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Seed processing — Code of practice

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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 567 was prepared by Technical Committee RSB/TC 032, *Seeds and planting materials*.

Committee membership

The following organizations were represented on the Technical Committee on *Seeds and planting materials* (RSB/TC 032) in the preparation of this standard.

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INNOPRO Ltd

Rwanda Agriculture and Animal Resources Development Board (RAB)

Rwanda Institute for Conservation Agriculture (RICA)

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Introduction

After harvesting, seeds are threshed, dried, cleaned and tested before being stored and distributed to farmers for planting. Newly harvested and threshed seeds from the field often contain undesirable materials (e.g. stems, leaves and chaff; stones and soil particles; weed seeds and other unwanted seeds). It is essential to remove impurities to obtain good quality, pure seed of the required crop and variety.

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Seed processing — Code of Practice

1 Scope

This Draft Rwanda Standard specifies guidelines for seed processing from harvesting to storage.

This applies to dry packaged seeds and irish potato seeds.

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.

DRS 566, *Warehouse and warehousing for storage of bagged dry packaged seeds and irish potato seeds — Requirements*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply

3.1

seed storage

preservation of seed with initial quality until it is needed for planting.

Note. The seeds are considered to be in storage from the moment they reach physiological maturity until they germinate or until they are thrown away because they are dead or otherwise worthless.

3.2

seed loss

loss of seed viability or reduction of seed quantity as a result of pest, diseases or inappropriate handling.

3.3

seed processing (seed conditioning)

preparation of harvested seed for marketing to farmers. The processes involved include drying, threshing, pre-cleaning, cleaning, size grading, treating, quality testing, packaging and labelling.

4 Requirements

4.1 Seed processing facilities

4.1.1 General

An efficient seed process requires an appropriate facility design which takes some key factors into consideration. Among many factors, the following may be considered:

- a) kinds of crop seeds to be handled and kinds of contaminating crop and weed seeds usually present in the seed lots;
- b) Size of operation;
- c) Whether drying facilities should be required;
- d) Selection of suitable equipment;
- e) Location of the plant;
- f) Source of power for running machinery;
- g) System of seed delivery to processing plant; and
- h) Availability of labour.

4.1.2 Location and structure of seed processing facility

4.1.2.1 Location of facility

4.1.2.1.1 Seed processing facilities including temporary/mobile facilities, should not introduce any risks on seed from the environment that cannot be controlled.

4.1.2.1.2 The location of a seed processing facility shall be authorized by competent authority

4.1.2.1.3 The site shall be located at a relatively high elevation to avoid water logging and safe from natural flooding calamities.

4.1.2.1.4 The orientation of the seed processing facility should be such that radiant heat gain from the sun is minimal.

4.1.2.1.5 The seed processing facility shall be accessible by road.

4.1.2.1.6 The seed processing facility shall have access to clean water and power supply.

4.1.2.1.7 Seed processing facility shall not be located near the site for waste disposal and the surroundings shall be kept clean.

4.1.2.1.8 The seed processing facility shall not be near any facility where the danger of fire is constantly present.

4.1.2.1.9 Seed processing facility shall not be located near busy public facilities such as schools and hospitals. Existing seed processing facility near public facilities shall take necessary measures to mitigate the effects of their operations.

4.1.2.1.10 There should be ample space to facilitate operations related to movement, parking and loading and offloading.

4.1.2.2 Facility layout

4.1.2.2.1 Depending on the intended seed handling operations (quality testing, receiving, cleaning, threshing/shelling, drying, chemical treatment, storage, packaging, loading and unloading), the facility shall be designed to accommodate equipment, processes and personnel in a way that does not affect the safety of operators as well as the quality of seeds during and after processing.

4.1.2.2.2 Areas having different risks on seed quality should be separated through measures such as physical separation (e.g. walls, partitions) and/or location (e.g. distance), traffic flow (e.g. one-directional production flow), airflow, or separation in time, with suitable cleaning and disinfection between uses.

