# RWANDA STANDARD

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# Guidelines for the production of organic fertilizer and soils amendments from municipal solid wastes



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In order to match with technological development and to keep continuous progress in industries, standards are subject to periodic review. Users shall ascertain that they are in possession of the latest edition





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## Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 582 was prepared jointly by Technical Committee RSB/TC 7, *Fertilizers, soil conditioners and beneficial substances* and RSB/TC 76, *Solid wastes and hazardous wastes management.*

### Committee membership

The following organizations were represented on the Technical Committee on *Fertilizers, soil conditioners and beneficial substances* (RSB/TC 7) and *Solid wastes and hazardous wastes management* (RSB/TC 76) in the preparation of this standard.

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## Introduction

According to projections of the United Nations, about 67 % of the overall world population will reside in urban areas by the year 2025 compared to 50 % only in 1995 (UNFPA, 1996) Particularly in low-income countries, city administrations are faced with huge challenges, among those the proper disposal of an abundance of refuse from households, commerce and industry by safe means, and the sufficient supply of cheap but nutritious food rich in vitamins and minerals to feed the population of these expanding urban centers.

Composting is basically a process for decomposition of organic solid wastes (Airan and Bell, 1980). The decomposition process is accomplished by various microorganisms including bacteria, actinomycetes and fungi. In the process of composting, microorganisms break down organic matter and produce carbon dioxide, water, energy in forms of heat humus, and the relatively stable organic end product (Rynk et al., 1992). Under optimal conditions, composting proceeds through three phases:

a) the mesophilic, or moderate-temperature phase,

b) the thermophilic, or high-temperature phase,

c) a cooling and maturation phase.

Different communities of microorganisms predominate during the various composting phases. Initial decomposition is carried out by mesophilic microorganisms, which rapidly break down the soluble, readily degradable compounds. The heat they produce causes the compost temperature to rapidly rise. As the temperature rises above 40□C, the mesophilic microorganisms become less competitive and are replaced by others that are thermophilic. At temperatures of 55□C and above, many microorganisms that are human or plant pathogens are destroyed. During the thermophilic phase, high temperatures accelerate the breakdown of proteins, fats, and complex carbohydrates like cellulose and hemicellulose, that are the major structural molecules in plants. As the supply of these high-energy compounds becomes exhausted, the compost temperature gradually decreases and mesophilic microorganisms once again take over for the final phase of maturation of the remaining organic matter (Golueke, 1972; Rymshaw et al., 1992)

The production of compost has long been the object of great interest to researchers, since compost may be used as a fertilizer or as a material for producing plant nursery substrates. From an economic point of view, composting can therefore bring reductions in the cost of disposing of organic residues, as well as providing an income, by virtue of compost being used as a substitute for other materials (chemical fertilizers and peat) that may be quite expensive. In addition, composting can have a strong ecological environmental value, allowing organic by-products to be subtracted from the disposal cycle and put back into the production cycle, enhancing it and closing the organic carbon cycle, while also being a tool for the economic and social sustainability of production activities in rural areas.

Of the many elements required for microbial decomposition, carbon and nitrogen are the most important. Carbon provides both an energy source and the basic building block making up about 50% of the mass of microbial cells. Nitrogen is a crucial component of proteins, nucleic acids, amino acids, enzymes and co-enzymes necessary for cell growth and function. The ideal C/N ratio for composting is generally considered to be around 30:1 by weight. At lower ratios, nitrogen will be supplied in excess and will be lost as ammonia gas, causing undesirable odors. Higher ratios mean that there is not sufficient nitrogen for optimal growth of the microbial populations, So the compost will remain relatively cool and degradation will proceed at a slow rate (Rymshaw et al., 1992). In general, materials that are green and moist tend to be high in nitrogen, and those that are brown and dry are high in carbon. High nitrogen materials include grass clipping, plant cuttings, and fruit and vegetable scraps. Brown or woody materials such as rice straw, corn cobs, wood chips, and sawdust are high in carbon (Table 1).

**Table 1 – C/N ration of different organic materials**

| Materials | C/N |
|---|---|
| **Materials high in carbon** | |
| Straw | 40-100:1 |
| Wood chips or sawdust | 100-500:1 |
| Bark | 100-130:1 |
| Mixed paper | 150-200:1 |
| Newspaper or corrugated cardboard | 560:1 |
| **Materials high in Nitrogen** | |
| Vegetable scraps | 15-20:1 |
| Coffee grounds | 20:1 |
| Grass clippings | 15-25:1 |
| Manure | 15-25:1 |

As composting proceeds, the C/N ratio gradually decreases from 30:1 to 10-15:1 for the finished product. This occurs because each time that organic compounds are consumed by microorganisms, two-thirds of the carbon is given off as carbon dioxide. The remaining third is incorporated along with nitrogen into microbial cells, then later released for further use once those cells die (Golueke, 1972).

Another essential ingredient for successful composting is oxygen. As microorganisms oxidize carbon for energy, oxygen is used up and carbon dioxide is produced. Without sufficient oxygen, the process will become anaerobic and produce undesirable odors, including the rotten-egg smell of hydrogen sulfide gas (De Bertoldi et al., 1989) Adequate amounts of phosphorus, potassium, calcium and trace minerals such as iron, boron, copper, and others are essential to microbial metabolism. The mineralization of organic P in organic wastes differs widely. depending on the form and the percentage of P or C:P ratio (Bowman and Cole, 1987). P is a structural component of many biochemicals (nucleic acids, co-enzymes, phospho-proteins and phospho-lipids). Consequently, both plants and soil organisms actively compete for P as orthophosphate in the soil solution. Mineralization of organic P depends primarily on the activity of soil microorganisms, however, also invertebrates, especially earthworms, have an important regulatory function in this process. Surface casting earthworms can increase the short-term availability of P in plant residues by 2- to 3-fold through the release of inorganic P in plant material by physical disruption which is especially important in soils of low P status (Mansell et al., 1981). The net functional contribution of invertebrates, however, depends largely on their ability to stimulate microbial activity (Hutchinson and King, 1982).

