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SINGAPORE STANDARD

Specification for clean and green urban farms — Agriculture

Incorporating Amendment No. 1



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Specification for clean and green urban farms —

Agriculture

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Foreword

This Singapore Standard was prepared by the Working Group on Clean and Green Urban Agriculture Farms set up by the Technical Committee on Food Production under the purview of FSC.

The intent of this standard is to help urban farms in establishing a clean and green urban agriculture production system. Adoption of this standard will enable urban farms to enhance their business competitiveness through optimising operational efficiency in a sustainable manner and to brand their farm products for market access.

Permission has also been sought from the following organisations for the reproduction of materials from their publications into this standard:

1. ISPM 5 Glossary of phytosanitary terms by International Plant Protection Convention
2. Soil taxonomy, a basic system of soil classification for making and interpreting soil surveys by United States Department of Agriculture Natural Resources Conservation Service
3. Sustainability assessment of food and agriculture systems guidelines (version 3.0) by Food and Agriculture Organisation of the United Nations

4. SS 632: 2017 Specification for organic primary produce by Enterprise Singapore
Acknowledgement is made for the use of information from the above publications.

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such standards.

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Specification for clean and green urban farms – Agriculture 0

Introduction

0.1

Agriculture has progressed immensely in its journey to fulfil the world's demand for food.

However, it faces impending threats brought about by climate change, degradation of arable land, depletion of natural resources and competing land use as a result of urbanisation. Coupled with rapid population growth and influx of people into urban cities, the demand for food is predicted to outstrip its supply if agriculture practices were to remain status quo.

0.2

Rising consumer affluence has resulted in shifts in food demands and consumption habits.

Increasingly, consumers are consciously opting for higher quality and more sustainable food sources.

Likewise, businesses are beginning to transform their operations to become more sustainable and environmentally friendly so as to keep pace with the evolving needs of consumers.

0.3

In view of these developments, there is a pressing need for the agriculture sector to become more productive and future-ready, and at the same time, cleaner and greener. The need for transformation in the agriculture sector is even more imperative for Singapore, which imports more than 90 % of the nation's food supply. Being a small country with limited arable land and natural resources, it is important for the local farming sector to become more productive, innovative and resource-efficient, while ensuring the production of quality, safe and fresh food for consumers. This will greatly enhance the nation's food resilience by mitigating uncertainties in the agri-food supply from overseas.

0.4

Taking into account the unique circumstances and context of Singapore, this standard was conceived to provide guidance and inspire the movement for local food production that is done in a cleaner and more sustainable manner, while striving towards productivity and leveraging on innovations. Ultimately, this standard is envisioned to transform the urban agriculture sector in Singapore and to position Singapore at regional and global frontiers in the pursuit of sustainable production of quality and safe foods.

1

Scope

This standard establishes requirements on farming techniques, practices and management of a production system to grow farm products that can be labeled as clean and green. Key performance indicators are included for farms to monitor their resource consumption and waste management, together with specifications for a quality, safe and clean product. Recommended practices are provided in Annex A. This standard is applicable to urban farms that produce terrestrial vascular plants as crops meant for consumption as vegetables, fruits, herbs, sprouts and condiments. As Singapore is a city-state, all local farms are considered urban farms in the context of this standard.

2

Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

SS 628

Specification for compost used in agriculture and horticulture SS 668 : Part 3

Cold chain management of chilled and frozen foods

As amended,

Part 3 : Code of practice for vegetables and fruits

Aug 2022

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3

Terms and definitions

For the purpose of this Singapore Standard, the following terms and definitions apply.

3.1

Allowable crop protectant

A substance extracted or derived from naturally occurring plants, animals, microbes or mineral sources without any chemical alterations, or created by naturally occurring biological process. This substance is applied onto plants for controlling, destroying or preventing the growth and development of plant pest(s). The list of allowable crop protectants can be found in Table 2 of GL 32-1999. However, it excludes items considered as biological control agents, physical control methods and mechanical control methods.

3.2

Alternative water source

Any source of water other than water supplied by the national water agency.

Note 1 to entry – This can include, but not limited to, pond water, rainwater, processed used water, air conditioner condensate, water collected from dehumidification, grey water and seawater.

3.3

Biological control agent

A natural enemy, antagonist, competitor or other organism used for plant pest control.

Note 1 to entry – This can include entomophagous fungi, mycophagous fungi and natural predators/enemies.

3.4

Carbon footprint

Total greenhouse gas emitted as a direct and indirect result from agriculture activities.

3.5

Chemical pesticide

A synthetic substance that is formulated or manufactured by a chemical process, or by a process that chemically changes a substance extracted from naturally occurring plants, animals, microbes or mineral sources. This substance is applied onto plants for the purpose of controlling, destroying or preventing the growth and development of plant pest(s).

Note 1 to entry – Chemical process refers to the alteration of molecular structures of substances and excludes the physical process of extraction.

3.6

Clean product

Quality, safe and fresh crops that are produced from a production system that excludes the use of chemical pesticides throughout the entire production process. The product, at the point of sale, has no detectable chemical pesticide residues. It is presupposed that microbial and heavy metal levels on the product are within safety limits in accordance with applicable statutory and regulatory requirements.

3.7

Compost

Decayed organic material used as a fertility amendment in agriculture production. It is produced by a combination of actions by microbes, invertebrates, temperature and other factors (moisture content, aeration) over a period of time. Composted material shows no substantive resemblance to the original source(s) from which it was made.

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3.8

Cultivar

A cultivated variety of a particular type of crop.

3.9

Farm input

Resource used for crop production and can include water, fertiliser, substrate, soil, energy, seeds, propagation materials, crop protectants and carbon dioxide. Farm infrastructure is excluded.

3.10 Farm waste

Output of a farm, other than marketable production, that is generated as a result of farm activities.

Note 1 to entry – Farm waste can include unsold farm products, crop trimmings, damaged crops, inedible parts such as roots, as well as by-products of the crop cultivation process like spent substrate, spent nutrient solution and water used for cleaning cultivation systems.

3.11 Green product

Food that is produced in a sustainable and environmentally friendly manner with low carbon footprints, whereby the use of resources like energy, water and fertiliser is optimised. Farm waste resulting from agricultural activities is minimised, upcycled and properly managed in a manner that will not harm the environment.

3.12 Grey water

Untreated used water which has not come into contact with toilet waste.

Note 1 to entry – It includes used water from showers, bathtubs, bathroom/toilet wash basins as well as water from clothes washing and laundry tubs.

Note 2 to entry – It excludes used water from urinals, toilet bowls (or water closets), kitchen sinks and dishwashers.

3.13 Growing ambient environment

Range of conditions provided for plant growth, and can include light intensity, light duration, temperature, relative humidity, carbon dioxide concentration and air flow.

3.14 Growing media

Collective term for substances that roots of a plant extend into for anchor and support, and/or are in contact with for the uptake of water and nutrients.

Note 1 to entry – This includes water/nutrient solution (in the case of hydroponics cultivation), substrate, and/or soil.

3.15 Hydroponics

Growing of plants in a well-aerated growing medium that is predominantly made up of nutrient-rich aqueous solution. Plants may be anchored by a small amount of substrate such as sponge, peat or vermiculite.