4.1.2.3 Internal structures and fittings

4.1.2.3.1 Seed handling facilities shall be made of materials which can be easily maintained, cleaned and where appropriate easily disinfected.

4.1.2.3.2 Floors should be constructed to allow adequate drainage and cleaning. Windows should be easy to clean and should be constructed to minimise the build-up of dirt and, where necessary, be fitted with removable and cleanable insect-proof screens.

4.1.2.3.3 Adequate facilities for toilets, washing hands, hand drying, drainage and waste disposal, changing rooms should be provided and well maintained.

4.1.2.3.4 Temporary/Mobile seed handling facilities and structures should be covered to prevent damages of seeds quality due to weather conditions.

4.1.3 Equipment

4.1.3.1 Design and material

4.1.3.1.1 Seed lots received from the field are often at high moisture content and contain trash and other inert material, weed seeds, deteriorated and damaged seeds, off-size seeds, etc. Seed processing equipment is necessary in order to dry the seeds to an acceptable moisture level; remove or reduce to the extent possible the various undesirable materials, weed seeds, other crop seeds, deteriorated or damaged seeds.

4.1.3.1.2 Equipment for seed processing shall:

- a) be designed to handle seeds at minimum seed loss;
- b) be fit for the purpose, easy to clean and maintain; and
- c) be designed in a way it cannot affect the safety of the seeds.

4.1.3.2 Cleaning of equipment and facilities

4.1.3.2.1 Cleaning shall remove processing residues and dirt which may be a source of contamination.

4.1.3.2.2 The cleaning methods and materials necessary depend on the nature and type of the seeds and/or the surface to be cleaned. Attention should be paid during cleaning and maintenance operations so as not to compromise with the quality of seeds. Cleaning and disinfection reagents should be handled and used carefully.

4.1.3.2.3 Separate cleaning equipment and utensils, suitably designated, should be used for different hygienic purposes.

4.1.3.2.4 Cleaning equipment should be stored in an appropriate place and in such a manner to prevent contamination. Cleaning equipment should be kept clean and maintained.

4.1.3.3 Maintenance of equipment and facilities

4.1.3.3.1 A maintenance program shall be in place for equipment used in seed processing. maintenance shall be carried out in such a way that it cannot affect the quality of the seed. Maintenance may include:

- a) lubricating all moving parts of the equipment to ensure smooth operation and prevent wear and tear;
- b) regular inspection of the equipment for any worn, damaged, or missing parts, their replacement as needed;
- c) storing the equipment in a dry, cool, and protected place to prevent rust, corrosion, and damage; and
- d) training maintenance personnel in the product hazards associated with their activities.

Note: Follow the manufacturer's instructions: Always follow the manufacturer's instructions and recommendations for maintenance, lubrication, and calibration of the equipment where necessary.

4.1.3.3.2 There should be a procedure for releasing maintained equipment back to production and shall include cleaning up, sanitizing where specified in process sanitation procedures, and pre-use inspection

4.2 Utilities: air, water, energy

4.2.1 General

The provision and distribution routes for utilities to and around seed processing areas shall be designed to minimize the risk of product contamination.

4.2.2 Air

4.2.2.1 Ventilation (natural or mechanical) shall be provided to:

- a) Remove excess or unwanted steam, dust and odours, in the processing facility and to facilitate drying and water loss.
- b) help control ambient temperatures
- c) control humidity to ensure the safety and suitability of seeds (e.g. to prevent an increase in moisture of dried seeds that would allow growth of microorganisms).

4.2.2.2 vents shall be provided near the floor level in the wall, at the top of the walls near the grid line. A suitable meshed ventilation duct should be placed in each gable so that warm air accumulating under the roof can escape

4.2.2.3 Ventilation systems should be designed and constructed so that air does not flow from contaminated areas to clean areas; the systems should be easy to maintain and clean

4.2.3 Water

The supply of clean water shall be sufficient to meet the needs of the seed processing. Where needed, temperature control of the water shall be designed to meet specified water quality requirements.

