentals for both of the following:

- Integrated Farm Assurance (IFA) standard version 6
- Impact-Driven Approach to Sustainability (IDA) add-on/module in its current version

The purpose of this guideline is to provide producers and auditors with information to support the interpretation of the principles and criteria (P&Cs) associated with the use of metrics. The guideline gives more detailed specifications on what type of metrics producers are expected to record in order to meet the requirements of the P&Cs.

The same guideline is used for the IDA add-on and IDA module. Those parts of the guideline which apply to the IDA add-on/module only are indicated.

The table below describes the level of the requirement for each metric both in IFA and in IDA for flowers and ornamentals.

	IFA for flowers and ornamentals v6	**IDA for flowers and ornamentals (add-on and module)**
Fertilizer (nitrogen (N) and phosphorus (P))	Keeping records of fertilizer use **Minor Must** Recording amounts (in kg) of N and P **Recommendation**	Digitally sharing amounts (in kg) of N and P **Major Must**

	IFA for flowers and ornamentals v6	IDA for flowers and ornamentals (add-on and module)
Plant protection products (PPPs) with chemically synthesized active ingredient	Keeping records of PPP use **Major Must** Recording amounts (in kg) of active ingredient **Recommendation**	Digitally sharing data on types and amounts of active ingredient of a PPP **Major Must**
Water use	Keeping records of abstracted water and of water use in irrigation **Minor Must**	Digitally sharing data on amounts of water abstracted and water used in irrigation **Major Must**
Energy	Keeping records per energy source **Major Must** Analyzing total energy use to reduce the use of non-renewable energy sources **Recommendation**	Digitally sharing data on energy consumption per source and total per farm, distinguishing (non-)renewable sources **Major Must**

13.1 Glossary for this guideline

Definition: Definition of the metric and a short description of what shall be recorded for the metric.

Frequency to record: Indicates how often and when the producer shall record the events related to the metric. Certification body (CB) auditors shall check that the recording of the data meets the frequency requirement. CB auditors shall also check that the producer has a system in place where the information is consistently recorded and that the recording of the metrics is centralized to this system.

Frequency to report to the GLOBALG.A.P. Secretariat: *Applicable to the Impact-Driven Approach add-on/module*. To comply with the IDA add-on, the producer shall transfer the metric-related data to the GLOBALG.A.P. Secretariat on regular basis via a GLOBALG.A.P. approved farm management system (FMS). The FMS can also automatically transfer the information as soon as it has been recorded, but this section defines the minimum frequency of transferring the metric-related data to the GLOBALG.A.P. Secretariat.

The producer shall make sure to use the FMS in the way instructed by the FMS provider so that information can be transferred to the GLOBALG.A.P. Secretariat. The producer shall also make sure that the FMS has the necessary permissions to transfer information to the GLOBALG.A.P. Secretariat. The FMS shall be set up so as to ensure that the technical connection to the GLOBALG.A.P. Secretariat is working and that any potentially necessary unit conversions are done before transferring the information to the GLOBALG.A.P. Secretariat.

Impact-Driven Approach (IDA): IDA is a GLOBALG.A.P. module and add-on applicable to flowers and ornamentals, fruit and vegetables, and aquaculture. IDA uses data and metrics to encourage and measure continuous improvement at farm level. Certain sections of this metrics guideline address requirements that are relevant to only those producers aiming to comply with the IDA add-on/module. These sections are marked with an asterisk (*) and do not concern IFA-related metrics or their evaluation.

Information related to the Impact-Driven Approach (IDA): For the purposes of the IDA add-on/module, the GLOBALG.A.P. Secretariat will require that the data be transferred to the GLOBALG.A.P. Secretariat in a particular format so that proper data analysis and aggregation can be performed.

For this purpose, the producer shall use an approved FMS that can convert the units and data used by the producer so that they will be compatible with GLOBALG.A.P. requirements. The CB auditor shall check that the producer is using one of the approved FMSs.

Approved FMSs can be found here.

Latest technical documentation on data formats and system requirements for FMSs can be found here.