3.16 Marketable production

Fresh farm products that are consumed by consumers and other farm outputs (e.g. crop trimmings) that are processed into edible products.

Note 1 to entry – Fresh farm products that are not eaten/used by consumers are excluded.

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3.17 Plant pest

Any species, strain or biotype of plant, animal or pathogenic agent that is injurious to plants.

Note 1 to entry – This is a collective term for fungus, bacterium, virus, insect, mite, mollusc, nematode, plant or animal that can adversely affect crop growth.

3.18 Ready-to-eat product

Any article of food that is made available for sale for direct human consumption without the need for cooking, washing, or any other form of processing to eliminate or reduce microbial concentrations to allowable levels specified by applicable statutory and regulatory requirements.

3.19 Soil

A natural body comprising solids (minerals and organic matter), liquids and gases that occurs on the land surface, occupies space and is characterised by one or both of the following: horizons and/or layers, that are distinguishable from the initial material as a result of additions, losses, transfers and transformations of energy and matter, or the ability to support rooted plants in a natural environment.

3.20 Soil amendment

A substance added to soil to improve the soil's physical and/or chemical properties.

Note 1 to entry – Chemical properties includes pH, cation exchange capacity, organic matter content, water holding capacity.

3.21 Substrate

A predominantly solid material, other than soil, in which plant roots grow for anchor and support.

Note 1 to entry – Common substrates used for cultivation of crops are peat, cocopeat, perlite and vermiculite.

3.22 Substrate culture

Production of crops using substrates as the predominant growing media.

3.23 Sustainability

Ensuring human well-being and achieving food security without depleting or diminishing the capacity of the Earth's ecosystems to support life, or at the expense of others' well-being for the current and future generations.

3.24 Terrestrial vascular plant

Land-dwelling plant that, in terms of plant anatomy, contains conducting tissues for transport of water and nutrients around the plant.

Note 1 to entry – It excludes algae, bryophytes (moss, liverwort and hornwort) and mushrooms.

3.25 Urban farm

Farm that grows and distributes food within the boundary of a city. In Singapore, farms within the whole nation are considered urban farms.

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In this standard, the following verbal forms are used:

—

“shal ” indicates that the requirement is strictly to be followed in order to conform to the standard and from which no deviation is permitted.

—

“should” indicates a recommendation;

—

“may” indicates a permission;

—

“can” indicates a possibility or a capacity.

4

Principles

4.1

Overview

This standard is rooted in two key principles, namely the principle of clean and the principle of green.

Collectively, these principles represent the fundamental foundations that translate into how farms interact with their environments and the greater food system to grow quality and safe foods with low carbon footprints for consumers, while minimising adverse impacts on the Earth's ecosystem.

4.2

Clean: Quality and safety

A clean farm is one that adopts a clean approach in its entire management system and production process, all the way from its source materials to the final products. Through judicious prevention and minimisation of chemical, biological and physical contaminants, together with adherence to best practices that reduce negative impacts on human and environmental health, the farm strives to produce high quality food that is safe for consumption with no detectable chemical pesticide residues.

4.3

Green: Environmental stewardship

A green farm is one that adopts the philosophy of “growing more with less”. The farm actively strives to minimise negative environmental impacts resulting from its production activities while seeks to foster positive environmental impacts and achieves high farm productivity. Food will be produced in an environmentally responsible and sustainable manner, towards reducing the carbon footprint of crop production to the lowest possible. This will be achieved through optimisation of resource use, with particular emphasis on water, energy and fertiliser, together with minimisation, management and upcycling of wastes, so as not to jeopardise the health of the environment and ecosystem.

5

General requirements

5.1

Farm management system

5.1.1 A farm management system shall be established and documented in the form of a farm management manual (FMM) with the following components:

a)

Farm management policy statement;

b)

Farm organisation or management structure;

c)

Job descriptions of farm employees;

d)

Minimum competency requirements of farm employees according to their job descriptions and training provision;

e)

Green procurement practices;

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f)

Food safety management plan;

g)

Farm resource management plans for water, fertiliser and energy; h)

Farm waste management plan;

i)

Key farm operations, workflows and processes;

j)

Procedures for monitoring and improving farm performance in the key performance indicators; k)

Procedures for product recall;

l)

Procedures for handling customers' complaints;

m)

Procedures for control of documented information;

n)

Procedures for conducting internal audit, handling non-compliances and administering corrective actions;

o)

Maintenance and cleaning schedule for premise and equipment; and p)

Documented information (e.g. audit checklist, fertiliser record, farm input purchase record, equipment maintenance record).

5.1.2 The management structure shall include the names of key personnel responsible for managing the farm and for conducting internal audits. When there is any change in the appointment of key personnel, the management structure shall be updated and the change shall be communicated to all farm employees within 30 days.

5.1.3 The management shall ensure that all farm employees are adequately trained and meet the minimum competency requirements stipulated in the FMM. Continued training (e.g. in personal hygiene, farm safety and farm sustainability) shall be in place to keep employees updated or to serve as a refresher and can be conducted via briefings or distribution of circulars.

5.1.4 Records of training and qualifications for all farm employees shall be maintained.

5.1.5 A system shall be in place to ensure maintenance of hygiene standards in a facility. In particular, the system shall ensure that employees who are feeling unwell are disallowed from working in the facility, and that all employees wash their hands thoroughly with water and soap before entering the production area and handling any product.

5.1.6 Procedures shall be established and appropriate equipment shall be made available to deal with emergencies that affect production in particular accidental spills of fertilisers, lubricants, oils and allowable crop protectants. Employees shall be sufficiently trained to deal with such emergencies.

5.1.7 The procedures for product recall shall include the types of event which may result in a recall, investigation report, personnel responsible for making decision on the recall, mechanism for notifying buyer(s) and other relevant parties, methods of recall and management of the recalled product. The farm shall implement measures to ensure segregation of recalled products from other farm products within its facility.

5.1.8 A maintenance and cleaning schedule for the premise and equipment associated with cultivation, harvesting, packaging and storage of farm products shall be established and implemented to ensure optimal operating conditions of the facility and equipment at all times.

5.1.9 The FMM shall be reviewed minimally on an annual basis to assess if there is any need for improvement and be revised accordingly if deemed necessary.

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5.1.10 An internal audit on the entire farm management and production system shall be conducted at least once a year.

5.1.11 Following the internal audit, a report containing the following components shall be documented by an auditor:

a)

Audit checklist;

b)

Identification of production site;

c)

Date(s) and duration(s) of audit;

d)

Name of auditor;

e)

Farm products;

f)

Details of non-compliance found and the period to administer corrective actions; and g)

Audit results.

5.1.12 If any non-compliance is being found, the proposed corrective action shall be evaluated by an internal auditor on its effectiveness of resolving the non-compliance, and be administered within the time frame stipulated in the internal audit report.

5.1.13 The management shall inform the auditor immediately when there is any change in the production site and farm products.

5.2

Documentation

5.2.1 Adequate document control shall be in place to ensure that all staff members have access to and are referring to the latest version of the FMM.

5.2.2 The FMM shall be reviewed and approved by authorised personnel before issuance and distribution to farm employees.

5.2.3 All controlled documents shall include the document version number, date of review and page number.

5.2.4 A system shall be in place to ensure that all superseded documents are not used upon issuance of new documents.

5.2.5 All farm records (e.g. input purchases, production logs, laboratory tests, internal audit reports, corrective actions taken) shall be kept up-to-date and be retained for at least two years. Such records shall be genuine, legible and stored or maintained in a suitable condition and be available for audit as required.