4.2.4 Energy

4.2.4.1 The seed processing facility shall have a reliable source of energy preferably renewable energy

4.2.4.2 The lighting provided (natural or artificial) shall allow personnel to operate in a safe and hygienic conditions.

4.2.4.3 The intensity of the lighting should be appropriate to the nature of the operation.

4.2.4.4 Energy-providing accessories shall be protected to ensure that materials, product or equipment are not damaged or contaminated.

4.2.4.5 Energy-providing accessories shall be made in a way that minimizes risks of contamination or hazard in the case of breakages,

4.2.4.6 Lighting should be such that it does not adversely impact the ability to detect defects of, or contaminants in seeds or the examination of facilities and equipment for cleanliness.

4.3 Harvesting

Harvesting consists of all activities of separating the food stuff with or without non edible portion from its growth medium. The stage of attainment of physiological maturity by 80 per cent of the population is considered as the harvestable maturity. All seed crops have to be harvested at full maturation. Generally, the seed crop is harvested at the harvestable maturity stage for getting high quality seed. The following steps should be undertaken:

- a) Check the maturity of the crops to avoid early or late harvesting;
- b) For potatoes fifteen (15) days before harvesting, the top kill is compulsory, to control the size of plants and help strengthen the skin of the tubers to reduce injuries during harvesting and sorting
- c) Harvesting shall be carried out in a clean and dry facility, by avoiding damaging the grains and or tubers.

Note: Avoid harvesting the seed potatoes when the soil is wet or during rainy days, as the tubers will carry soil and be at risk of disease infection. If tubers are harvested wet, they should be dried before storage. The drying should be done away from direct sunlight and heat.

- d) Use appropriate harvesting and handling equipment to safeguard the quality of harvested seeds (Hangar,crates, collection centres , etc.)
- e) In vegetables, the harvests are to be taken in different pickings, and seed extraction shall be conducted depending on the processing technology (e.g. wet vs. dry extraction).

4.4 Threshing/ Shelling and pre-cleaning

Threshing and shelling grains are post-harvest operations meant to separate grains from the rest of the plant. Threshing and shelling should be conducted at appropriate moisture content of the seed crop. Threshing and shelling techniques and equipment should not affect the quality of the seed. Seeds shall be properly cleaned after threshing and shelling.

4.5 Drying

Most seeds are harvested at a relative moisture content higher than the processing and storage requirement. The following steps are recommended for an effective seed drying:

- a) Dry grains immediately after threshing and shelling;
- b) Grains shall be dried up to the acceptable moisture content;
- c) For sun drying, plastic sheets (preferably black) should be used;
- d) Where a mechanical grain drying system is used:

- 1) carry the necessary energy to the grain to evaporate the moisture;
 - 2) carry the evaporated water out of the grain mass by blowing dry air;
- e) Check regularly the moisture content rate with appropriate tools.

4.6 Cleaning, sorting, and grading

4.6.1 Seeds shall be clean from any materials, such as inert materials, common weed seeds, noxious weed seeds, deteriorated seeds, damaged seeds, other crop seeds, other variety seeds, and off-size seeds.

4.6.2 For tubers, it is recommended to let the tubers clean themselves before storing. Only healthy tubers, free from all mud/soil, will be stored.

4.6.3 Depending on seeding technology, seeds may be graded by size.

4.7 Treatment

4.7.1 Before bagging, seeds shall be treated with suitable chemicals (fungicide, insecticides or a combination of both) to protect against seed borne diseases and pest damage.

4.7.2 Seed treatment shall be performed by a competent personnel, and record of the treatment (type of chemical used, the date and the duration of treatment) shall be taken and retained.

4.8 Packaging

4.8.1 General

After processing and treatment, seeds should be packaged into containers of specified weight to protect the quality of the seeds. Packaging may consist of the following operations:

- a) Filling seed containers to an exact weight;
- b) Leaflets regarding improved cultivation practices may be placed in the container; and
- c) Attaching labels, certification tags on the seed bags, and sewing of the containers.