A pH between 5.5 and 8.5 is optimal for compost microorganisms. As bacteria and fungi digest organic matter, they release organic acids. In the early stages of composting, these acids often accumulate. The resulting drop in pH encourages the growth of fungi and the breakdown of lignin and cellulose. Usually the organic acids become further broken down during the composting process. If the system becomes anaerobic, however, acid accumulation can lower the pH to 4.5, severely limiting microbial activity. In such cases, aeration usually is sufficient to return the compost pH to acceptable ranges (De bertoldi et al., 1989).

Microbial activity generally occurs on the surface of the organic particles. Therefore, decreasing particle size, through its effect of increasing surface area, will encourage microbial activity and increase the rate of decomposition. On the other hand, when particles are too small and compact, air circulation through the pile is inhibited. This decreases $O_2$ available to microorganisms within the pile and ultimately decreases the rate of microbial activity.

# Guidelines for the production of organic fertilizer and soils amendments from municipal solid wastes

## 1 Scope

This Draft Rwanda Standard provides the guidelines for the production of organic fertilizers and organic soil amendments from municipal solid wastes in order to maintain the sustainability of agro-ecosystems land.

This document covers the production of organic fertilizer and organic soil amendments from municipal solid wastes using composting or vermicomposting technology. It focuses on the selection of raw materials, production processes, quality control and documentation to ensure consistency, sustainability and consumer trust.

It also covers the organizational and practical advice on the management of the human, technical and administrative factors affecting the quality of final product.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS 279, *Organic fertilizers — Specification*

RS ISO 8157, *Fertilizers and soil conditioners — Vocabulary*

RS ISO 14820-1, *Fertilizers and liming materials — Sampling and sample preparation — Part 1: Sampling*

RS ISO 14820-2, *Fertilizers and liming materials — Sampling and sample preparation Part 2: Sample preparation*

## 3 Terms and definitions

For the purposes of this standard, the terms and definitions given in RS ISO 8157 and the following apply.

**3.1**

**audit**

systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable for achieving objectives

**3.2**

**batch**

defined quantity of raw material, packaging material or product issued from one process or series of processes so that it could be expected to be homogeneous

**3.3**

**batch number**

distinctive combination of numbers, letters and/or symbols, which specifically identifies a batch

**3.4**

**bulk product**

any product which has completed manufacturing stages up to, but not including, final packaging

**3.5**

**calibration**

set of operations that establish, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, or values represented by a material measure, and the corresponding known values of a reference standard

**3.6**

**cleaning**

all operations that ensure a level of cleanliness and appearance, consisting of separating and eliminating generally visible dirt from a surface by means of the following combined factors, in variable proportions, such as chemical action, mechanical action, temperature, duration of application

**3.7**

**complaint**

external information claiming a product does not meet defined acceptance criteria

**3.8**

**compost**

well decomposed organic wastes like plant residues, animal slurry from livestock sheds

**3.9**

**contamination**

occurrence of any undesirable matter such as chemical, physical and/or microbiological matter in the product

**3.10**

**control**

verification that acceptance criteria are met

**3.11**

**deviation**

doing something that is different from what people consider to be normal or acceptable

**3.12**

**finished product**

product that has undergone all stages of production, including packaging in its final container, for delivery

**3.13**

**internal audit**

systematic and independent examination made by competent personnel inside the company, the aim of which is to determine whether activities covered by these guidelines and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable for achieving objectives

**3.14**

**maintenance**

any periodic or unplanned support and verification operations designed to keep premises and equipment in proper working condition

**3.15**

**out-of-specification**

examination, measurement or test result that does not comply with defined acceptance criteria

**3.16**

**packaging operation**

all packaging steps including filling and labelling, which a bulk product has to undergo in order to become a finished product

**3.17**

**packaging material**

any material employed in the packaging of a finished product

**3.18**

**premises**

physical location, buildings and supporting structures used to receive, store, produce, package, control and deliver raw materials, product, and packaging materials

**3.19**

**production**

processes of making and packaging compost

**3.20**

**quality assurance**

all those planned and systematic activities necessary to provide confidence that a product satisfies given acceptance criteria

**3.21**

**raw material**

any substance going into or involved in the production of a bulk product

**3.22**

**recall**

decision made by a company to call back a product batch that has been put on the market

**2.23**

**sample**

one or more representative elements selected from a set to obtain information about that set

**3.24**

**sampling**

set of operations relating to the taking and preparation of samples

**3.25**

**waste**

any residue of a production operation, transformation or use, any substance, material, product that its holder intends for disposal

# 4 Concept of organic fertilizers and organic soil amendments production

## 4.1 General principles for organic fertilizers and organic soil amendments' production

**4.1.1** Organic fertilizers and organic soil amendments should be produced from natural materials having definite chemical composition with a high analytical value that supply plant nutrient in available form. Organic fertilizers and organic soil amendments should be derived from animal matter, human execrate or vegetable matter (e.g. compost, manure). Organic fertilizers and organic soil amendments are made with natural raw material; it usually pertains to our biodegradable wet suit. Usually compost is made by decomposing biodegradable wastes. These wastes include paper, leaves, fruit peelings left over foods and even fruit juices.

**4.1.2** Organic fertilizers and organic soil amendments should make:

a) a good addition to the soil;

b) the soil reach and

c) ideal to planting.

**4.1.3** Organic fertilizers and organic soil amendments characteristics vary with the intended uses but the producer should consider the following elements (in order of importance):

a) quality (moisture, odor, feel, particle size, stability, nutrient concentration, product consistency, and a lack of weed seeds, phototoxic compounds and other contaminants).

b) price (should be competitive with other composts, although high quality and performance can justify a higher price).

c) appearance (uniform texture, relatively dry, earthy color).

d) information (products benefits, nutrient and pH analysis, and application rates and procedures).

e) reliable Supply

## 4.2 General principles for the selection of raw materials

**4.2.1** No matter what the raw material, the general principles for choosing the raw materials for production of organic fertilizers and organic soil amendments are as follows.

a) the source of raw materials is extensive and the supply is stable;

b) low water content of raw materials;

c) appropriate nitrogen, phosphorus, potassium and organic nutrients;

d) perishable;

e) low or low price.