5.3

Product identification and traceability

5.3.1 Each package or bulk-packed product leaving the farm shall be tagged with a lot number and be traceable to the farm (e.g. label ed with the name of the farm).

5.3.2 Records of lot number shall be maintained for all farm products leaving the farm.

5.3.3 Records of production log, harvest date and packing date for each lot shall be maintained and be traceable to the lot.

5.3.4 The farm shall keep records of the quantities of certified product sold for each transaction.

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5.3.5 All transaction related documents such as invoices shall be labelled with the lot number(s) of the product. An exception to this is when a buyer specifically requests for the lot number to be excluded in the transaction document and a written request shall be provided by the buyer to the farm.

6

Farm characteristics

6.1

Farm layout

6.1.1 The layout of a production facility shall optimise workflow of employees and operations while ensuring smooth flow and cleanliness of farm inputs and outputs in and out of the facility.

6.1.2 The majority of the facility floor area shall be used for production and production-related activities. Floor space for ancillary activities (e.g. areas for office, pantry, toilets, visitors) shall be kept to a minimum.

6.1.3 Ancillary space shall be physically separated from production and production-related spaces by suitable barriers.

6.1.4 Storage areas for fertilisers, soil amendments, lubricants, oils and allowable crop protectants shall be segregated from the production, washing, packing and product storage areas to prevent contamination of product. They shall be located where risks to the environment or human health are minimised in case of fire, spillage, flooding or other emergencies.

6.1.5 To reduce the risk of causing diffuse pollution to the water catchment, the farm layout shall account for how water flows around the farm premise, particularly where the drains and sanitary drain lines are and where they lead to.

6.1.6 Clean toilets with hand washing facilities for employees shall be provided in the farm. Toilets shall be clearly segregated from the production and packing areas.

6.1.7 Animal-proof measures shall be implemented.

6.2

Farm site and facility

6.2.1 When determining the suitability of a site for farming, the farm shall assess the likelihood of introducing harmful contaminants from the environment to the product and the negative effects the farm's activities may

have on the environment. If necessary, preventive or mitigating measures shall be implemented by the farm.

6.2.2 Barriers and buffer zones shall be established, if necessary, to avoid potential contamination of inputs and farm products from the surroundings (e.g. chemical pesticide drift from the surrounding farms).

6.2.3 When selecting a site, the farm shall consider available amenities (e.g. water and electricity), waste management methods and accessibility of the site for pickup of harvest and transport of equipment.

6.2.4 If applicable, the farm shall consider the amount of sunlight and shading the site receives.

6.2.5 Appropriate maintenance and cleaning of farm premise, structure and equipment shall be conducted regularly to ensure operational effectiveness and efficiency.

6.2.6 The storage areas for farm inputs shall be clean and dry. They shall be roofed and properly covered with impervious flooring and kerbs. Storage items shall be placed slightly elevated above the ground on pallets to avoid contaminating the farm products. Crop protectants/adjuvants, cleaning/sanitising/disinfecting agents and lubricants/oils shall be stored separately.

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7

Farm inputs and resource optimisation

7.1

Sourcing and procurement

Inputs used for production shall be, as much as possible, sourced from green or sustainable sources, or be made from recycled materials. Accurate records of sourcing and procurement shall be kept to allow farm analyse performance of their operations and to make necessary adjustments for more efficient operation.

7.2

Seeds and germination

7.2.1 Seeds with good purities and germination rates shall be used by the farm.

7.2.2 The farm shall , as much as feasible, purchase and use seeds that are not treated or coated with chemical pesticides. In the event that such seeds are unavailable, the farm shall take measures to minimise chemical pesticide residues contamination of the final product. The final product shall have no detectable residue of the chemical pesticide used for the seed treatment and be verified via testing by an ISO/IEC 17025 accredited laboratory.

7.2.3 Seeds shall be stored under appropriate conditions specified on the seed packaging (or dry, sealed and store within temperature range from 5 °C to 20 °C if conditions are not specified on the seed packaging), to protect against contamination by microbes or animals like rodents and to prevent deterioration and reduction in seed viability.

7.2.4 The name of cultivar, seed source, batch number (if applicable), location in farm, sowing date, transplanting date (if applicable) and quantity sown shall be recorded in a production log.

7.3

Water management

7.3.1 A water conservation and management plan shall be established by the farm to ensure that water usage is being continually optimised. In general, the plan shall account for the irrigation system and the type and amount of water use at key water usage areas in a farm production process. It shall include information on an irrigation schedule based on crop water requirements, and measures for leak detection and management.

7.3.2 The farm shall strive to use alternative sources of water and recycled streams to meet non-potable water requirements, such as for landscape irrigation, toilet flushing, cooling tower make-up and general washing activities like vehicle washing, where possible. If grey water is used, it shall not be used for irrigation or washing of farm products and shall meet the requirements stipulated in the technical guide for grey water recycling system. Use of alternative sources of water and recycled streams shall be efficient.

7.3.3 The irrigation system shall be designed to minimise water consumption, while taking into consideration the frequency and ease of monitoring and maintenance, to ensure consistent delivery of quality irrigation water. Measures shall be in place to prevent and rectify any reduction in irrigation water quality, leakage, blockage and back siphonage.

7.3.4 Water-saving technologies shall be implemented for irrigation processes. Water used for irrigation shall be recirculated or recovered from dehumidification processes as far as feasible; otherwise, farms shall utilise other water-saving technologies (e.g. pressure compensated drip emitters for irrigation, or soil amendment to retain water). Use of water supplied by the national water agency for irrigation using overhead sprinklers shall be prohibited. For farm irrigating via sprinklers using alternative water supplies, a robust irrigation scheduling programme shall be in place. Where feasible, appropriate measures or technologies shall be used to minimise evapotranspiration of crops without compromising yields.

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7.3.5 If pond water is used for irrigation, the farm shall ensure that the pond water used is not contaminated. Potable water shall be used for washing of ready-to-eat product or for seed soaking and irrigation of ready-to-eat sprouts.

7.3.6 For the installation of water-efficient fittings and flow rates/flush volumes for basin, sink, shower and bib taps/mixer and urinals at farms, it is presupposed that these are in compliance with applicable statutory and regulatory requirements.

7.3.7 The farm shall calculate and monitor its water consumption (WC) using formula (1). The frequency of monitoring shall be determined by the farm, with the duration between each monitoring not exceeding the maximum stated in Annex B.

WC (L/kg) =

V_{Total} (L)

(1)

$W_{\text{marketable}}$ (kg)

As amended,

where: V_{Total} is the total volume of water supplied (including water from alternative sources and water *Aug 2022*

supplied by the national water agency) for crop production activities (excluding postharvest activities and water used in cooling towers) in a period determined by the farm.

$W_{\text{marketable}}$ is the weight of marketable production in the same period.

Water used in cooling towers shall be recorded separately, where applicable.

7.3.8 The farm shall indicate the proportion of water used, in terms of percentage, which is derived from alternative water sources for each WC calculation.

7.3.9 Where applicable, the farm shall record the volume of water used for postharvest activities in the same period through installation of appropriate sub-metering system.