4.8.2 Seed packaging materials

4.8.2.1. The choice of packaging materials is guided by the following factors:

- a) Type of seed crop;
- b) quantity of the seed;

- c) cost of the packaging material;
- d) storage environment;
- e) targeted storage period; and
- f) transportation of seeds.

4.8.2.2 The selected packaging material should provide the following

- a) maximum possible protection from ground moisture, rain, insect pests, moulds, rodents, birds, etc;
- b) necessary facility for inspection, disinfection, loading, unloading, cleaning and reconditioning; and
- c) protect seeds from excessive moisture and temperature favourable to both insect and mould development.

4.8.3 Filling of seed bags to an exact weight

4.8.3.1 The weight of the package should consider the type of the package, loading and unloading methodology and sowing practices and regulation in place.

4.8.3.2 The weighing equipment used should be:

- a) calibrated or verified at specified intervals prior to use;
- b) adjusted or re-adjusted as necessary;
- c) safeguarded from adjustments that would invalidate the measurement results;
- d) protected from damage and deterioration.

4.8.3.3 The calibration of weighing equipment should be traceable to international or national measurement standards; where no standards exist, the basis used for calibration or verification should be retained as documented information.

4.8.3.4 The organisation should assess the validity of the previous measurement results when the equipment or process environment is found not to conform to requirements. The organisation should take appropriate action in relation to the equipment or process environment and any product affected by the non-conformance.

4.8.4 Placing leaflets in the seed bags regarding improved cultivation practices

In addition to the information required by labelling, Seed bags should be provided with leaflet guiding user of seeds on the following:

- a) Recommended planting methodology;

- b) Suitable agro-ecological zone;
- c) Storage conditions; and
- d) Handling and disposal of packages.

4.8.5 Attaching labels, certification tags on the seed bags, and sewing of the bags.

4.8.5.1 Attaching labels and certification tags should be done as guided by the competent authority

4.8.5.2 Bags should be sewed as to avoid easy breaking

4.8.5.3 Sewing should leave enough head space, normally 20% of the entire capacity of the bag for easy stacking.

4.8.5.4 Bag stitching/sewing machine should be maintained so as to:

- a) Ensure the sewing machine is always clean and tidy;
- b) Lubricate according to the manufacturer's instructions;
- c) Pay attention to the type of oil: use only recommended oils; and
- d) Ensure that the machine is regularly serviced by a competent person.

4.9 Labelling

4.9.1 Each package of seeds must bear a label. That label shall contain at least the following information:

- a) crop, variety, class of seed, germination rate, purity level and net weight;
- b) date of expiry of the certificate;
- c) chemicals used in fumigating the seeds, dangers and related warnings;
- d) lot number;
- e) year of production;
- f) date of certification, certificate number and label number;
- g) a written statement label as the validity of quality assurance if the package or label are mishandled.

4.9.2 Depending on seed category, labels shall have the following colours:

- a) pre-basic seeds are labelled with a violet band on white background;
- b) basic seeds are labeled in white;
- c) first generation certified seeds are labeled in blue;
- d) second generation certified seeds are labeled in red; and
- e) quality declared seeds are not labelled.

4.10 Storage

4.10.1 General

The storage conditions including infrastructure, equipment, environment and activities should be designed in such a way to:

- a) maintain the seed in good physical and physiological conditions; and
- b) protect seed from insects, pests, and diseases.

4.10.2 Seed storage preparedness

Before storing the seed, the responsible person should check and ensure for the following:

- a) readiness of the seed processing facility (no water leakage, drainage system, tightness to insect);
- b) cleanliness of the facility and surrounding environment;
- c) assessment of capacity of the facility;
- d) availability of pest control chemicals if used;
- e) availability of sufficient spacers/ pallets;
- f) environmental conditions including temperature and relative humidity; and
- g) security and fire-fighting arrangements.

4.10.3 Reception of seed for storage

During reception of seed for storage, the storekeeper should make sure seeds have the acceptable quality including:

- a) varietal and physical purity;

- b) free of infestation and when present, for type and extent of infestation;
- c) acceptable moisture content; and
- d) not been heated up in earlier processing steps and has any musty or rancid odour.