**4.2.2** Raw materials employed in the production of organic fertilizers or organic soil amendments should be well sorted at the source to guarantee the quality and safety of the final product. The Annexes A and D could guide in the selection of raw materials.

**4.2.3** Systems should be in place to track the origin and journey of raw materials from sourcing to processing, enabling effective traceability and accountability.

**4.2.4** The received raw materials should undergo thorough inspection and testing to verify compliance with quality specifications and identify potential contaminants.

# 5 Production of organic fertilizers or organic soil amendments

## 5.1 Process Efficiency

**5.1.1 Maximization of Resources**: The production of organic fertilizers or organic soil amendments should prioritize the efficient use of resources, aiming to minimize waste and maximize output while adhering to sustainability principles. And there should be no waste dumped at the site.

**5.1.2 Optimized Operations**: Processes should be streamlined and optimized to ensure smooth and efficient production workflows, reducing unnecessary downtime and delays.

**5.1.3. Greenhouse gases emission**: the production processes should be able to reduce the emission of methane.

## 5.2 Compliance and Quality Assurance

**5.2.1 Regulatory Adherence**: Production activities should comply with relevant scientific principles governing the production of organic fertilizers or organic soil amendments, ensuring product legality and safety.

**5.2.2 Quality Control Measures**: Severe quality control protocols should be in place to monitor each stage of the production process, guaranteeing the consistency and purity of the final product.

**5.2.3 Cleanliness standards**: Strict hygiene practices must be upheld throughout production areas to prevent contamination and maintain product integrity.

**5.2.4 Sanitation protocols**: Regular sanitation procedures should be implemented to clean equipment, surfaces, and production environments, minimizing the risk of any contamination.

**5.2.5 Regular inspections**: Production equipment should undergo routine inspections and maintenance checks to identify and address any potential issues promptly.

**5.4.2 Preventive maintenance**: Scheduled maintenance activities should be carried out to prevent equipment breakdowns and ensure optimal performance.

## 5.3 Production monitoring and documentation

**5.3.1 Monitoring Systems**: Robust monitoring systems should be in place to track production metrics, ensuring process efficiency and identifying areas for improvement.

**5.3.2 Documentation Practices**: Comprehensive documentation of production activities, including batch records and quality control data, should be maintained for traceability and quality assurance purposes.

## 5.4 Training and personnel

**5.4.1 Training programs**: Personnel involved in production should receive adequate training on relevant procedures, safety protocols, and quality standards to ensure competency and compliance.

**5.4.2 Employee engagement**: Encouraging employee involvement and empowerment can foster a culture of responsibility and accountability, contributing to overall production excellence.

## 5.5 Continuous improvement

**5.5.1 Feedback mechanisms**: Feedback from customers and quality control assessments should be utilized to identify opportunities for process optimization and continuous improvement.

**5.5.2 Innovation and adaptation**: Embracing innovation and staying abreast of technological advancements can lead to enhanced production efficiency and product quality over time.

## 5.6 Environmental impact mitigation

**5.6.1 Sustainable practices**: Implement sustainable production practices to minimize the environmental footprint of the production of organic fertilizers or organic soil amendments, including water conservation and waste reduction strategies.

**5.6.2 Pollution and offensive odour prevention**: Develop measures to prevent pollution, and minimize emissions and offensive odour, ensuring compliance with environmental regulations and minimizing adverse impacts on surrounding ecosystems.

**5.6.3. Soil contamination prevention:** Avoid the use of contaminated raw materials.

## 5.7 Risk management

**5.7.1 Risk assessment**: Conduct thorough risk assessments to identify potential hazards and vulnerabilities in the production process, implementing appropriate controls and mitigation measures to minimize risks to product quality and safety.

**5.7.2 Contingency planning**: Develop contingency plans to address potential disruptions or emergencies, ensuring continuity of production operations and timely response to unforeseen events.

## 5.8 Traceability and recall procedures

**5.8.1 Traceability systems**: Establish robust traceability systems to track the movement of raw materials, intermediate products, and finished goods throughout the production process, enabling rapid identification and recall of products if necessary.

**5.8.1 Recall protocols**: Develop clear and effective recall protocols to promptly remove any compromised products from the market in the event of safety concerns or quality issues, minimizing potential harm to consumers and reputational damage to the brand.

## 5.9 Research and development

**5.9.1 Innovation initiatives**: Invest in research and development efforts to drive innovation in the production of organic fertilizers or organic soil amendments, exploring new technologies, ingredients, and formulations to improve product quality, efficiency, and sustainability.

**5.9.2 Continuous learning**: Stay informed about industry trends, scientific advancements, and best practices in the production of organic fertilizers or organic soil amendments, continuously seeking opportunities to enhance production processes and product offerings.

## 5.10 Community engagement and stakeholder relations

**5.10.1 Community outreach**: Engage with local communities, stakeholders, and regulatory authorities to foster positive relationships, address concerns, and promote transparency and accountability in production operations.

**5.10.2 Social responsibility**: Demonstrate commitment to social responsibility by supporting community initiatives, adhering to ethical labor practices, and contributing to the well-being of local communities affected by production activities.

## 5.11 Performance metrics and key performance indicators (KPIs)

**Measurement and Evaluation**: Establish performance metrics and KPIs to assess the effectiveness of production processes, track progress towards goals, and identify areas for improvement, enabling data-driven decision-making and continuous performance optimization.