7.3.10 The farm within water catchment area shall observe the maximum allowable limit stipulated in Table 1 for their stormwater discharge into the drainage system.

Table 1 – Maximum allowable limit for stormwater discharge

Item

Maximum allowable limit (mg/L)

Total nitrogen

10

Total phosphorus

0.65

Total organic carbon

20

Ammonia

1

7.4

Fertiliser management

7.4.1 Fertilisers that are used shall not be contaminated with heavy metals beyond the safety limits stipulated in Annex C. For farms that mix its own fertiliser solution, the fertiliser stock solutions purchased shall be of technical grade.

7.4.2 The preparation of fertiliser solution shall be carried out in an enclosed and clean environment to prevent pest infestation or environmental pollution to the surrounding areas. The containers used to store/mix the fertilisers shall be visually checked to be leakproof.

7.4.3 Composts that are used shall meet the quality parameters specified in SS 628. Composts produced on farms shall not be allowed for sale.

7.4.4 Composting activities, if any, shall be carried out using proper composting facilities in roofed and kerbed areas with impervious flooring such as concrete flooring to prevent feedstock from leaching 14

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into the ground and entering the drains or sanitary drain lines. All feedstock for composting shall be stored in roofed and kerbed areas with impervious flooring.

7.4.5 Raw animal manure, animal carcass, human waste and waste treatment sludge shall not be used for crop cultivation or for composting in the farm.

7.4.6 A fertiliser management plan for crops cultivated by the farm shall be established and documented.

7.4.7 For hydroponics cultivation, the diluted fertiliser solution shall be reused over multiple crop cycles and only be disposed and replaced if necessary

(e.g. if its nutrient composition becomes significantly imbalanced due to build-up of certain nutrients, or accumulation of other ions that can cause phytotoxicity).

7.4.8 As part of the production log, records on the date of use, crop type, fertiliser type, fertiliser batch number (if applicable), growing area where fertiliser is used and quantity of fertiliser used shall be kept and provided during the audit.

7.4.9 The farm shall calculate and monitor its fertiliser consumption (FC) using formula (2). The frequency of monitoring shall be determined by the farm, with the duration between each monitoring not exceeding the maximum stated in Annex B.

$$FC \text{ (g/kg)} = (N+P+K) \times W_{\text{fertiliser}} \text{ (kg)} \times 10$$

(2)

$W_{\text{marketable}} \text{ (kg)}$

where:

N, P and K are numbers, in terms of percentage, associated with each letter found on the fertiliser label. For compost, the values of N, P and K can be obtained via laboratory testing, or the sum of N, P and K can be assumed to be a default value of 3.

$W_{\text{fertiliser}}$ is the total weight of fertiliser used for crop production in a period determined by the farm. In the case of liquid fertiliser, $W_{\text{fertiliser}}$ refers to the weight of the undiluted solution.

$W_{\text{marketable}}$ is the weight of marketable production in the same period.

7.4.10 The farm shall indicate the proportion of fertiliser used, in terms of percentage, which is derived from upcycling (e.g. composting) for each FC calculation.

7.5

Energy management

7.5.1 If applicable, energy efficient lights (e.g. LED grow lights) shall be used as the main light source for crop cultivation to reduce overall energy costs.

7.5.2 Energy efficient measures shall be implemented, if applicable, for the farm's mechanical and electrical equipment (e.g. use of sensor, timer, thermostat controller, variable speed drives for pumps, air conditioning split unit/chiller with good coefficient of performance, variable frequency drive on fan, right location and sizing of equipment, certified or high efficiency equipment).

7.5.3 If applicable and feasible, energy efficient and effective cooling system shall be installed according to crop needs. For air conditioning split units, the outer air conditioning units shall be placed as close to the inner units as possible to optimise electrical efficiency of air conditioning. Farms using cooling system to cool its growing ambient environment shall seek appropriate measures to minimise loss of cooled air to the outside environment and/or reduce heat gain from the outside environment (e.g.

ensure that door gaps are properly sealed or insulation of growing facility and cooling system with appropriate materials).

7.5.4 As much as feasible, renewable energy shall be incorporated as part of the farm's energy source. The farm shall strive to increase the proportion of renewable energy usage over time and put in place plans to reduce future energy consumption.

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7.5.5 The farm shall calculate and monitor its energy consumption (EC) using formula (3). The frequency of monitoring shall be determined by the farm, with the duration between each monitoring not exceeding the maximum stated in Annex B.

$EC \text{ (kWh/kg)} = E_{\text{Total}} \text{ (kWh)}$

(3)

$W_{\text{marketable}} \text{ (kg)}$

where:

E_{Total} is the total electricity used for crop production activities (excluding postharvest activities) in a period determined by the farm.

$W_{\text{marketable}}$ is the weight of marketable production in the same period.

7.5.6 The farm shall indicate the proportion of energy used, in terms of percentage, that is derived from renewable energy for each EC calculation.

7.5.7 Where applicable, the farm shall record the amount of energy used for postharvest activities in the same period through installation of appropriate sub-metering system.

7.6

Growing substrates

7.6.1 Substrates used shall not be contaminated with heavy metals beyond the safety limits stipulated in Annex C.

7.6.2 For farms practising substrate culture, the substrate used shall be recyclable, made from recycled materials, or be used repeatedly over multiple crop cycles for as long as possible without compromising yield before being discarded.

7.7

Carbon dioxide

7.7.1 Use of carbon dioxide for carbon enrichment to enhance crop growth shall only be permitted in enclosed cultivation areas. Carbon dioxide used shall be food grade.

7.7.2 Carbon dioxide shall be released evenly into the enclosed cultivation areas. The concentration and uniformity of carbon dioxide distribution within the enclosed cultivation areas shall be monitored.

7.7.3 It is presupposed that measures (e.g. installation of sensors) to ensure the carbon dioxide concentration within the farm facility (including production and ancillary areas) is maintained within safe level and are in compliance with applicable statutory and regulatory requirements.

7.7.4 The farm shall keep records on the use of carbon dioxide, and this shall include the source of carbon dioxide, rate of release, period of release and carbon dioxide concentrations within the farm facility.

7.8

Other agents or substances

7.8.1 For soil-based cultivation, the soil shall be tested every five years, or when there is a large scale top up of soil, for heavy metals by an ISO/IEC 17025 accredited laboratory, to ensure that concentrations are within the safety limits stipulated in Annex C.

7.8.2 Soil amendments for large-scale application to soil shall not be contaminated with heavy metals beyond the safety limits stipulated in Annex C. Heavy metal analyses of the soil amendment shall be conducted by an ISO/IEC 17025 accredited laboratory before any large-scale application to the soil.

Alternatively, the farm shall obtain a copy of heavy metal analysis report from the soil amendment supplier.

7.8.3 It is presupposed that detergents, disinfectants and sanitisers are used carefully and effectively in accordance with applicable statutory and regulatory requirements and as recommended on the manufacturer's label. Farms shall check with the relevant authority for the approved agents/substances 16

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and select these according to safety for employees, farm products and environment, together with stability and non-corrosiveness (to the farming structure/equipment). These agents/substances shall be kept in their original packaging or in bottles that are clearly labelled and kept separately from fertilisers.

