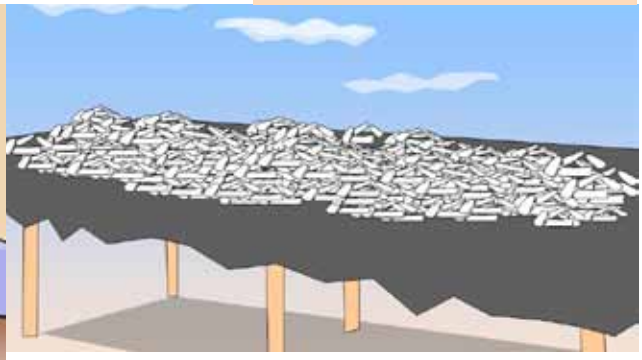
ASARECA
Transforming Agriculture for Improved Livelihoods

QUALITY ASSURANCE FOR CASSAVA FLOUR PROCESSING

A TRAINING MANUAL



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This training manual was produced jointly by the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and the International Institute of Tropical Agriculture (IITA) as part of the 'Enhancing adoption of Harmonized Standards for roots and tubers in Eastern and Central Africa' project. The goal of the project is to enhance the livelihoods of smallholder value chain actors through commercialization and increased regional trade in roots and tuber crops in East and Central Africa. The key components of the project include creating awareness among the value chain actors on the available harmonized standards for cassava and potato in the region and building their capacities to apply the harmonized standards to improve the quality and safety of their products. The project is funded by funded by the US Agency for International Development (USAID). Other project partners include Rwanda Bureau of Standards (RBS), Uganda National Bureau of Standards (UNBS), Tanzania Bureau of Standards (TBS) and University of Nairobi (UoN).

ASARECA

The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) is a non-political organization of the National Agricultural Research Institutes (NARIs) of ten countries: Burundi, DR Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda. It aims at increasing the efficiency of agricultural research in the region so as to facilitate economic growth, food security and export competitiveness through productive and sustainable agriculture. ASARECA's primary goal is to facilitate agricultural research in ECA that will promote agriculture oriented towards markets and income generation. Its secondary goal is to serve as the main forum where strategies and ideas for agricultural research and their relationship to agricultural development in the sub-region are conceived and exchanged.

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More details at *z*

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TERMS

The following expressions or words - used for the purpose of this training manual - are defined according to the harmonized East African Standards for cassava, and code of practice for hygiene in the food and drink manufacturing industry:

Cleaning	The removal of soil, food residues, dirt, dust, grease or other objectionable matter.
Container	Any enclosure for food, including but not limited to metal, plastic, or polypropylene sacs and polyethylene.
Contaminant	Any biological, chemical, or physiological agent, foreign matter or other substances not intentionally added to cassava flour which may compromise safety.
Detoxification	Process of reducing cyanide on fresh weight basis to acceptable level.
Filth	Impurities of animal origin, including dead insects.
Food grade material	One which will not transfer non-food chemicals into the food and contains no chemicals which would be hazardous to human health.
Foreign matter	All organic and inorganic materials such as sand, soil and grass.
Food hygiene	All conditions and measures necessary to ensure the safety and suitability of food (cassava flour).
Food safety	Assurance that food (cassava flour) will not cause harm to a consumer when it is prepared or eaten according to its intended use.
Flow diagram	A systematic representation of the sequence of steps or operations in the production of a particular food item.
Food handler	Any person who directly handles food, food equipment or utensils or food contact surfaces and therefore expected to comply with food hygiene requirements.

TABLE OF CONTENTS

LIST OF FIGURES

1.0 Introduction

Cassava is one of the main root crops grown and consumed in most parts of East Africa, and Africa at large. Despite its strategic role in reducing hunger among smallholder farmers in Africa the crop also holds high industrial potential for food, feed and industrial raw materials. The crop has been identified to have huge potential to contribute to poverty reduction and growth in East and Central Africa. The New Partnership for Africa's Development (NEPAD) identifies cassava as a "poverty fighter" capable of spurring industrial development in Africa, and has launched a Pan-African Cassava Initiative (PACI) to tap the enormous potential of the crop for food security and income generation.

However, the marketability of this commodity is affected by its bulk and perishable nature. Furthermore, factors such as a country's specific inputs, market logistics, and product regulation regimes restrict the existing informal cassava trade. With increased incomes, urbanization and changing eating habits, the demand for processed food has increased several-folds, providing a rationale for supporting the commercialization of this root crop. To enhance the value of this commodity, the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) initiated a project on harmonization of standards for cassava, potato and their products in the East African Community (EAC) which led to the harmonization of seven (7) standards for cassava and related products. The harmonized standards were approved by the East African Standards Committee and subsequently declared by the East African Council of Ministers for use as East African Standards.