4.10.4 Stacking and shelving

Stacking and shelving should facilitate inspection, cleaning and assure the health and safety of workers. Detailed guidelines are provided in DRS 566 on Warehouse and warehousing for storage of bagged dry packaged seeds and Irish potato seeds — Requirements

4.10.5 Monitoring of stored seeds

Stored seeds should be monitored to ensure:

- a) maintenance of cleanliness;
- b) proper aeration;
- c) checking for leakage after rains;
- d) regular inspection for pests or any other deterioration; and
- e) pesticidal treatments where necessary based on observations.

4.11 Pest control

4.11.1 Seed storage shall have appropriate measures to prevent pest infestation. In case of pest infestation, approved chemicals and personnel shall be used to eliminate the pest.

4.11.2 Pest control chemicals shall be used following the manufacturer's instructions and their effectiveness shall be verified by visual inspection of premises.

4.11.3 Further, a seed conditioner shall put in place preventive and curative measures (both chemical and non-chemical methods) to minimize any risks of pest infestation during the seed processing activities.

4.11.4 Records for pest control should be retained

4.12 Waste management

4.12.1 Seed processing facility should ensure that waste produced, transported, recycled, composted and stored on farm premises does not harbour pests at a level that could increase the likelihood of infesting stored seeds.

4.12.2 Seed processing facility should identify which types of waste, including human and animal effluents, that, taking into account its handling on the facility, are likely to affect the quality of seeds.

4.12.3 Seed processing facility should implement procedures for the proper handling and disposal (or reuse) of waste. Depending on the operations and where appropriate to minimize the likelihood of the proliferation of pests, activities that should be implemented are as follows:

- a) dispose of wastes at an appropriate frequency;
- b) identify, properly maintain waste containers, and keep them closed in potential areas of pest proliferation;
- c) isolate, identify as waste for disposal and dispose of in a specified safe manner the chemicals and similar products of concern (e.g. plant protection products) that cannot be used (e.g. due to an exceeded expiry date), as well as the empty containers from which such substances have been removed;
- d) dispose of in an appropriate way, the waste waters coming from the cleaning of equipment used for plant protection products;

4.12.4 Wastes should be appropriately collected and disposed away from the seed handling area to prevent pest infestation. Containers for wastes, by-products and inedible or hazardous substances should be specifically identifiable, suitably constructed and, where appropriate, made of impervious material. Containers used to hold hazardous substances prior to disposal should be identified and, where appropriate, be lockable to prevent intentional or accidental contamination of seeds.

4.13 Quality assurance

4.13.1 Required preliminary information

For effective quality assurance, preliminary documented information should be collected, maintained and updated by the organisation. This shall include, but not be limited to:

- a) applicable statutory, regulatory and standards requirements;
- b) type and category of processed seed and processes, activities and equipment of the seed processing facility; and
- c) quality issues relevant to processed seeds.

4.14 Characterization of types and category of seeds

4.14.1 General

The organisation shall maintain documented information concerning the characteristics of processed seeds to the extent needed to ensure their quality throughout the processing steps and period. This information should include:

- a) crop and seed category;

- b) composition of the seed to ensure purity;
- c) biological, chemical and physical characteristics of the seed relevant to ensure the required quality of the seeds;
- d) intended storage period under specified conditions;
- e) packaging and labelling relating to seed; and
- f) instructions for handling and storage.

4.14.2 Description of processes, activities and process environment

4.14.2.1 The organization shall describe to the extent needed to control and monitor the quality of processed seeds:

- a) the layout of facilities;
- b) processing equipment, packaging materials.;
- c) process and activities and related criteria; and
- d) external requirements (e.g., from statutory and regulatory authorities or customers) that can impact the choice and the strictness of the control measures;

4.14.2.2 The variations resulting from expected seasonal changes or shift patterns shall be included as appropriate. The descriptions shall be updated as appropriate and maintained as documented information.