7.8.4 Use of other agents/substances such as bio-stimulants, plant hormones and plant vitalisers shall be avoided unless there is sufficient proven data that such substances are not detrimental to human health and the environment.

8

Crop protection

8.1

General

8.1.1 A pest management programme based on the principles of integrated pest management (IPM) shall be established and documented. The programme shall consist of three basic sequential steps of prevention, monitoring and control.

8.1.2 Farm employees shall be sufficiently and continually trained to be equipped with knowledge of IPM and be able to detect the early symptoms of plant pests on crops, perform simple identification of the plant pests detected and administer measures to control them.

8.1.3 All pest management processes shall be documented.

8.2

Prevention

8.2.1 Potential plant pest problems shall be anticipated (e.g. by conducting a plant pest risk analysis) so that preventive measures can be taken.

8.2.2 Appropriate biosecurity and sanitary measures shall be administered to prevent and minimise incursion of plant pests into the farm (e.g. installation of double doors, foot baths and anteroom equipped with air showers).

8.2.3 The farm shall make every effort, where possible, to ensure that the production area is fully enclosed with no gaps (e.g. between the door and the floor) for the entry of small insects. Any gaps shall be properly sealed and checked frequently to ensure the integrity of the seal. Where applicable, the protected structure (e.g. greenhouse) shall be fully enclosed (e.g. with plastic sheet and/or insect mesh of suitable size) to prevent the entry of insects.

8.2.4 The farm shall ensure adequate and efficient ventilation in the production area to prevent the onset of diseases.

8.2.5 Crop waste and weeds shall be removed from the production area promptly.

8.2.6 Measures (e.g. removal of crop debris from recirculating water; use of ozone, ultraviolet lamps, or nanobubble technology for water sterilisation; maintenance of beneficial microbes; appropriate schedule to sanitise production system) shall be administered to prevent build-up of disease pathogens.

8.2.7

Equipment (e.g. cultivators, pruners, secateurs) shall be cleaned and sterilised on a regular basis.

This can be achieved by using an effective cleanser, disinfectant, sanitiser or by physical treatment.

8.3

Monitoring

8.3.1 Crops shall be monitored regularly to determine presence of any plant pests.

8.3.2 Any infested or diseased plant/part of the plant, plant/part of the plant suspected to be infested or infected, or plant/part of the plant showing symptoms out of the norm, shall be removed and disposed from the production area immediately to reduce the source of plant pest inoculum.

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8.3.3 In the case of plant/part of the plant showing unusual symptoms or is suspected to be infested or infected, the suspected plant pest shall be identified. Upon confirmation of the identification as a plant pest, farm employees shall be trained on the proper identification of the plant pest and symptoms.

8.4

Control

8.4.1 In the event of increased plant pest pressure, the farm shall implement a combination of physical control methods (including use of pheromone traps for mass trapping), cultural control methods, and/or biological control methods (application of biological control agents) that are product-safe and environmentally friendly for plant pest control.

8.4.2 Use of any form of chemical pesticide for plant pest control shall be strictly prohibited.

8.4.3 If all feasible alternative plant pest control measures described in 8.4.1 have been exhausted, allowable crop protectants may be used for plant pest control. The farm shall maintain proper documentation to illustrate the lack of alternative suitable plant pest control measures and plant pest severity leading to the decision to apply allowable crop protectants.

8.4.4 It is presupposed that the suitability of use and application methods of allowable crop protectants in the context of the production facility are in compliance with applicable statutory and regulatory requirements. Allowable crop protectant shall be used in accordance with recommendations on the product label (e.g. recommended crop type and dosage), where applicable.

8.4.5 When feasible, the farm shall opt for spot application of the infected/infested area(s), instead of applying the allowable crop protectant to the entire production facility.

8.4.6 When mixing allowable crop protectant solution for application, the applicator shall prepare only the required amount for the intended treatment area to prevent leftover solution after application.

8.4.7 Allowable crop protectants with different modes of action shall be rotated between treatments to prevent build-up of plant pest resistance.

8.4.8 During the application of allowable crop protectants, the farm shall use appropriate personal protective equipment and calibrated application equipment.

8.4.9 The farm shall adhere strictly to the application rate, re-entry interval and pre-harvest interval on the product label, where applicable.

8.4.10 Allowable crop protectants shall be stored in a separate locked area and be accessible only to authorised personnel. The storage area shall be clean, dry and clearly marked as an allowable crop protectant store. All allowable crop protectant products shall be stored in their original containers with their original labels and arranged such that liquid products are stored below powdered/dry products.

8.4.11 The production log shall include the causal agent i.e. plant pest detected, date of application, name of allowable crop protectant applied, quantity used per area, pre-harvest interval and permissible harvesting date.

8.4.12 When necessary to use substance not listed in Table 2 of GL 32-1999 for plant pest control, the substance used shall not be applied onto and come into contact with the crops, and the farm shall, as much as possible, use only substance that is environmentally friendly. The farm shall assess the risk of contamination of product with such substance and the final product shall be tested by an ISO/IEC

17025 accredited laboratory for residue of the substance if the risk is deemed significant.

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9

Postharvest

9.1

Harvest and packaging

9.1.1 Harvesting shall be conducted rapidly with measures implemented to minimise damage and contamination of the farm products. Potential contaminant sources can include harvesting equipment, receptacles used for transportation, composts, growing media, fertilisers, allowable crop protectants and non-farm activities.

9.1.2 Where applicable, the harvested product shall be brought out of direct sunlight and into the shade in the shortest time possible, after which relevant cold chain measures according to SS 585 shall be implemented to ensure product freshness.

9.1.3 Washing and packing area for harvested product shall be separated from the toilet, storage and production areas, sheltered from the weather, and shall be kept clean, tidy, well-ventilated, with proper pest control and free of foul smell at all times.

9.1.4 Washing and packing areas shall be cleaned according to appropriate cleaning schedules and procedures.

9.1.5 It is presupposed that the appropriate measures are taken to ensure that ready-to-eat products are in compliance with applicable statutory and regulatory requirements. If disinfectants or sanitisers are used to clean the product, they shall be used in accordance with the recommended dosage stated on the manufacturer's label to ensure minimal environmental impact.

9.1.6 Farms shall minimise water and electricity used in postharvest activities, such as washing and processing of farm products, and keep records of the amount of water and electricity used for such activities.

9.1.7 Surface of the harvested farm products shall be clean and dry before packing.

9.1.8 Packing line and machines shall be washed and disinfected/sanitised regularly before and after packing.

9.1.9 Clean packing receptacles, crates and materials shall be used. These shall be kept away from animals, pests, physical and chemical hazards. Packing receptacles and crates that have direct contact with the farm products shall be disinfected/sanitised prior to use for packing of farm product. Farms shall consider using clean, recyclable packing materials (except newspaper) and receptacles.

9.1.10 Farm products shall be packed in new, single-use bags, with consideration to minimise use of non-recyclable packaging as far as possible.

9.1.11 Farm employees shall be in clean uniform and shoes when entering packing house and/or product processing room and shall wash their hands thoroughly with water and soap before handling farm products. They shall not smoke, drink or eat when handling the farm products, as they may introduce microbes and/or contaminate the products. They shall wear head gears, clean gloves and aprons during washing and packing.