However, there still remain factors that are hindering the implementation of the harmonized standards and enhancement of trade along the crop's value chain. These include:

(a) Inadequate awareness on the availability and requirements of harmonized standards for roots crops among the value chain actors and other stakeholders
(b) Inadequate capacity in the application of standards among the value chain actors
(c) Sub-standard and unsafe marketed products, and,
(d) Limited capacity of regulatory agencies in monitoring compliance with standards.

This training manual has been developed against this background to guide farmers and other processors, in a simple and direct manner, in the implementation of harmonized cassava standards, focusing on both fermented and non-fermented cassava flour. It focuses on quality assurance of the raw materials, processing, hygiene, storage and transportation, packaging and labeling.

The manual outlines the operational steps or procedures that should be followed in the manufacture of safe and good quality cassava flour. These practices should be evaluated for effectiveness through monitoring and documentation in form of records. By following the simple descriptions of the technology and taking the necessary precautions, the farmers and processors will be able to produce cassava flour of consistent quality at minimal cost.

Extension agents working with farmers and small-scale processors can use the manual to develop the necessary skills for processing cassava to products that meet the required local quality and safety standards, and improve the possibility to supply the product to the new, emerging markets.

Objectives of the manual

- To illustrate the necessary steps and procedures needed to produce good quality and safe cassava flour to cassava farmers and processors.
- To help the processors monitor all the factors related to good manufacturing practices (GMP).
- To help the processors to produce and package cassava flour in accordance with the code of hygiene, rendering the product safe and fit for human consumption.

2.0 Production of cassava flour

Cassava flour is prepared from either of these: fresh cassava roots, dried cassava chips, paste or crumbs, or from partially fermented cassava cakes that are fully dried, followed by a pounding, grinding or milling process, and by sifting to remove fiber. Cassava flour that is prepared from bitter cassava is detoxified before the flour is dried either as chips, cake, paste or crumbs (See Figure 1).