# 6 Personnel

## 6.1 Principle

Personnel involved in production, control, and storage must have appropriate training to ensure quality and safety of organic fertilizers or organic soil amendments

## 6.2 Organization of the company producing compost

**6.2.1** The organizational structure including departments, teams and reporting relationships should be defined, appropriate for the company's size and compost diversity

**6.2.2** Adequate staffing levels should be maintained across different activities

**6.2.3** Independence of quality units should be ensured

## 6.3 Key responsibilities

**6.3.1** Management should support the implementation of sustainable production practices

**6.3.2** Personnel should understand their roles, responsibilities, and access areas

**6.3.3** Personal hygiene, reporting irregularities, and skills are emphasized

## 6.4 Training

**6.4.1** Personnel should have skills based on relevant training and experience

**6.4.2** SPP training should be provided for all personnel, with tailored programs based on individual needs

**6.4.3** Training should be ongoing and subject to regular updates

**6.4.4** Newly recruited personnel should receive appropriate training

**6.4.5** Evaluation of personnel training is essential

## 6.5 Personnel hygiene and health

**6.5.1** Hygiene programs should be established and followed by all personnel

**6.5.2** Personnel should use hand washing facilities, wear appropriate clothing, and avoid unhygienic practices

**6.5.3** Availability of restroom facilities, first aid kits and fire extinguishers

**6.5.4** Ill or injured personnel should be excluded from direct contact with produced compost

**6.5.5** Establish protocols for identifying and temporarily excluding ill or injured personnel from production activities involving organic fertilizer

## 6.6 Visitors and untrained personnel

**6.6.1** Before entering the production, control, and storage areas, **v**isitors or untrained personnel should receive information on personal hygiene and protective clothing such as lab coats, gloves, hairnets, or shoe covers to prevent contamination and be closely supervised

**6.6.2** Implement physical barriers or signage to clearly delineate restricted areas and prevent unauthorized entry

**6.6.3** Use access control measures such as keycards, badges, or security personnel to regulate entry into sensitive areas

**6.6.4** Maintain records of visitor access and any instances of untrained personnel entering restricted areas

# 7 Premises

## 7.1 Foundational principles

**7.1.1** The location, design, construction, and utilization of premises should prioritize:

a) ensuring the safeguarding of the product;

b) allowing for efficient cleaning, sanitizing, and maintenance procedures when necessary; and

c) minimizing the risk of product, raw material, and packaging material mix-ups.

**7.1.2** Design recommendations for premises are outlined within these guidelines. Design decisions should be tailored to the specific type of compost being produced, considering existing conditions, as well as cleaning and sanitizing protocols.

## 7.2 Type of Areas

Separate or clearly delineated areas should be allocated for storage, production, quality control, auxiliary services, washing, and restroom facilities.

## 7.3 Adequate space

Sufficient space should be provided to facilitate various operations, including but not limited to, receipt, storage, and production activities.

## 7.4 Material flow management

The flow of materials, products, and personnel within the premises should be clearly defined to prevent any involuntary mixing.

## 7.5 Maintenance of surfaces

**5.5.1** Surfaces including floors, walls, ceilings, and windows within production areas should be designed or constructed for easy cleaning and, if necessary, sanitization, and should be maintained in a clean and sound condition.

**5.5.2** Windows should be designed without openings where adequate ventilation is ensured. If windows need to be opened, they should be properly screened to prevent the entry of pests.

**5.5.3** During new construction, considerations for proper cleaning and maintenance should be integrated. Design elements should incorporate smooth surfaces where appropriate, capable of withstanding corrosive cleaning and sanitizing agents.

## 7.6 Hygiene facilities

Adequate, clean washing and toilet facilities should be provided for personnel. These facilities should be distinct from production areas yet easily accessible. Facilities for showering and changing clothes should be provided when necessary.

## 7.7 Illumination standards

**5.7.1** All areas should be adequately illuminated to support operational activities.

**5.7.2** Lighting fixtures should be installed in a manner that prevents contamination in case of breakage. Alternatively, measures should be taken to shield the product from potential debris.

## 7.8 Ventilation requirements

Ventilation systems should be sufficient for the intended production operations. Alternatively, specific measures should be implemented to safeguard the product if natural ventilation is not sufficient.

## 7.9 Plumbing and drainage

**5.9.1** Pipework, drains, and canals should be installed to prevent drip or condensation from contaminating materials, products, surfaces, or equipment.

**5.9.2** Drains should be kept clean and free from backflow.

**5.9.3** Leachate should be collected, stored and treated.

## 7.10 Cleaning and sanitization protocols

**5.10.1** Premises used for activities described in these guidelines should be maintained in a clean condition.

**5.10.2** Cleaning and, if necessary, sanitization should be conducted to ensure the protection of each product.

**5.10.3** Cleaning and sanitizing agents used should be specified and proven to be effective.

**5.10.4** Cleaning and sanitization programs should be made-to-order to the specific requirements of each area.

## 7.11 Maintenance standards

Premises used for activities described in these guidelines should be maintained in good repair at all times.

### 7.12 Consumables management

Consumables used within the premises should not compromise the quality of the final product.

### 7.13 Pest control measures

**5.13.1** Premises should be designed, constructed, and maintained to prevent access by insects, birds, rodents, pests, and other vermin.

**5.13.2** An appropriate pest control program should be established for the premises.

**5.13.3** Measures should be taken to manage the exterior surroundings of the premises to discourage the attraction or habitation of pests.

## 8 Equipment

### 8.1 Foundational principle

Equipment should be suitable for the intended purpose and capable of being cleaned and, if necessary, sanitized and maintained. This clause applies to all equipment within the scope of these guidelines. If automated systems are introduced into activities described in these guidelines, they should take into account the application of the given relevant principles.

### 8.2 Installation

The design and installation of equipment should facilitate drainage for cleaning and sanitization purposes. Equipment placement should ensure that the movement of materials, mobile equipment, and personnel does not compromise product quality. Adequate access under, inside, and around equipment should be provided for maintenance and cleaning purposes. Major equipment should be easily identifiable.