9.1.12 When the farm uses a shared facility for packaging, the farm shall ensure that the packaging line for clean and green product is segregated physically or temporal y, and a traceable record for packaging is retained.

9.2

Storage and distribution

9.2.1 The farm shall schedule its daily harvest according to daily demands to maximise freshness of its product and minimise the need for long-term cold storage.

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9.2.2 If there is a need for pre-cooling and cold storage (recommended between 2 °C and 10 °C), farm products shall be treated or stored immediately after harvesting and packing respectively. In addition, the farm shall keep records of electricity used for pre-cooling and cold storage of farm products.

9.2.3 Refrigeration equipment, chillers and reefer trucks shall be in good working condition. Regular temperature checks and calibration shall be conducted and recorded. Appropriate coolant to ensure energy efficiency of the refrigeration system shall be used where applicable.

9.2.4 The blower units within refrigerated/cold stores shall be installed according to the temperature requirement of the fresh products. Air circulation shall be optimised and unhindered with adequate spaces between the product storage crates/pallets or tote boxes to allow cold air to circulate around them. The cold room shall not be overloaded and its door shall be kept closed at all times.

9.2.5 Containers/crates holding the finished packed products shall be elevated above ground on pallets during storage or in the holding area prior to delivery.

9.2.6 During storage, unpacked vegetables for bulk delivery shall be protected appropriately from moisture loss and potential contamination with clean cover.

9.2.7 The cold room and transport vehicles shall be sanitised and cleaned on a regular basis, and be free from decaying crop wastes, pest infestation, chemical spills and foul smell at all times.

9.2.8 The farm shall calculate the transport fuel consumption (TFC) using formula (4) for delivery of its products to consumers and/or businesses.

TFC (L/kg)=

V_{Fuel} (L)

(4)

$W_{\text{marketable}}$ (kg)

where: V_{Fuel} is the total volume of fuel used by the farm (excluding fuel used by third-party delivery companies) for delivery of its products in a period determined by the farm.

$W_{\text{marketable}}$ is the weight of marketable production in the same period.

10

Farm waste management and circularity

10.1 General

The farm shall develop and document a farm waste management plan with the aim of reducing and upcycling farm waste to enhance resource circularity over time. The farm waste management plan shall include the characterisation and reporting of farm waste, strategy to reduce and upcycle farm waste, and method of farm waste disposal.

10.2 Farm waste characterisation

Farm waste shall be classified according to the categories in Table 2, and the amount of waste corresponding to each category shall be quantified, recorded and monitored over time.

10.3 Farm waste reporting

The farm shall calculate its net edible crop waste output (Net waste edible) using formula (5). The frequency of monitoring shall be determined by the farm, with the duration between each monitoring not exceeding the maximum stated in Annex B.

W

Net waste

waste disposed (kg)

edible (kg/kg) =

(5)

Wmarketable (kg)

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where: Wwaste disposed is the total weight of edible crop waste produced that is sent for disposal/incineration during a period determined by the farm.

Wmarketable is the weight of marketable production in the same period.

Table 2 – Categories of farm waste (crop and non-crop)

Waste category

Explanation

Examples

Part of the plant that is meant for human consumption but is not eventually exceeding market demand, crop consumed. This includes farm products trimmings like yellowing lower Edible crop waste

that are of sellable quality, but are not leaves or leaves that are damaged eventually consumed, and those that are by insects, spoiled/rotten crops not of sellable quality, but are otherwise

intended for human consumption.

Inedible crop waste Part of the plant that is not meant for Roots, tomato vines human consumption.

Non-crop solid waste that is generated as Spent substrate, polystyrene Other solid farm

a by-product of the main process of crop sponges, containers used for waste cultivation and is never intended for storage of cleanser, disinfectants, human consumption.

sanitisers,

al owable

crop

protectants and packaging waste

Non-crop liquid waste that is generated Spent fertiliser solution, water as a by-product of the main process of used for cleaning cultivation Liquid farm waste

crop cultivation and is never intended for systems

human consumption. This does not

include stormwater runoff from the farm's

premise.

10.4 Farm waste reduction and upcycling strategy

10.4.1 As much as feasible, the farm shall adopt initiatives to reduce and upcycle the four categories of waste according to the waste reduction and upcycling hierarchy described in Annex D. In particular, the farm shall strive to implement measures to upcycle their farm waste towards improving farm circularity in terms of resource use. Any action to move towards farm circularity shall not be at the expense of food quality and safety.

10.4.2 The farm shall quantify and monitor the results of its efforts to divert generated farm waste away from disposal/incineration at a monitoring frequency determined by the farm, according to the diversion factor formula (6).

Diversion factor (%) = $W_{\text{diverted}} \text{ (kg)} \times 100$

(6)

$W_{\text{gross waste}} \text{ (kg)}$

where:

W_{diverted} is the weight of farm waste (excluding liquid farm waste) that is diverted from disposal/incineration in a period determined by the farm.

$W_{\text{gross waste}}$ is the total weight of farm waste (excluding liquid farm waste) generated in the same period.

10.4.3 The farm shall strive to increase its performance in the diversion factor over time.

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10.5 Farm waste disposal

10.5.1 Proper rinsing of used containers of cleanser, disinfectant, sanitiser and allowable crop protectant shall be done. These containers shall be stored and disposed in a proper manner and not be used for storage of food and water.

10.5.2 Residual cleanser, disinfectant, sanitiser and allowable crop protectant shall be disposed in a proper manner/channel with minimal environmental impact.

10.5.3 It is presupposed that liquid farm waste meet, or be treated in order to meet, the applicable statutory and regulatory requirements before disposal into public sewerage and drains. All liquid farm waste to be discharged into the public sewerage system shall be done so only with the consent of the competent authority. Used nutrient solution shall not be discharged into the drainage system. Farms shall keep records of the volume of liquid farm waste discharged.

11

Product specifications and key performance indicators 11.1 The farm shall meet the corresponding performance level for the quality indicators and green indicators stipulated in Annex B.

11.2 Supporting documents such as utility bills and laboratory test reports shall be kept to support the determination of quality indicators and green indicators.

11.3 The farm shall, over time, strive to and demonstrate improvement in the farm's performance in all the green indicators.

11.4 The farm shall be able to make clean and green claim, or any claim of equivalent meaning, if it is in compliance with this standard, i.e. SS 661.

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Annex A

(informative)

Recommended clean and green practices

A.1

Documentation

A.1.1 Appropriate measures should be in place to prevent adulteration of electronic records (e.g.

record can be password protected by authorised personnel).

A.1.2 All electronic records should be backed up regularly.

A.2 Farm layout

The garbage collection point should be located away from the farm facility to minimise incursion of plant pests and contamination of farm products.

A.3 Farm site and facility

A.3.1 The farm facility should be sited out of heavy industrial and chemical industrial zones.

Otherwise, measures should be taken to mitigate possible contaminations.

A.3.2 An environment impact assessment of the overall farming location should be conducted.

This assessment should include:

a)

Risk analysis of surrounding environment on safety of farm products. Examples of possible risks are contamination from nearby heavy industries and chemical pesticide drifts from surrounding farms or ornamental plant nurseries.

b)

Impacts of farming activities on the environment, surrounding communities and residents, if applicable.