Indicator: A type of data that indirectly measures the (sustainability) issue in question

Information to be recorded: Indicates what level of information recording is expected in order to meet the P&Cs. The producer shall have records of the expected data points to meet the metric criteria. The producer can record the data points in the units most appliable to the producer's circumstances, as long as the recording of the information is consistent and done with the necessary frequency.

Metric: A system or standard of measurement

Peer group: *Applicable to the IDA add-on/module.* For the purposes of the IDA add-on/module, the GLOBALG.A.P. IT systems will compile similar producers into peer groups to provide comparable data on the peer group's average inputs (see "Type of output") compared to the producer's own inputs. The peer group is based on the producer's location, crops grown, and growing circumstances as recorded by the producer according to GLOBALG.A.P. requirements. Members in the peer group are anonymized and an individual producer cannot see the data of other individual producers, only aggregated average values of the peer group.

Purpose: Briefly describes the rationale ("the why") for using the metric.

Type of output: *Applicable to the IDA add-on/module*. With participation in the IDA add-on/module, the producer will receive benchmark reports sent to their FMS. The benchmark reports will contain the producer's aggregated historical data regarding the input consumption of the metric. Furthermore, the benchmark report will contain an anonymized comparison to other relevant producers in the peer group in the IDA system and the intensity of the input consumption of the producer compared to peer producers for the given metric.

13.2 Prerequisites for metric recording

Site

To record metrics, the producer shall have a clear understanding and records of sites and their boundaries. The producer shall be aware of the site's total area, as well.

*For IDA add-on/module purposes, the producer shall also record the location of the site with geospatial coordinate information.

*Note: Only with the above-mentioned data points shall the producer be able record the metric data for the IDA add-on/module.

Crop

Some metrics require the producer to register the input consumption associated with the metric of a crop grown on the site. Therefore, the producer shall be aware of and record the crops grown on each site, the dates when the crops are grown, and the area of the crop on the site. With this information, the producer can relate the input consumption metrics to the size of production.

*For IDA add-on/module purposes, the producer shall also record a production type, and other growing circumstances as specified here. This information allows generating the outputs that compare the producer to the relevant peer group growing under similar circumstances.

*The producer shall also indicate the company type for each crop and whether the producer is a member of a producer group.

*Note: Only with the above-mentioned data points shall the producer be able record the metric data for the IDA add-on/module.

13.3 Compliance with Impact-Driven Approach for flowers and ornamentals – elements for auditing

The producer shall have either three (IDA add-on) or six (IDA module) months of consecutive data registering history before a first CB audit may take place.

Once the CB audit can take place, three conditions are required for a producer to demonstrate compliance with IDA for flowers and ornamentals (as described in the IDA flowers and ornamentals rules, section “Audit process” both for the add-on and the module).

The CB audit includes checking the following three aspects:

a) **Reliability of digitally registered data** against farm conditions, including records kept at farm level and ways in which data is collected and recorded

b) **Compliance with the P&Cs** of the IDA add-on/module

c) **Confirmation** that the **producer digitally registered the data through the FMS for the GLOBALG.A.P. Secretariat on a monthly basis**, as required in the P&Cs

Reliability of digitally registered data refers to the confirmation that registered and digitally shared data correspond to real use/applications and to real farm conditions. The CB audit is not meant to verify all data. A sample or several samples of data may be verified in different ways. Examples of verification may include the following:

- Confirming that the fields and crops are active at the time of the use/application
- Identifying how data was obtained: whether through estimations or using measuring devices
- Confirming whether the mentioned devices are on site and functional
- Cross-checking with invoices or records of fertilization/pest management programs

Compliance with the P&Cs of the IDA add-on/module refers to the CB audit of P&Cs as specified in the corresponding P&Cs in the add-on/module.

Confirmation that the producer digitally registered the data through the FMS for the GLOBALG.A.P. Secretariat on a monthly basis: is a critical element in IDA for flowers and ornamentals, since the producer is required to share data at regular intervals.

Prior to the audit, the CB shall confirm that the producer has been sharing data as required in the add-on/module, i.e., with respect to periodicity and data points.

- If the applicant producer is already certified against a scheme that claims to digitally collect the same data points, the CB may perform the audit without confirmation that the producer has shared data for the minimum period required. At the producer’s risk, the CB can confirm this during the audit.