### 8.3 Calibration

Laboratory and production measuring instruments critical to product quality should undergo regular calibration. If calibration results fall outside acceptance criteria, the measuring instruments should be appropriately identified and taken out of service. Any out-of-calibration condition should be investigated to assess its impact on product quality, with appropriate steps taken based on this investigation.

### 8.4 Cleaning and sanitization

All equipment should be subject to an appropriate cleaning and, if necessary, sanitization program. Cleaning and sanitizing agents should be specified and proven effective. Equipment assigned to continuous production or the production of successive batches of the same product should undergo cleaning and, if necessary, sanitization at appropriate intervals.

### 8.5 Maintenance

Equipment should undergo regular maintenance to ensure its proper functioning. Maintenance operations should not compromise the quality of the product. Defective equipment should be promptly identified, excluded from use, and isolated if possible.

### 8.6 Consumables

Consumables used for equipment should not impact the quality of the final product.

### 8.7 Authorizations

Access to equipment or automated systems used in production and quality control should be restricted to authorized personnel.

### 8.8 Back-up Systems

Adequate alternative arrangements should be in place for systems that need to be operated in the event of a failure or breakdown.

## 9 Finished product guidelines

### 9.1 Quality Assurance

**9.1.1 Product Specifications:** Clear specifications for finished compost products should be defined, including nutrient composition, particle size, and moisture content, ensuring consistency and effectiveness.

**9.1.2 Quality Control Checks:** Standard operating procedures should be in place and properly implemented to ensure the quality of the compost over time. Regular quality control procedures should be implemented to inspect finished products for adherence to specifications, ensuring they meet established standards before distribution.

### 9.2 Packaging and labelling

**9.2.1 Secure packaging:** Durable and tamper-evident packaging materials should be used to protect finished products from contamination, moisture, and physical damage during storage and transit.

**9.2.2 Accurate labelling:** Product packaging should provide clear and comprehensive labelling, including product name, nutrient composition, usage instructions, and other essential information.

### 9.3 Storage and Handling

**9.3.1 Optimal storage conditions:** Finished products should be stored in controlled environments with proper ventilation and shade to preserve their quality and efficacy over time.

**9.3.2 Proper handling practices:** Protocols for proper handling of finished products should be established to minimize the risk of falls, breakage, or contamination during loading, unloading, and transportation.

## 9.4 Traceability and recall procedures

**9.4.1 Batch tracking:** Traceability systems should be implemented to track the production history of each batch of finished products, enabling rapid identification and recall of any products that may pose safety concerns.

**9.4.2 Recall protocols:** Comprehensive recall procedures should be developed to promptly and effectively remove defective or contaminated products from the market, mitigating potential risks to consumers and ensuring regulatory compliance.

## 9.5 Customer feedback and complaint handling

**9.5.1 Feedback Mechanisms:** Channels for collecting customer feedback on finished products should be established to monitor satisfaction levels, identify areas for improvement, and address any concerns or complaints promptly.

**9.5.2 Complaint Resolution:** Efficient procedures for investigating and resolving customer complaints regarding finished products should be implemented, striving to maintain customer satisfaction and trust in the brand.

## 9.6 Product testing and validation

**9.6.1 Quality Testing:** Regular testing of finished products should be conducted to verify their nutrient content, consistency, and efficacy, ensuring they meet quality standards and regulatory requirements.

**9.6.2 Validation Studies:** Validation studies should be performed to assess the performance and effectiveness of finished products under various environmental conditions and application methods, confirming their suitability for intended use.

## 9.7 Shelf life and stability testing

**9.7.1 Shelf Life Determination:** Stability testing should be carried out to determine the shelf life of finished products under different storage conditions, allowing for accurate expiration date labelling and ensuring product efficacy throughout its lifespan.

**9.7.2 Expiration Date Labelling:** Expiration dates should be clearly displayed on product packaging based on shelf life testing results, providing consumers with essential information for product usage and storage.

## 9.8 Continuous Improvement and Innovation

**9.8.1 Research and Development:** Ongoing research and development initiatives should be invested in to innovate and enhance finished product formulations, incorporating new ingredients, technologies, and production methods to improve performance and sustainability.

**9.8.2 Process Optimization:** Production processes should be continuously evaluated and optimized to increase efficiency, reduce waste, and maintain product quality standards, striving for continuous improvement and market competitiveness.

## 10 Quality control

### 10.1 Principle

**10.1.1** Principles described for personnel, premises, equipment, subcontracting, and documentation should apply to the quality control laboratory.

**10.1.2** The quality control laboratory is responsible for ensuring that the necessary and relevant controls, within its activity, are carried out for sampling and testing so that materials are released for use and products are released for shipment, only if their quality fulfils the required acceptance criteria.

### 10.2 Test methods

**10.2.1** The quality control laboratory should use all test methods necessary to confirm that the product complies with acceptance criteria.

**10.2.2** Controls should be performed on the basis of defined, appropriate and available test methods.

### 10.3 Acceptance criteria

Acceptance criteria should be established to specify the requirements to be met for raw materials, packaging materials, bulk products and finished products.

### 10.4 Results

All results should be reviewed. After this review, a decision should be made, notably in terms of approval, rejection or pending.

### 10.5 Out-of-specification results

**10.5.1** Out-of-specification results should be reviewed by authorized personnel and properly investigated.

**10.5.2** There should be sufficient justification for any re-testing to be performed.

**10.5.3** After the investigation, a decision by authorized personnel should be made, notably in terms of deviation, rejection or pending.

### 10.6 Reagents, solutions, reference standards

Reagents, solutions, reference standards, etc. should be identified by the following information:

a) the name;

b) its strength or concentration, when appropriate;

c) expiration date, when appropriate;

d) the name and/or signature of the person who prepared it, when appropriate;

e) opening date; and

f) storage conditions, when appropriate.

### 10.7 Sampling

**10.7.1** Sampling should be performed by authorized personnel.

**10.7.2** Sampling should be defined in terms of:

a) sampling method;

b) equipment to be used;

c) amounts to be taken;

d) any precautions to be observed to avoid contamination or deterioration;

e) identification of sample; and

f) frequency.