4.14.3 Monitoring of processes and activities

4.14.3.1 Based on the information and description provided above, the organisation shall identify the processes and activities to be monitored and establish the monitoring system. Documented information from monitoring should be retained.

4.14.3.2 The monitoring system should include:

- a) What to monitor;
- b) criteria;
- c) who to monitor;
- d) how to monitor;
- e) frequency of monitoring; and

f) Correction when criteria are not met.

4.14.4 Monitoring of environment conditions

4.14.4.1 The organisation should monitor and record the relative humidity and temperature of where seeds are stored on a regular basis. The organisation should assess the risk associated with deviations and take appropriate action.

4.14.4.2 There is a need to undertake inspection during or after rain to ensure there is no leakage and take appropriate action

4.14.5 Quality verification of stored seeds.

4.14.5.1 The organisation should establish a seed quality testing plan for stored seeds based on the type and category of seeds, storage conditions. Among the parameters to be verified are moisture content and viability including germination and vigour.

4.14.5.2 The test methods used should be comparable to those established by International Seed Testing Association (ISTA). Results from verification activities should be retained.

4.15 Documentation and traceability system

4.15.1 Documented information

4.15.1.1 General

Seed processing plant documentation should include:

- a) documented information determined as being necessary for effective traceability system;
- b) documented information and seed quality requirements required by statutory and regulatory authorities and customers.

4.15.1.2 Creating and updating

When creating and updating documented information, the Seed processing facility ensure appropriate:

- a) identification and description (e.g. a title, date, author, or reference number);
- b) format (e.g. language, software version, graphics) and media (e.g. paper, electronic); and
- c) review and approval for suitability and adequacy.

4.15.1.3 Control of documented information

4.15.1.3.1 Documented information shall be controlled to ensure:

- a) it is available and suitable for use, where and when it is needed; and
- b) it is adequately protected (e.g. from loss of confidentiality, improper use, or loss of integrity).

4.15.1.3.2 For the control of documented information, the Seed processing plant shall address the following activities, as applicable:

- a) distribution, access, retrieval and use;
- b) storage and preservation, including preservation of legibility;
- c) control of changes (e.g. version control); and
- d) retention and disposition.

4.15.1.3.3 Documented information retained as evidence of conformity shall be protected from unintended alterations.

4.15.2 Traceability system

The seed processing facility should establish the traceability system which shall ensure:

- a) to trace back and forward the history of processed seeds from the reception to the first level of distribution;
- b) detect the cause of identified non conformity;
- c) compliance with applicable statutory and regulatory requirements.

4.16 Health and safety in seed processing

4.16.1 General

Adherence to best practices on health and safety during seed processing is essential to ensure employee health, safety, comfort and performance, and to avoid negative impacts on the environment. Health and safety shall be ensured in all aspects of seed processing including general housekeeping, dust control and seed treatment. To avoid all hazards related to machinery, processes, fire and acts of hostility, the following shall be done:

- d) supplying of appropriate personal protective equipment and clothing;
- e) provision of adequate lighting and ventilation;
- f) ensuring that machinery are properly guarded;
- g) provision of adequate fire protection equipment;

- h) provision of suitable washing and toilet facilities;
- i) making working areas as free as possible from dust and noise; and
- j) ensuring good housekeeping standards.

4.16.2 General housekeeping

Appropriate facilities and procedures should be in place to ensure that:

- a) cleaning and maintenance are carried out effectively and do not compromise seed;
- b) an appropriate degree of personal hygiene is maintained to ensure personnel are not a source of contamination; and
- c) all loose items of wood, metal, tools, furniture etc that may cause accidents are removed from the working area.

4.16.3 Dust control

Seeds dust generated during seed processing can be a nuisance, a health risk and a safety hazard for a safe and secure working environment, dust collection system shall be connected to areas or equipment where large quantities of dust are generated.