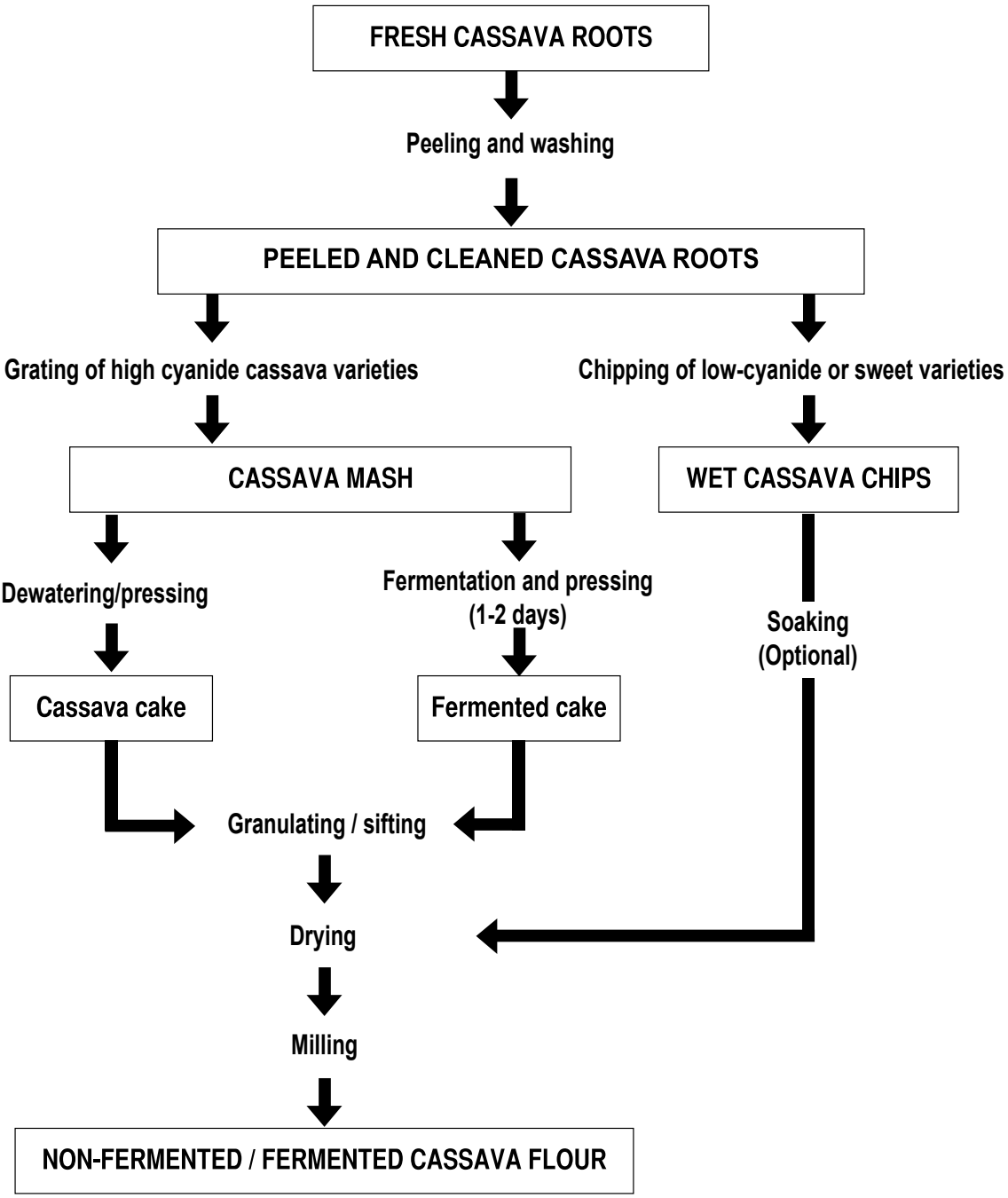

Figure 1: Flow diagram of production of cassava flour from fresh cassava roots

2.1. Fresh cassava roots

- Harvest cassava roots at the right stage of maturity (9-12 months or 15-18 months for late-maturing varieties).
- Avoid overaged or immature cassava roots.
- Ensure that harvested cassava roots are fresh, firm, clean, wholesome and free from pests and diseases.
- Transport harvested cassava roots to the processing site quickly.
- Process cassava roots within 8-12 hours after harvesting.

2.2 Peeling

- Take care not to remove useful parts of the cassava roots with the peels.
- Peeling loss can range from 10 to 22 percent, depending on wholesomeness, size, or age of the roots, and the carefulness of the people involved in peeling.
- Careless peeling, use of tiny, woody, or spoilt roots will lead to a low yield of flour.
- Peeled roots may be soaked in water while waiting to be washed.
- Remove any woody parts stuck to the roots.
- Remove the peels and all spoilt portions.

Figure 2: Peeling fresh cassava roots

2.3. Washing

- Wash peeled roots thoroughly with clean and safe water.
- Wash immediately after peeling.
- Remove all dirt, sand, sticky mud, and smelly parts.
- Wash several times in clean water until the roots are completely clean.

Figure 3:Washing peeled fresh cassava roots for grating / chipping

2.4 Grating

- Wash the grater thoroughly before and after grating.
- Grate the cassava roots immediately after washing to maintain the white color.
- Collect the grated cassava mash in clean containers such as basins.
- Pack the mash into clean polypropylene sacks with a fine mesh for dewatering.
- Tie the sacks.
- The grating area should be well drained.
- Never allow the sack containing the cassava mash to touch dirty surfaces such as floors.