A.4 Seeds and germination

A.4.1 For every batch of seeds of each cultivar, a germination test to determine germination rate and uniformity should be conducted and recorded prior to large-scale production. The farm should use the results of the germination test to determine the quantity of seed required for sowing and in production scheduling.

A.4.2 The farm should make a conscious effort to select crop cultivars that are bred for resource efficient and environmentally friendly characteristics (e.g. drought tolerance, heat tolerance, enhanced fertiliser uptake rates).

A.4.3 When transplanting, optimum spacing for the cultivar as provided by the seed supplier should be used to optimise cultivation space.

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A.5 Water management

A.5.1 To reduce the risk of causing diffuse pollution to the environment, best management practices such as cut-off drains and treatment ponds should be adopted to meet the discharge requirements stipulated under the applicable statutory and regulatory requirements to prevent the discharge of nutrient-rich water into the drainage and sewerage systems.

A.5.2 Farms with water consumption (including water not supplied by the national water agency and excluding water supplied to downstream customers) of at least 60,000 m³ in any of the three preceding calendar years will be required to install private water meters at various water usage areas within its premise to track and monitor water usage.

A.5.3 Farms with water usage of less than 60,000 m³/year should consider installing private water meters to track and monitor water usage at key areas of water use (e.g. process use or irrigation systems, toilets, cooling towers). This may be further enhanced with the use of online metering systems to provide more timely information on water usage and improve leak detection capabilities.

A.5.4 For farms utilising cooling towers, the cooling towers should achieve a minimum of 7 and 10

cycles of concentration using potable water and NEWater respectively.

NOTE 1 – Cycles of concentration refer to the number of times water is circulated within a cooling system before being discarded.

NOTE 2 – NEWater is reclaimed water produced from treated used water that is further purified using advanced membrane technologies and ultraviolet disinfection.

A.5.5 Moisture content of substrate/soil should be monitored (e.g. using moisture sensors) and irrigation should only be applied when there is a moisture content deficit in the substrate/soil.

Alternatively, where applicable, sensors can be used to monitor environmental conditions to guide irrigation scheduling.

A.5.6 If equipment is used for dehumidification, the farm should recycle the water collected from the dehumidification process for irrigation, provided that the water is free from contaminants.

A.5.7 Farms should comply with SS ISO 46001.

A.5.8 Where applicable, farms should use equipment that meets green-labeled water use requirements.

A.6

Fertiliser management

A.6.1 The farm should actively monitor the pH of the growing media and fertiliser uptake rate of crops over time through periodic sampling. The pH and fertiliser content of the growing media should be adjusted accordingly to match the crop type, stage and rate of crop growth.

A.6.2 For farms that utilise substrate/soil as part of its production process, crop rotation should be practised whenever feasible. For example, the farm can rotate with crops that fix nitrogen to improve nitrogen content of the substrate/soil, and/or rotate between crops that have different fertiliser requirements to capture excess fertilisers in the substrate/soil.

A.6.3 Farms should follow the procedures for composting described in Annex A of SS 628.

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A.7

Energy management

A.7.1 LED grow lights used by the farm should have a minimum photosynthetic photon efficacy (PPE) of 2.2 $\mu\text{mol}/\text{J}$. PPE, which describes the photosynthetically active radiation photon output per electrical energy input (in $\mu\text{mol}/\text{J}$), is considered as the appropriate metric for electrical efficiency of light sources for plant growth.

A.7.2 Electrically-driven, water-cooled chilled water system, comprising, among others, chiller, chilled water pump, condenser water pump or cooling tower, which uses chilled water as the media to transfer heat, that has a total installed capacity of 1055 kW (300 RT) or more, and produces chilled water at a temperature of 3 °C or higher, should meet the minimum energy efficiency levels stipulated in Table A.1

below, or in the latest minimum energy efficiency standard.

Table A.1 – Minimum energy efficiency levels for water-cooled chilled water system Chilled

water

15

14

13

12

11

10

9

8

7

6

5

4

3

temperature

(°C)

Minimum

energy

efficiency

0.59 0.60 0.61 0.62 0.63 0.64 0.65 0.66 0.67 0.68 0.69 0.70 0.71

level

(kW/RT)

NOTE – kW/RT = Total energy consumption of the chilled water system (kWh) during the assessment period ÷

total cooling load produced by the system (RTh) during the assessment period.

A.7.3 Non-chiller type of air conditioning system should meet the minimum energy efficiency levels stipulated in Table A.2 below, or in the latest green mark for non-residential buildings standard.

Table A.2 – Minimum energy efficiency levels for non-chiller type of air conditioning system

Peak cooling load (RT)

Minimum energy efficiency level (kW/RT)

< 500

1.08

≥ 500

0.98

NOTE – $\text{kW/RT} = \frac{\text{Total energy consumption of the air conditioning system (kWh) during the assessment period}}{\text{total cooling load produced by the system (RT)}_{\text{h}} \text{ during the assessment period.}}$

A.8 Other agents or substances

The farm should strive to increase the use of green, environmentally friendly or biodegradable detergents, disinfectants and sanitisers over time.

A.9 Crop protection

A.9.1 Farms should be installed with double doors at the entrance/exit of the production area. The doors should be positioned such that they are not facing one another. When entering/exiting the production area, farm employees should open the double doors one at a time, and not both doors concurrently.

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A.9.2 Where applicable, employees should put on or change into clean clothes or overalls before entering the production area.

A.9.3 Air purification technologies should be used where applicable.

A.9.4 Crop rotation should be practised when applicable and feasible.

A.9.5 Based on the plant pest risk analysis, the farm should choose to grow crop cultivars with resistance to the anticipated plant pests.

A.9.6 Physical control methods for plant pest management can include the use of ultraviolet lights and mass trapping using insect pheromones.

A.9.7 Cultural control methods can include the use of trap crops, companion planting and creation of biodiversity habitats to attract natural enemies of plant pests.

A.9.8 Biological control methods can include the use of natural predators (e.g. lacewings and predatory mites), entomophagous fungus, mycophagous fungus and microbial control agents (e.g.

bacteria).

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Annex B

(normative)

Key performance indicators

B.1 Quality indicators

Quality indicators and their corresponding requirements, monitoring frequencies and performance levels are listed in Table B.1.

Table B.1 – Requirements, monitoring frequencies and performance levels of quality indicators

Quality indicator

Requirements

Frequency

Performance level

The farm shall follow the specified storage conditions Conducted at least once for each under SS 585. For farm products not listed under SS type of farm products without Freshness

585, the farm shall conduct a shelf-life assessment and

Annex A of SS 585

established storage conditions and

establish the storage conditions to ensure freshness of shelf life the products for the farm's market.

Representative samples of the farm products shall be

Free from detectable

Below detection limits for GC-

tested by an ISO/IEC 17025 accredited laboratory

chemical pesticide

Tested at least once every year

MS/MS

and/or

LC-MS/MS

using GC-MS/MS and/or LC-MS/MS methods for

residues

methods

multiple pesticide residues.

NOTE – GC-MS/MS = Gas chromatography - tandem mass spectrometry; LC-MS/MS = Liquid chromatography - tandem mass spectrometry 27

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B.2 Green indicators

Green indicators and their corresponding monitoring frequencies, applicable culture systems and performance levels are listed in Table B.2.