- If the producer applying for the CB audit has already registered data through a different FMS, the audit can take place as long as the data has been shared with the GLOBALG.A.P. Secretariat and meets the required periodicity and data points.

If a producer has been granted a letter of conformance, failing to report continuously may lead to sanctions. It is important for the CB to monitor every month whether the producer meets this requirement.

13.4 Quantitative fertilizer indicator

Metric	Amounts of nitrogen (N) and phosphorus (P) used for fertilization in agricultural production**.**
Definition	This indicator describes the amounts of N and P used per crop per hectare in a defined time-period.
Purpose	• Avoiding the excessive use of N and P, as these may leak into the environment, causing pollution and eutrophication of water sources • Implementing good agricultural practices (see IFA standard) in order to avoid leakage of N and P, optimize fertilizer use, and save money • Monitoring the amounts of N and P inputs used at crop/farm level, allowing producers to set quantitative goals and have better control
Formula (kilograms as per international unit system, other units also possible)	Total kilograms of **N** per ha = Total sum of kilograms of N used on the crop in a defined period per production area in hectares or square meters (of crop or farm) Total kilograms of **P** per ha = Total sum of kilograms of P used on the crop in a defined period per production area in hectares or square meters (of crop or farm)
Information to be recorded	To record the fertilizer-related metrics, the producer shall record/report each fertilizer application along with the following data: • Amounts of N and/or P used; N and P amounts to be recorded separately • Date of the application • Crop to which the fertilizer was applied The N and/or P amount can be manually entered by the producer or can be automatically calculated by the producer's FMS based on the amount of commercial product applied. The producer shall, regardless, be aware of the N and/or P loads of fertilizer applications.
IDA-related information*	The data shall be recorded with a GLOBALG.A.P. approved FMS that will ensure that the data is transferred to the GLOBALG.A.P. Secretariat. The FMS shall enable the correct conversion of units so that the GLOBALG.A.P. Secretariat can receive the data.

Frequency to record	After each fertilizer application is made. Each application shall be recorded separately.
Frequency to report to the GLOBALG.A.P. Secretariat*	Monthly – at the end of a calendar month, the GLOBALG.A.P. Secretariat shall receive the fertilizer application information.
Type of output*	An individual historical report, a report with data of a single producer showing trends in use over time: • Amounts of N and/or P used per ha A benchmarking or comparison report between peer producers, comparing amounts (in kilograms) of N and/or P used by different producers near the producer's location. Comparison on a monthly level with peer producers' average consumption and the producer's N and/or P use intensity in terms of percentile. Within a peer group, the indicator provides a notion of the range of distribution of N and P consumption in the same crop under similar circumstances. Peer producers are anonymized.

13.5 Quantitative active ingredient (PPP) indicator

Metric	Amounts of active ingredient of plant protection products (PPPs) (of chemical synthesis) used in agricultural production
Definition	This indicator describes the amounts of each active ingredient used per crop per hectare of area. Area refers to area under production. Active ingredient refers to the active ingredient(s) of PPPs obtained from chemical synthesis and to biopesticides. It does not include biological controls such as those containing living organisms.
Purpose	• Identifying the amount of active ingredients(s) applied through use of PPPs on a particular crop or on the farm in a defined time period • Monitoring amounts of active ingredient use in relation to crops and sites • Setting quantitative goals in active ingredient consumption as a complementary indicator of pest management
Formula (units can be adjusted to region)	Total average kilograms of active ingredient per ha = Total sum of kilograms of active ingredient used on the crop or farm in a defined period per production area in hectares or square meters (of crop or farm)