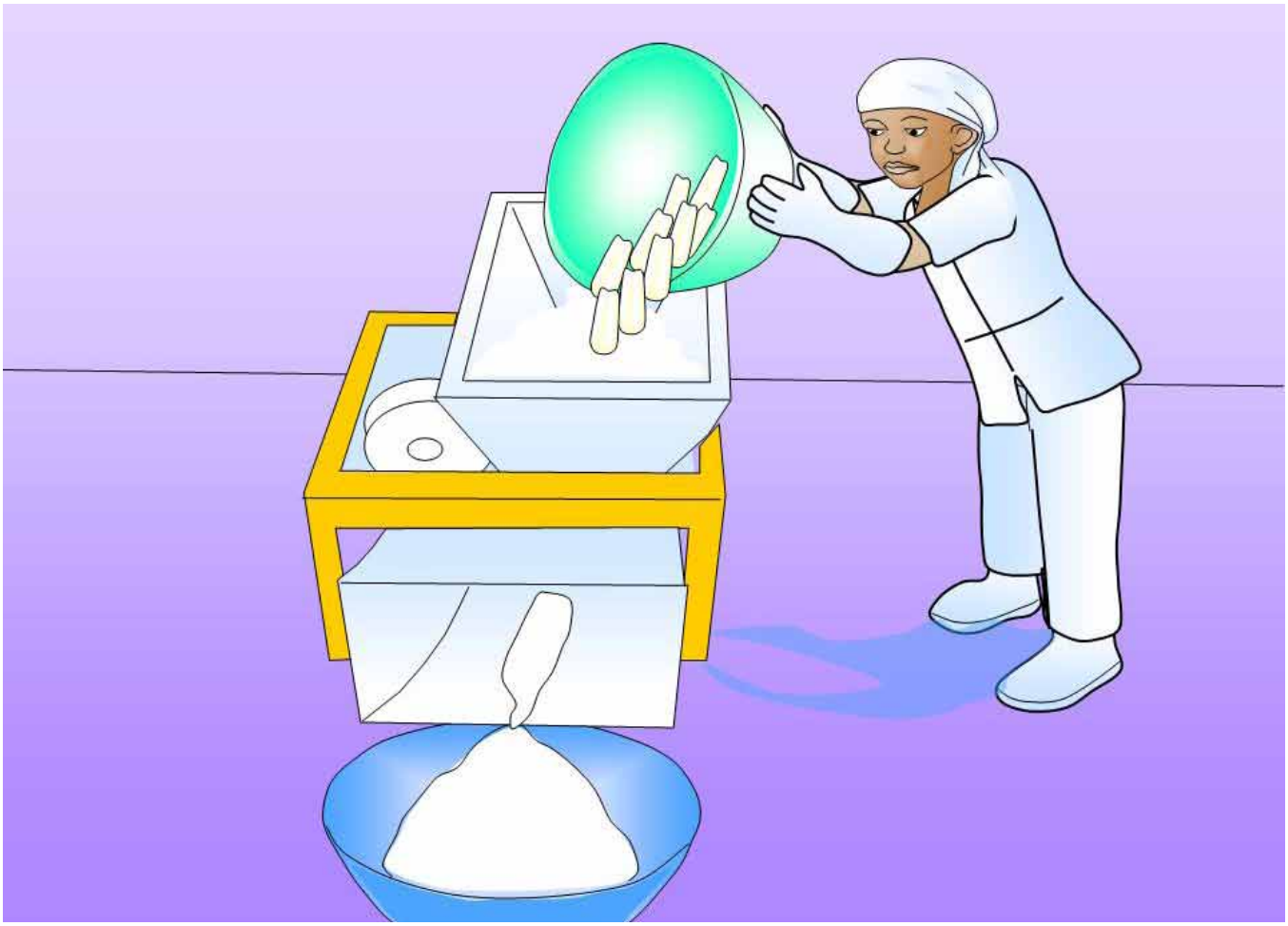

Figure 4: Grating peeled fresh cassava roots

2.5 Chipping

This method, an alternative to grating, dewatering and granulation, is used to make flour from a low cyanide cassava variety.

- Chip cassava roots into small and thin chips immediately after washing.
- Collect the chips in a clean containers for drying.
- Never chip high cyanide cassava to produce cassava flour meant for human consumption.
- Any cassava variety known to be bitter or to contain a high amount of cyanogens must be grated.
- Any variety whose level of bitterness or cyanogens content is unknown should be grated.

2.6 Dewatering / Pressing

The process of removing cyanide from grated cassava mash by pressing excess water out of the bags of cassava mash is known as dewatering or pressing. Hydraulic or screw presses are used in pressing the cassava mash from the graters. Here are basic steps to be followed in the process:

- Place cassava mash in a sack and tie tightly before placing the sack on the platform of the pressing machine.
- If using a jack, apply pressure onto the sack until it is tight.
- Allow the liquor to drain out for 3 - 10 minutes.
- Apply pressure repeatedly until the mash is well dewatered to form a cake that crumbles easily.

- The dewatering should be done as quickly as possible to prevent the mash from fermenting as most industrial users would reject fermented cassava flour.