Table B.2 – Monitoring frequencies, applicable culture systems and performance levels of green indicators

Green indicator

Frequency

Culture system

Performance level

Hydroponic culture or substrate culture

≤ 35 L/kg

Calculated at least once

Water consumption

every six months

Soil-based culture

≤ 150 L/kg

Hydroponic culture or substrate culture

≤ 20 g/kg

Calculated at least once

Fertiliser consumption

every six months

Soil-based culture

≤ 30 g/kg

Control ed environment with artificial
lighting and/or air conditioning

≤ 30 kWh/kg

Calculated at least once

Energy consumption

every six months

All other farms

≤ 10 kWh/kg

Net edible crop waste

Calculated at least once

All farms

≤ 0.2 kg/kg

output

every six months

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Annex C

(normative)

Heavy metal safety limits for farm inputs

Safety limits (ppm)

Heavy metal

Soil amendment

Fertiliser

Soil

and substrate

Arsenic

≤ 40

≤ 55

≤ 40

Cadmium

≤ 3

≤ 12

≤ 2

Chromium

≤ 2

≤ 380

≤ 2

Lead

≤ 120

≤ 530

≤ 120

Mercury

≤ 1

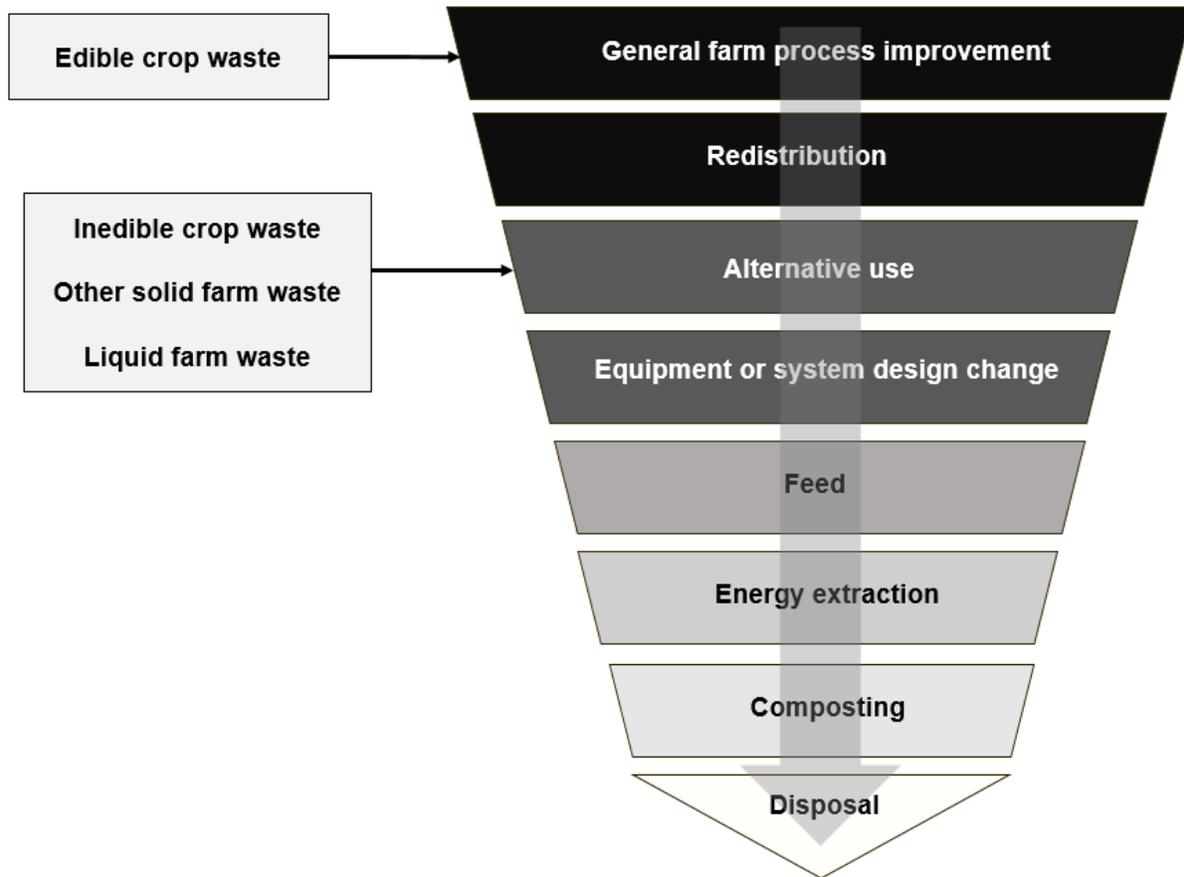
≤ 10

≤ 1

NOTE – Values were adapted from the Dutch target and intervention values (2000) and product function categories (PFCs) of EU fertilising products.

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Annex D

(normative)

Farm waste reduction and upcycling hierarchy

D.1 Hierarchy overview

The waste reduction and upcycling hierarchy is guided by the value retention of farm waste, with initiatives falling within the higher ranks of the hierarchy

retaining higher values. As such, initiatives that fall within the higher ranks are preferred where possible. The hierarchy is illustrated in Figure D.1.

Figure D.1 – Waste reduction and upcycling hierarchy

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D.2 Edible crop waste

For edible crop waste, the farm shall first consider initiatives that fall under the ranks of general farm process improvement, and redistribution, before gradually moving down the ranks in the hierarchy when there are no suitable initiatives.

D.3 Inedible crop waste

For inedible crop waste, other solid farm waste and liquid farm waste, the farm shall first consider initiatives that fall under the rank of alternative use and gradually move down the ranks in the hierarchy when there are no suitable initiatives.

D.4 Examples

Examples of initiatives associated with each rank of the waste reduction and upcycling hierarchy are shown in Table D.1.

Table D.1 – Examples of waste reduction and upcycling initiatives Rank of waste reduction

Examples

and upcycling hierarchy

General farm process

- Change in standard operating procedures to optimise improvement

production systems and resource consumption

- Improvements in scheduling of crop production according to forecasted demands
- Use of technologies to improve fertiliser management and growing environment to minimise yellowing of old leaves

- Crop rotation

- Improvements in cold chain management and packaging

Redistribution

- Donate to food distribution charities

Alternative use

- Process into other food products
- Reuse spent substrate for landscaping and horticultural use as soil amendment
- Reuse spent hydroponics fertiliser solution for

fertigation of landscape plantings

- Seek outlets for some farm wastes

Equipment or system

- Integrate different production systems (e.g.

design change

aquaponics) whereby waste from one system is used

as input for the other

Feed

- Use by-product recovery of crop cultivation directly as animal feed
- Recycle to use as feed (e.g. for black soldier fly) then harvested as a potential protein source for animal feed

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Rank of waste reduction

Examples

and upcycling hierarchy

Energy extraction

- Anaerobic digestion

- Gasification

- Pyrolysis

Composting

- Divert spoiled produce from the waste stream to be mixed with bulking agents (e.g. roots, vegetable trimmings) and made into compost

Disposal

- Disposed with other trash

- Disposed as waste water

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Public utilities (water supply) regulations

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[6]

Sewerage and drainage (trade effluent) regulations

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Workplace safety and health (general provisions) regulations NOTE – The regulations and acts listed above are not exhaustive. Users of the standard will need to check with the relevant regulatory bodies on the latest regulatory and statutory requirements.

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