**10.7.3** Samples should be identified by:

a) the name or identifying code;

b) the batch number;

c) the date of sampling;

d) the container from which the sample was taken;

e) the sampling point, if applicable.

**10.7.4** Sampling and sample preparation for inspection and testing shall be carried out in accordance with ISO 14820-1 and ISO 14820-2.

**10.7.5** Samples of finished product should be retained in an appropriate manner and in designated areas.

**10.7.6** Sample size of finished products should allow analyses to be carried out in accordance with local regulations.

**10.7.7** Retain samples of finished product should be kept in their primary package for an appropriate time under the recommended storage conditions.

**10.7.8** Samples of compost may be retained according to company practice or in accordance with local regulations.

### 10.8 Treatment of product that is out of specification

**10.8.1 Rejected finished products, bulk products, raw materials and packaging materials**

**10.8.1.1** Investigations of rejected product or materials should be performed by personnel authorized to do so.

**10.8.1.2** Decisions to destroy or to reprocess should be approved by the personnel responsible for quality.

**10.8.2 Reprocessed finished products and bulk products**

**10.8.2.1** If all or part of a batch of finished product or bulk product does not meet the defined acceptance criteria, a decision to reprocess in order to obtain the defined quality should be approved by personnel responsible for quality.

**10.8.2.2** The method of reprocessing should be defined and approved**.**

**10.8.2.3** Controls should be performed on the reprocessed finished products or bulk products. Results should be reviewed by authorized personnel in order to verify the conformity of the finished product or bulk product with the acceptance criteria.

## 11 Wastes management

**Commented [AN1]:** To be explained in the Definition section or explain it somewhere

### 11.1 Principle

Wastes should be disposed of in a timely and sanitary manner at official disposal site. Waste storage at the production site of organic fertilizer or soil amendments is only for intermediary collections on small amount.

### 11.2 Types of waste

The organization should define the different types of waste that could affect the quality of the product.

### 11.3 Flow

**12.3.1** The flow of waste should not impact on the production operations.

**12.3.2** Appropriate measures should be taken concerning collection, transportation, storage and disposal of wastes.

### 11.4 Containers

**11.4.1** Containers of waste should be properly identified as to contents and other information, as appropriate.

**11.4.2** The container should have a label with the following information:

a) The type of material.

b) Its hazardous properties (HP Code).

c) The quantity.

d) The date that the waste was generated or placed in storage.

e) The producer's contact details (name, telephone number, address, email etc).

### 11.5 Disposal

The disposal of waste should be performed in an appropriate way with an adequate level of control.

## 12 Subcontracting

### 12.1 Principle

A written contract or agreement should be established, mutually confirmed and controlled between the contract giver and the contract acceptor covering subcontracted activities. The objective of this step is to obtain a product or service that complies with the defined contract giver requirements.

### 12.2 Types of subcontracting

This clause concerns subcontracting of:

a) manufacturing;

b) packaging;

c) analysis;

d) cleaning, sanitization of premises;

e) equipment and premises maintenance.

### 12.3 Contract giver

**12.3.1** The contract giver should assess the contract acceptor's ability and capacity to carry out the contracted operations. Further, the contract giver should ensure that the contract acceptor has all the means available to carry out the contract. The contract giver should assess the contract acceptor's ability to comply with these guidelines, as appropriate, and to ensure the operations can be performed as agreed.

**12.3.2** The contract giver should provide the contract acceptor with all the information required to carry out the operations correctly.

### 12.4 Contract acceptor

**12.4.1** The contract acceptor should ensure that they have the means, experience and competent personnel to meet the contract requirements.

**12.4.2** The contract acceptor should not pass to a third party any of the work entrusted to them in the contract without the contractor giver's prior approval and consent. Arrangements should be made between the third party and the contract acceptor to ensure that all information about operations is made available to the contract giver in the same way as in the original contract.

**12.4.3** The contract acceptor should facilitate any checks and audits that the contract giver has defined in the contract.

**12.4.4** The contract acceptor should inform the contract giver of any changes that may affect the quality of the services or products provided prior to implementation unless otherwise specified in the contract.

### 12.5 Contract

**12.5.1** A contract or agreement should be drawn up between the contract giver and the contract acceptor which specifies their respective duties and responsibilities.

**12.5.2** All data should be kept or made available to the contract giver.

## 13 Deviations

**13.1** Deviations from the specified requirements should be authorized with sufficient data to support the decision.

**13.2** Corrective action should be made to prevent recurrence of the deviation.

## 14 Complaints and recalls

### 14.1 Principle

**14.1.1** All complaints relevant to these guidelines must be reviewed, investigated, and followed up accordingly upon communication to the organization.

**14.1.2** Upon deciding on compost recall, appropriate measures must be taken to complete the recall within the framework of these guidelines and to implement corrective actions.

**14.1.3** In cases of contracted operations, the contracting parties should establish an agreed-upon process for managing complaints

### 14.2 Product complains

**14.2.1** Establish procedures for handling customer complaints

**14.2.2** Designated personnel should centralize all complaints

**14.2.3** Complaints related to the produced compost should be documented with original details and any subsequent follow-up information

**14.2.4** Proper follow-up on the affected lot should be conducted

**13.2.5** Complaint investigations and follow-up should include measures to prevent recurrence of the defect and checking other lots for potential impact, if necessary.

### 14.3 Product recalls

**15.3.1** Designated personnel should manage the recall process

**14.3.2** Compost recall procedures should be capable of prompt initiation

**14.3.3** Relevant authorities should be notified of recalls that could affect users' safety

**14.3.4** Recalled compost should be clearly identified and stored separately in a secure area pending further action

**14.3.5** The compost recall process should be periodically evaluated for effectiveness and improvement

## 15 Change Control

### 15.1 Implement procedures for managing changes to processes, equipment, or materials

**15.1.1** Develop protocols for conducting pre- and post-change evaluations to assess the impact on product quality and safety

**15.1.2** Conduct trials or pilot runs to test the effects of proposed changes under controlled conditions

### 15.2 Evaluate the impact of changes on product quality and safety

**15.2.1** Develop protocols for conducting pre- and post-change evaluations to assess the impact on product quality and safety

**15.2.2** Utilize analytical techniques and testing procedures to quantify the impact of changes on key quality parameters such as nutrient content, microbial activity, and contaminant levels.