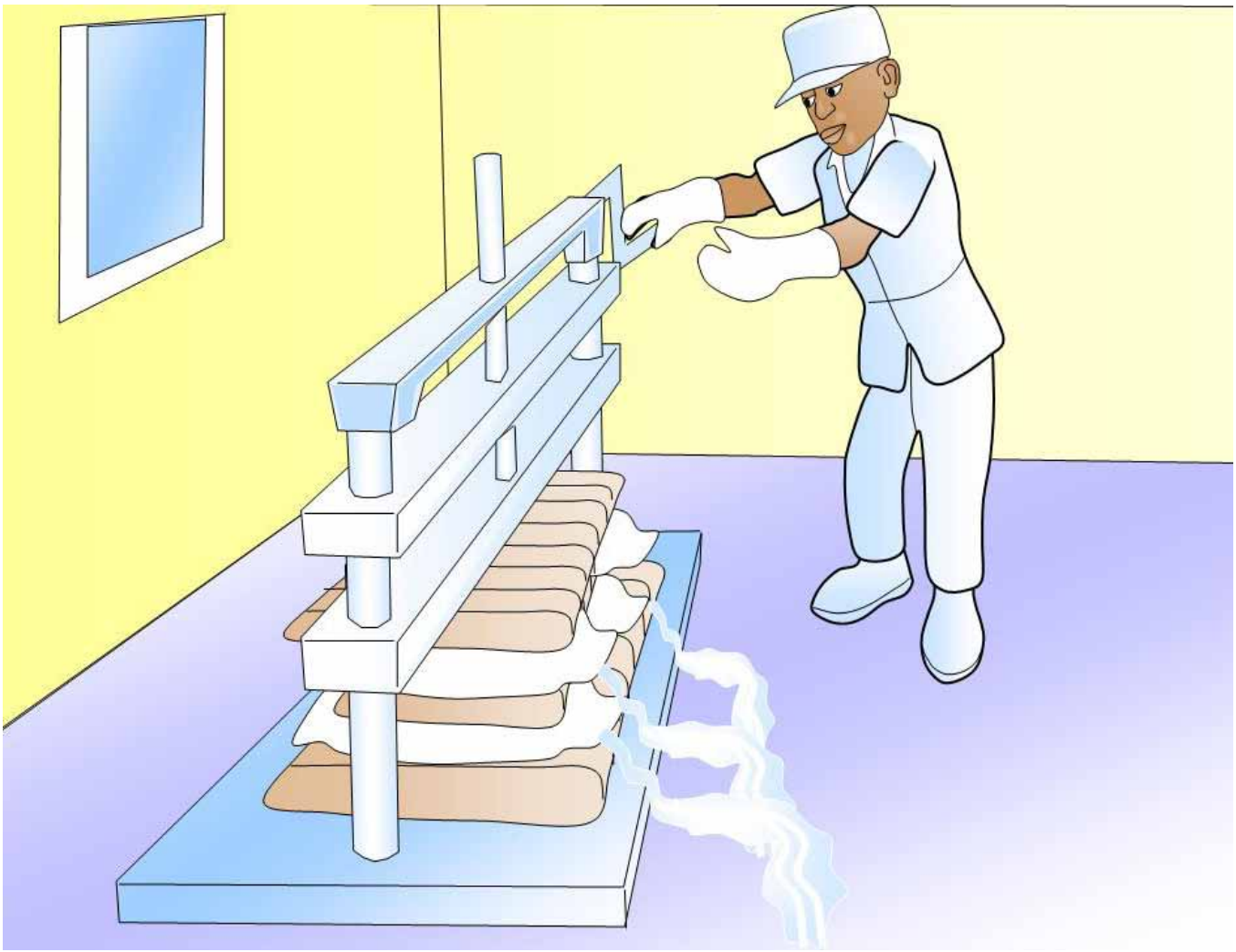

Figure 5: Pressing grated cassava mash to remove water

2.7 Fermentation

The cassava mash may be allowed to ferment for 1 to 2 days if the end-users prefer aromatic and sour flour (for home cooking, for example). In this case, dewatering does not have to be done rapidly. This batch of flour must be labeled "Fermented Cassava Flour."

2.8 Cake breaking / granulating

- Empty the cassava cake into clean pans, bowls or sacks.
- Feed the cake into a dry cassava grater that will break it into granules.
- Sift the resulting wet granules to remove lumps.

- If a cassava grater is not available, a manual sifter may be used to break the cake and sift the granules at the same time.
- Do not place sacks containing cake or granules on dirty surfaces (such as floors).
- Use clean containers to hold the wet granules.

2.9 Drying

- Spread the granules or chips thinly on clean black polyethylene sheets or drying mats on raised platforms.
- Stir granules or chips regularly for fast drying.
- Pack dry granules or chips into clean moisture-proof containers or sacks after cooling.
- Label each batch of dried granules.
- For sun-drying, process cassava during dry weather only.
- Begin processing early in the morning so you can maximize drying time.
- Do not load more than 5 kg of granules or chips per square meter of drying surface.
- Use a raised platform to prevent contamination by dust, animals, and pests, including honey bees.
- It takes 6 to 8 hours to dry granules or chips completely in hot and dry weather.
- Any insufficiently dried batch of granules should be spread out in a ventilated room and allowed to dry overnight and throughout the following day.
- Keep drying surfaces and materials clean.

Figure 6: Drying cassava chips / grit on raised platforms

2.10 Milling

- Mill dried granules or chips to fine flour (Particle size: 250microns to 500microns).
- Leave to cool.
- Sieve if necessary.
- Put the flour in a clean moisture-proof container.
- Avoid overloading the mill or sifter.
- Prevent air pollution (dust and noise).

Figure 7: Milling of cassava

2.11 Storage and transportation

2.11.1 Storage

Applies to the storage of raw material (fresh cassava roots and dried chips), finished product or cassava flour), packaging material and spare parts.