Information to be recorded*	To record the active ingredient metric, the producer shall record each PPP application with the following data: • Amounts of active ingredient used, with each different active ingredient being recorded separately • Identification of which active ingredient is used • Date of the application • Crop on which the active ingredient was applied The active ingredient amounts can be manually entered by the producer or can be automatically calculated by the producer's FMS based on the amount of PPP. The producer shall, regardless, be aware of the active ingredient loads of PPP applications.
IDA-related information*	The data shall be recorded with a GLOBALG.A.P. approved FMS that will ensure that the data is transferred to the GLOBALG.A.P. Secretariat. The FMS shall enable the correct conversion of units so that the GLOBALG.A.P. Secretariat can receive the data. For active ingredient identification, a Chemical Abstract Service (CAS) number shall be given (usually provided by the FMS).
Frequency to record	After each PPP application is made. Each application shall be recorded separately.
Frequency to report to the GLOBALG.A.P. Secretariat*	Monthly – at the end of a calendar month, the GLOBALG.A.P. Secretariat shall receive the active ingredient use information.
Type of output*	An individual historical report, a report with data of a single producer showing trends in use over time: • Amounts of active ingredient(s) used per ha A benchmarking or comparison report between peer producers, comparing amounts (in kilograms) of the total sum of active ingredient(s) used by different producers near the producer's location. Comparison on a monthly level with peer producers' average consumption and the producer's active ingredient use intensity in terms of percentile. Within a peer group, the indicator provides a notion of the range of distribution of the total sum of active ingredient consumption in the same crop under similar circumstances. Peer producers are anonymized.

13.6 Quantitative water use indicator

The water use indicator is a combination of four metrics: Three based on measuring/estimating amounts of water abstracted and used at farm level. The fourth is a proportion of two of these.

13.6.1 General overview

Water Metrics	• Volume of water abstracted from water sources • Volume of water used in irrigation • Total volume of water used on the farm (irrigation, postharvest, spraying, etc.) • Percentage of water used in irrigation which originates from water sources (i.e., is not collected rainwater or recycled water).
Overall purpose	• Identifying the amounts of water used in irrigation and other uses • Identifying and monitoring the pressure and dependency of the production system on water resources versus the capacity to recycle water or collect rainwater
Frequency to record	Monthly at minimum. Information can be aggregated per site per month if more accurate recording of water abstraction and water used in irrigation is not possible.
Frequency to report to the GLOBALG.A.P. Secretariat*	Monthly – at the end of a calendar month, the GLOBALG.A.P. Secretariat shall receive the information on water abstraction and water used in irrigation. Information can be aggregated per site per month if more accurate recording of water abstraction and water used in irrigation is not possible.
Type of output*	An individual historical report, a report with data of a single producer showing trends in use over time: • Volume of water used in irrigation • Total volume of water used in production (irrigation plus other uses) • Volume of water abstracted from water sources • Percentage of water used in irrigation which originates from water sources (i.e., is not collected rainwater or recycled water) A benchmarking or comparison report between peer producers, comparing amounts of water used in irrigation per ha and percentage of dependency on water sources by different producers near the producer's location. Comparison on a monthly level with peer producers' average consumption intensity (per ha) and the producer's dependency on water abstraction (percentage of water abstracted) in terms of percentile.

	Within a peer group, the indicator provides a notion of the range of distribution of water used in irrigation per ha and dependency on water abstraction under similar circumstances. Peer producers are anonymized.
IDA-related information*	The data shall be recorded with a GLOBALG.A.P. approved FMS that will ensure that the data is transferred to the GLOBALG.A.P. Secretariat. The FMS shall enable the correct conversion of units so that the GLOBALG.A.P. Secretariat can receive the data.

13.6.2 Quantitative water use indicator 1 – water sources

Metric	Volume of water abstracted from water sources by the producer
Purpose	• Identifying the volume of water abstracted from water sources • Monitoring the pressure of the production system on the water sources
Definition	Total volume of water obtained from one or several water sources per month Water sources may include groundwater, surface water, or an aqueduct.
Formula	Total volume of water abstracted by the producer per month = Total volume for source 1 per month + total volume for source 2 per month + … + total volume for source n per month
Units	Water volumes: cubic meters (m^3)
How to measure	For every source of water, volumes can be measured using a water meter, a flow meter, or other artifacts. In their absence, estimations are acceptable.
Information to be recorded	Water abstraction: • Volume of water abstracted, indicating the source • Date of abstraction

13.6.3 Quantitative water use indicator 2 – water used in irrigation

Metric	Volume of water used in irrigation on the farm per month
Purpose	• Identifying the volume of water used to irrigate the crop • Allowing comparisons of water use with peer producers so as to identify possible effects of better practices
Definition	Water used in irrigation: Total volume of water used in irrigation per area in production per month. Does not include water for spraying, but can include water used for fertilization (fertigation).