### 15.3 Obtain approval for changes before implementation

**15.3.1** Ensure that all proposed changes undergo a formal approval process before implementation

**15.3.2** Communicate approved changes to relevant personnel and provide training as necessary to ensure understanding and compliance with updated procedures

**15.3.3** Maintain records of approvals for all implemented changes, including signatures, dates, and any conditions or stipulations associated with the approval

## 16 Internal Audit in the production of organic fertilizer

### 16.1 Conduct regular internal audits to evaluate compliance with GMP and organic standards

**16.1.1** Develop a regular audit schedule based on the requirements of SPP, as well as the complexity and risk level of production processes

**16.1.2** Assemble a qualified audit team consisting of personnel with expertise in SPP, organic certification requirements, quality assurance, production processes, and regulatory compliance

**16.1.3** Develop a comprehensive audit checklist that covers all relevant aspects of SPP, including facility cleanliness, equipment maintenance, raw material handling, production practices, documentation procedures, and record-keeping

**16.1.4** Conduct audits according to the established schedule, following the audit checklist to systematically assess compliance with SPP

### 16.2 Approach

**16.2.1** Specially designated competent personnel should conduct internal audits in an independent and detailed manner, regularly or on demand.

**16.2.2** All observations made during the internal audit should be evaluated and shared with appropriate management.

### 16.3 Identify areas for improvement and take corrective actions as needed

**16.3.1** Document audit findings systematically, noting any instances of non-compliance, deviations from standards, or areas for improvement

**16.3.2** Conduct root cause analysis to understand the underlying reasons for non-compliance or deficiencies identified during the audit

**15.3.3** Develop and implement corrective action plans to address identified deficiencies and non-conformities

**16.3.4** Identify and implement preventive actions to mitigate the risk of recurrence

**16.3.5** All recommendations for corrective action should be implemented within a specified time period.

### 16.4 Document audit findings and actions taken

**16.4.1** Prepare detailed audit reports documenting the findings, observations, and conclusions of each audit conducted

**16.4.2** Maintain a centralized system for tracking corrective and preventive actions resulting from audit findings

**16.4.3** Retain all audit documentation, including audit reports, corrective action plans, evidence of implementation, and verification of effectiveness

### 16.5 Follow-up

**16.5.1** There should be an effective follow-up programme. The management should evaluate both the audit report and the corrective actions as necessary

**16.5.2** Internal audit follow-up should confirm the satisfactory completion or implementation of corrective action

## 17 Documentation

### 17.1 General

**17.1.1** Good documentation is an essential part of the quality assurance system and, as such, should exist for all aspects of SPP. Its aims are to define the specifications and procedures for all materials and methods of production and control; to ensure that all personnel concerned with production know what to do and when to do it; to ensure that authorized persons have all the information necessary to make decisions, to ensure the existence of documented evidence, traceability, and to provide records and an audit trail that will permit investigation. It ensures the availability of the data needed for validation, review and statistical analysis.

**17.1.2** The organization should establish, design, install and maintain its own system of documentation that is appropriate to its organizational structure and to the type of products. An electronic system can be used to prepare and manage documents.

### 17.2 Maintain accurate and up-to-date documentation of all aspects of production

**17.2.1** Establish a document control system to manage all documentation related to production activities

**17.2.2** Maintain documentation covering all aspects of production, including standard operating procedures (SOPs), work instructions, batch records, quality control records, raw material specifications, equipment maintenance logs, and regulatory compliance documentation

**17.2.3** Implement version control procedures to ensure that only the most current versions of documents are used in production

**17.2.4** Involve relevant stakeholders, such as production managers, quality assurance personnel, and regulatory compliance experts, in the review and approval process

### 17.3 Document procedures, specifications, and records related to SPP compliance

**17.3.1** Develop and maintain documentation that outlines procedures and specifications required for compliance with Sustainable Production Practices (SPP)

**17.3.2** Document all quality control activities, including raw material testing, in-process testing, finished product testing, and environmental monitoring. Maintain records of test results, deviations, and corrective actions taken to address any non-conformances

**17.3.3** Document employee training programs related to SPP compliance. Keep records of training attendance, topics covered, and competency assessments to ensure that employees are adequately trained to perform their duties in accordance with SPP requirements

### 17.4 Ensure documentation is readily accessible for review and inspection

**17.4.1** Maintain a centralized document repository or electronic document management system (EDMS) to store and organize all production-related documentation

**17.4.2** Establish procedures for retrieving documents quickly and efficiently when needed for review, inspection, or reference

**17.4.3** Regularly review and update documentation to ensure that it accurately reflects current practices and complies with regulatory requirements. Conduct internal audits to verify the completeness and accuracy of documentation and prepare for external inspections by regulatory agencies or certification bodies. When a document has been revised, a system should exist to prevent inadvertent use of the superseded version. Superseded documents should be retained for a specific period of time.

## 18 Records

**18.1** Records should be maintained of the distribution of each batch of a product in order, e.g. to facilitate the recall of the batch if necessary.

**18.2** Records should be kept for major and critical equipment, as appropriate, of any validations, calibrations, maintenance, cleaning, or repair operations, including dates and the identity of the people who carried these operations out.

**18.3** The use of major and critical equipment and the areas where products have been processed should be appropriately recorded in chronological order.

**18.4** There should be written procedures assigning responsibility for cleaning and sanitation and describing in sufficient detail the cleaning schedules, methods, equipment and materials to be used and facilities and equipment to be cleaned. Such written procedures should be followed.