Best recommended practices

- Keep stores clean and free of vermin.
- Establish a rule of first in and first out in removing the stored raw materials and finished product(s).
- Ensure adequate lighting and ventilation in the storage area.
- Finished products should be stored separately, away from raw materials.
- Store bulky flour and dry chips in plastics containers, clean polypropylene bags or aluminum containers that have covers, and are of food grade.
- Store cassava flour, dry chips, cake and spare parts separately.
- Store bags of flour on pallets in well ventilated storage rooms free from high humidity and pests.

2.11.2 Transportation

- Use clean vehicles to transport packaged flour for distribution or storage.
- Avoid contamination through split or leaking sacks.

Figure 8: Transportation of cassava products

2.12 Packaging and labeling of cassava flour

- Use food grade clean bags to prevent cross-contamination by microorganisms and spoilage.
- Check packaging materials for packaging integrity markers, including leakage and dust.
- Label all bags "Cassava Flour" and provide necessary product information on the label.
- Weigh and pack the flour in bags of appropriate sizes.
- Sew or seal the top securely.

Figure 9: Packing and weighing of cassava flour

3.0 Quality assurance

Quality refers to the level of fitness of a consumer product. To ensure that quality attributes conform to the specification as discussed in Appendix I the management of the quality shall be done at all levels of production (from receiving and handling of raw materials to storage of finished product).

3.1 Raw materials

Fresh cassava roots and dried cassava chips are the major raw materials of cassava flour.

3.1.1 Fresh cassava roots

Harvest cassava roots at the right stage of maturity (9-12 months or 15-18 months for late-maturing varieties).

- Avoid over-aged or immature cassava roots.
- Ensure that harvested cassava roots are fresh, firm, clean, wholesome, and free from pests and diseases.
- Transport harvested cassava roots to the processing site quickly.
- Process cassava roots within 8 - 12 hours after harvesting.
- Store fresh cassava roots separately from areas in which final product preparation or packaging is conducted.

Figure 10: Fresh cassava roots

3.1.2 Cassava chips

- Use chips which are free from impurities such as dead insects, animal droppings, sand, soil and glass, and any other foreign matter.
- Ensure that the chips are not moldy.
- Use dry cassava chips with moisture content 12 percent or below.
- Ensure that the taste and odor of the chips are typical of the product
- Ensure that the color of the cassava chips has the characteristic of the variety. The common varieties are white, creamy or yellow.
- Store fresh cassava roots separately from areas in which final product preparation or packaging is conducted.
- Store dried chips in rodent-proof rooms.
- Store chips in cool and dry place.
- Ensure adequate transportation of dried chips from production areas to the processing plant using materials which will permit cleaning and prevent contamination to the product.

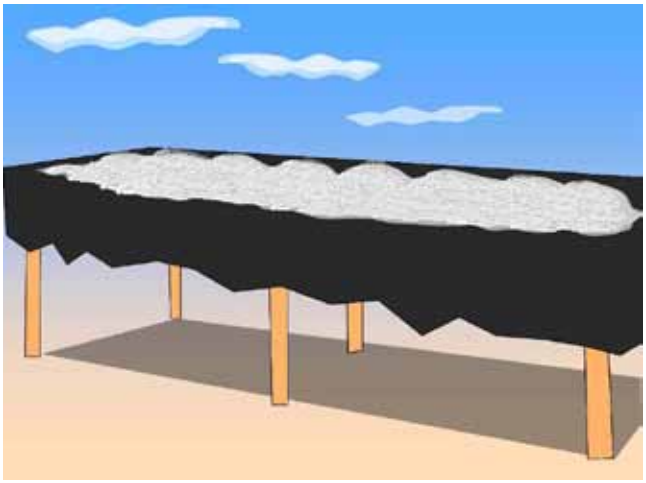

Figure 11: Good method of sun-drying

Figure 12: Bad method of sun-drying

3.1.3 Cassava flour

Ensure that cassava flour is:

- Free from filth in amounts that may represent a hazard to human health, and free of off-flavors and odors.
- Free from any living insects and foreign matter.
- Safe and suitable for human consumption, and has the color that is characteristic of the variety *(see figure 12)*.