Formula	Total volume of water used in irrigation of the crop per area per month = Total volume for crop 1 per month + total volume for crop 2 per month + ... + total volume for crop n per month
Units	Water volumes: Cubic meters per hectare (m^3/ha) or liters per second per hectare Production area: Square meters or hectares where crop is currently being grown
How to measure	Volumes of water used in irrigation can be measured using a water meter, a flow meter, or other artifacts. In their absence, estimations are acceptable.
Information to be recorded	• Volume of water used for irrigation • Date of irrigation (if a specific date cannot be given, the date can be the last date of the month) • Indication at which site the irrigation took place

13.6.4 Quantitative water use indicator 3 – rainwater/recycling indicator

Metric	Percentage of total volume of abstracted water divided by total amount of water used in irrigation (s) per farm per month
Purpose	• Identifying and monitoring the pressure and dependency of the production system on water sources versus the capacity to recycle water or collect rainwater • Identifying possible excess abstraction • Indirectly estimating amounts of recycled/collected rainwater
Definition	Percentage of water used in irrigation that is abstracted from water sources A value higher than 100% means water is being wasted, other uses require extremely high volumes of water, or water is being used to fill reservoirs.
Formula	Percentage = Total volume of water abstracted from water sources per farm per month divided by total volume of water used in irrigation per farm per month Summarized: Water abstracted from sources divided by water used in irrigation
How to measure	The percentage is calculated as the proportion (see “Formula” above) of the two previous water use indicators.

Information to be recorded	None

13.6.5 Quantitative water use indicator 4 – total water used at farm

Metric	Volume of total water used in production on the farm per month
Purpose	• Understanding and monitoring where water is used • Identifying possible excess uses • Allowing comparisons of total water use with other producers
Definition	Total amount of water used for production on the farm, including irrigation, fertigation, postharvest, washing, spraying, and other uses of water in production
Formula	Volume of water used in irrigation + volume of water used postharvest + volume of water used in A + volume of water used in B … = Total volume of water used in production on the farm
How to measure	This can be measured using a water meter, a flow meter, or other artifacts. In their absence, estimations are acceptable.
Information to be recorded	• Total volume of water used on the farm (irrigation, postharvest, washing, etc.)

13.7 Quantitative energy use indicator

Metric	Amount of energy used in agricultural production
Definition	This indicator describes the amount of energy used on the site.
Purpose	• Identifying opportunities to make more efficient use of energy • Monitoring the impact of energy sourcing

Information to be recorded	To record the energy metrics, the producer shall record energy use with the following data:
	• Energy use indicating
	  ○ Source of energy (incl. all energy sources such as fuels)
	  ○ Amount of energy consumed from each source
	  ○ Amount of renewable energy (if known) from each source
	  ○ Date of energy use (if a specific date cannot be given, the date can be the last date of the month)
	  ○ Site where the energy was used

IDA-related information*	The data shall be recorded with a GLOBALG.A.P. approved FMS that will ensure that the data is transferred to the GLOBALG.A.P. Secretariat. The FMS shall enable the correct conversion of units so that the GLOBALG.A.P. Secretariat can receive the data. For energy source indication, a list of energy sources retrieved from the GLOBALG.A.P. IT systems shall be used. This list is constantly updated and shall be retrieved from the FMS connected to the GLOBALG.A.P. IT systems.
Frequency to record	At minimum on a monthly basis. Information can be aggregated per site per month if more accurate recording of energy use is not possible.
Frequency to report to the GLOBALG.A.P. Secretariat*	Monthly – at the end of a calendar month, the GLOBALG.A.P. Secretariat shall receive the energy abstraction and use information. Information can be aggregated per site per month if more accurate recording of energy use is not possible.
Type of output*	An individual historical report, a report with data of a single producer showing trends in energy use over time: • Total amount of energy used per ha • Amount of energy used per source per ha • Share of renewable energy in energy use A benchmarking or comparison report between peer producers, comparing amounts of energy used by different producers near the producer's location. Comparison on a monthly level with peer producers' average consumption and the producer's energy use intensity in terms of percentile. Within a peer group, the indicator provides a notion of the range of distribution of energy use under similar circumstances. Peer producers are anonymized.

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