4.16.4 Seed treatment

4.16.4.1 Specific training shall be provided to operators handling treated seed and treatment chemicals.

4.16.4.2 Seed treatment chemicals shall be handled with care to avoid accidental exposure or poisoning of operators involved in seed treatment operations. Exposure occurs when the product is touched or when vapours are inhaled.

4.16.4.3 To avoid accidental mixing of treated seed with food or feed grain, warning against the use of treated seed for human consumption or feeding animals shall be provided. The warning shall be clear (both words and symbols) and highly visible on the seed package.

4.16.5 Employee safety

4.16.5.1 Staff canteens and designated areas for food storage and consumption shall be situated so that the potential for cross-contamination of processing areas is minimised.

4.16.5.2 Permissibility of smoking, eating, chewing shall be in designated areas only;

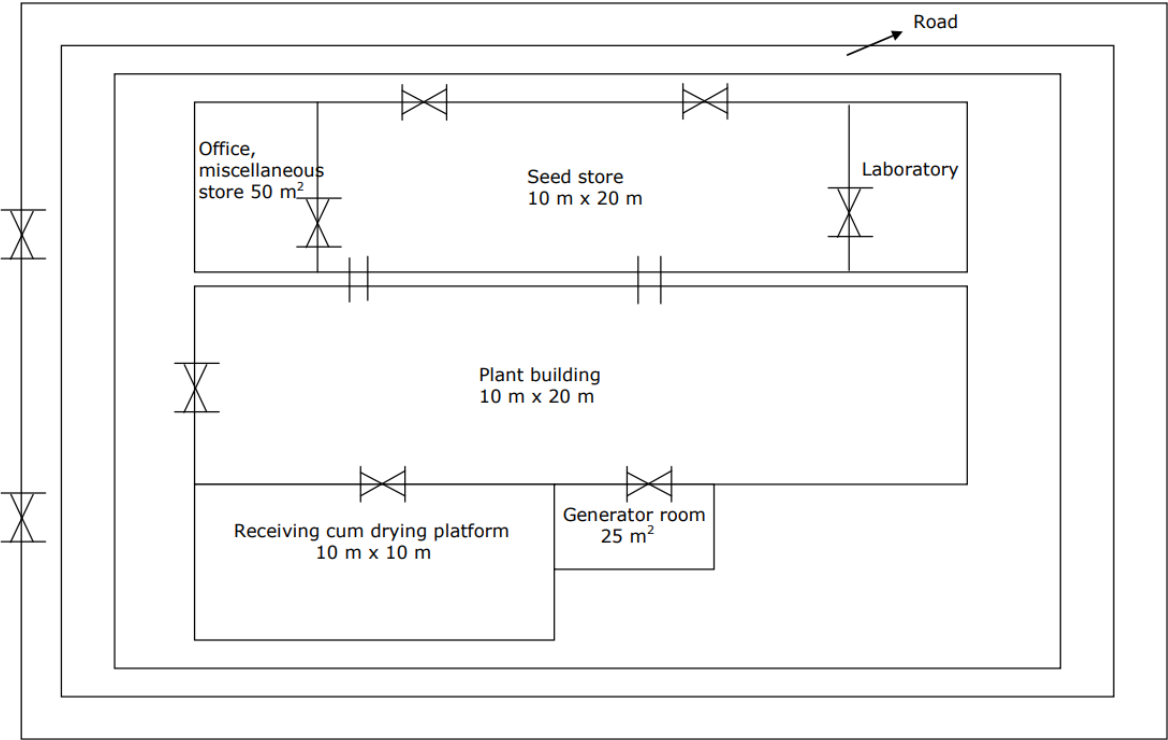
4.16.5.3 Medical examinations, where permitted, shall be carried out at intervals defined by the organisation

4.16.5.4 Visitors, including maintenance workers, in particular to seed treatment and handling areas, should, where appropriate, be instructed and supervised, wear protective clothing and adhere to the other personal hygiene provisions for personnel.

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Annex A
(informative)

Design layout for a seed processing facility



Building layout plan

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Bibliography

- [1] International Seed Testing Association (ISTA)

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