NOTE: *The color of cassava is usually white, creamy or yellow. The yellow-colored varieties are normally rich in carotenes.*

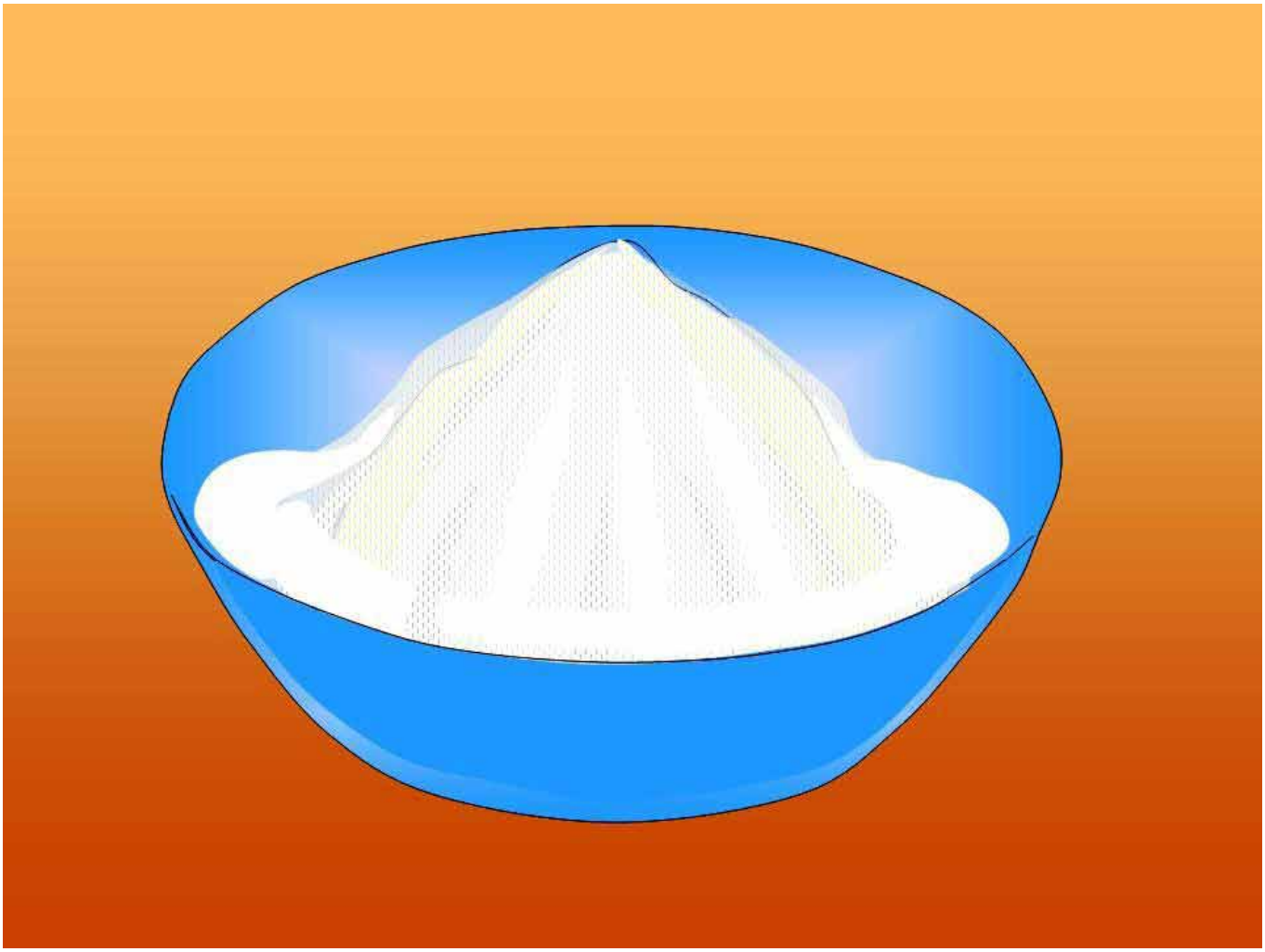

Figure 13: Fine cassava flour

4.0 Hygiene management

The following steps of GMP / GHP relate to the hygiene of the personnel and the cleanliness and sanitation of the facilities in the production process. These comprise of rules and regulations that must be observed in the following key areas:

- Site section
- Personal hygiene
- Cleanliness and sanitation of processing environment and equipment
- Management and control of rodents, insects, reptiles, birds and domestic animals.
- Waste management
- Plant layout and design

4.1 Building / structure

This includes production rooms, stores, dressing rooms and toilets.

- Buildings shall be designed and constructed to facilitate easy cleaning and maintenance i.e. smooth walls, floors and ceiling.
- The building shall be spacious enough to allow for free movement of staff, materials and installation of machinery.
- Bulbs and fixtures above processing lines and packing rooms shall be shielded to prevent glass fragments from contaminating the flour.
- Construction of the building shall ensure building does not allow the entrance of rodents, insects and dust into the processing area.
- Building shall be high enough and with adequate windows or openings to ensure maximum ventilation.