**18.5** Records should be made or completed when any action is taken and in such a way that all significant activities concerning the manufacture of products are traceable.

# Annex A
(informative)

## Substances that may be used as fertilizers or soil amendments

| Substance | Description; Compositional requirements; Conditions of use |
|---|---|
| **Plant and animal origin** | |
| Farmyard and poultry manure | Products comprising a mixture of animal excrements and vegetable matter (animal bedding).<br><br>Indication of animal species.<br><br>Coming from extensive farming, but if sourced from intensive farming or not sourced from organic production systems, need recognition by the approved certifying organisation and shall be composted. |
| Slurry or urine (not from human origin) | If not from organic farming sources, need recognition by the approved certifying organisation.<br><br>Use after controlled fermentation and/or appropriate dilution.<br><br>Factory farming sources not permitted.<br><br>Indication of animal species. |
| Composted animal excrements, including poultry manure | Need recognition by the approved certifying organisation.<br><br>Indication of animal species. |
| Dried farmyard manure and dehydrated poultry manure | Need recognition by the approved certifying organisation.<br><br>Indication of animal species.<br><br>Coming from extensive farming, but if from intensive farming sources it must be composted. |
| Guano | Need recognition by the approved certifying organisation. |
| Straw | Need recognition by the approved certifying organisation. |
| Composts from spent mushroom and dejecta of worms and insects (vermiculture substrates) | The initial composition limited to products on this list. |

| Substance | Description; Compositional requirements; Conditions of use |
|---|---|
| Composted or fermented organic household refuse | Organic vegetable and animal waste separated from household waste, which has been subjected to composting or anaerobic fermentation for biogas production.<br><br>Need recognition by the approved certifying organisation. |
| Composted or fermented plant residues | Need recognition by the approved certifying organisation.<br><br>Mixtures of plant matter which has been subjected to composting or anaerobic fermentation for biogas production. |
| Products and by-products of animal origin from slaughterhouses & fish industries:<br>— blood meal<br>— hoof meal<br>— horn meal<br>— bone meal or degelatinized bone meal<br>— fish meal<br>— meat meal<br>— feather, hair and "chiquette" meal<br>— wool<br>— fur<br>— hair<br>— dairy products | Need recognition by the approved certifying organisation.<br><br>—<br>—<br>—<br>Heavy metal contamination monitoring necessary<br>—<br>—<br><br><br><br><br>—<br>— |
| By-products of food & textile industries | Not treated with synthetic additives.<br><br>Need recognition by the approved certifying organisation. |
| Seaweeds and seaweeds products | Need recognition by the approved certifying organisation.<br><br>Directly obtained by — physical processes; extraction with water or acid and/or alkaline solution; and fermentation. |
| Sawdust, bark and wood waste | From wood not chemically treated after felling. |

| Substance | Description; Compositional requirements; Conditions of use |
|---|---|
| Wood ash | From wood not chemically treated after felling. |
| Calcium lignosulfate | Recognized by the competent authority |
| Naturally occurring biological organisms e.g. worms | |
| Peat | Should not be extracted or treated using inorganic chemicals; permitted for seed, potting module composts. |
| By-products of industries processing ingredients from organic agriculture | Need recognition by the approved certifying organisation. |
| Night soil-faeces and material containing faecal matter | Subjected to either of the following treatments: composting, incineration/drying, anaerobic digestion and ammonia treatment |
| Sewage Sludge | Subjected to anaerobic digestion/fermentation, composting or long-time treatments |
| Human urine | Proper storage (based on the action of ammonia in combination with temperature. |
| Stillage and stillage extract | Ammonium stillage excluded. |

## Annex B
(informative)

## Average nutrient concentrations and rates of availability for various organic materials

| Material | % Nitrogen | % Phosphate | % Potash | Availability* | Notes** |
|---|---|---|---|---|---|
| **Alfalfa hay** | 2-3 | 0.5-1 | 1-2 | slow/mod. | |
| **Bone meal** | 1-6 | 11-30 | 0 | moderate | alkaline |
| **Blood meal** | 12 | 1-2 | 0-1 | rapid | acidic |
| **Cottonseed meal** | 6 | 3 | 1 | slow | acidic |
| **Composts** | 1-3 | 1-2 | 1-2 | moderate | alkaline |
| **Feather meal** | 12 | 0 | 0 | moderate | |
| **Fish meal** | 6-12 | 3-7 | 2-5 | rapid | acidic |
| **Grass clippings** | 1-2 | 0-0.5 | 1-2 | moderate | |
| **Hoof/horn meal** | 12-14 | 1.5-2 | 0 | moderate | alkaline |
| **Kelp** | 1-1.5 | 0.5-1 | 5-10 | moderate | zinc, iron |
| **Leaves** | 1 | 0-0.5 | 0-0.5 | slow | |
| **Legumes** | 2-4 | 0-0.5 | 2-3 | moderate | |
| **Manures: Cattle** | 2-3 | 0.5-1 | 1-2 | moderate | weed seed |
| **Horse** | 1-2 | 0.5-1 | 1-2 | slow | weed seed |

| | | | | | |
|---|---|---|---|---|---|
| **Swine** | 2-3 | 0.5-1 | 1-2 | rapid | |
| **Poultry** | 3-4 | 1-2 | 1-2 | rapid | |
| **Sheep** | 3-4 | 0.5-1 | 2-3 | moderate | weed seed |
| **Pine needles** | 0.5 | 0 | 1 | slow | acidic |
| **Sawdust** | 0-1 | 0-0.5 | 0-1 | very slow | |
| **Sewage sludge** | 2-6 | 1-4 | 0-1 | moderate | zinc, iron |
| **Seaweed extract** | 1 | 2 | 5 | rapid | zinc, iron |
| **Straw/corn stalks** | 0-0.5 | 0-0.5 | 1 | very slow | |
| **Wood ashes** | 0 | 1-2 | 3-7 | rapid | |

**DRS 582: 2024**



Price based on nnn pages