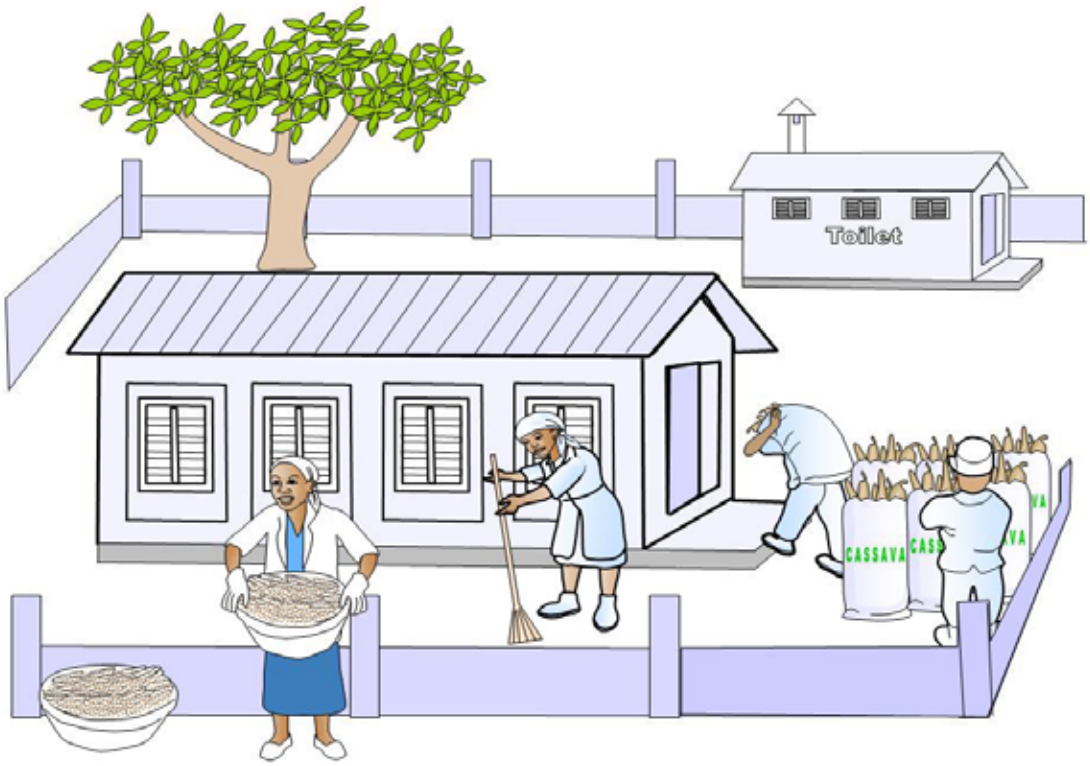

Figure 14: Building for cassava flour production

4.1.1 Site selection

Ideally, cassava flour should be produced very near to or in an area where cassava is grown. This is to ensure timely or regular delivery of sufficient quantity of fresh cassava to the processing plant and avoid spoilage during transportation since cassava roots are very perishable, and to reduce to the minimum possible, the high transportation cost resulting from the bulkiness. Specifically, the site should be selected with the following considerations in mind:

- Availability of required quantities of cassava roots all year round.
- Easy and low cost of transportation of fresh roots to the plant.
- Easy access to clean water.
- Availability of labor.
- Access to electricity, if electrically powered machinery is to be used.

4.1.2 Equipment and plant layout

4.1.2.1 Equipment

The major equipment used in cassava processing plants include graters, dewatering machines / press, chippers, dryers and grinding / milling machines. Others are weighing scales, filling and bagging equipment.

4.1.2.2 Plant layout

The layout of the cassava flour processing plant shall be such that operational processes from the reception of raw materials to finished product including packaging and storage can be executed smoothly. Interruption in the sequence of flow of raw materials and intermediate products during processing shall be very minimal. However, the following shall be observed in the layout of the cassava flour production plant:

- Separate the area by temporal structures or by constructing a concrete wall
- Separate areas for storage of raw materials and intermediate products as well as finished product in turn.
- Separate the peeling section of the plant from the other unit operations.
- Allow reasonable distance between the wet (peeling, grating, pressing, fermentation) and dry (drying, milling and packaging) sections.
- Prevent movement of dust into the production room, packing and storage of the finished product by fixing appropriate fittings.
- Ensure adequate supply of clean water, drainage system, facilities for cleaning and hand washing.
- Ensure that toilets are located away from the processing, drying, packaging and storage areas.

4.1.2.3 Zoning / separations / demarcation

This applies to the flow of the product (raw material, processing, finished product and by product) as well as the people.

Cross-contamination of food may arise from the machinery, people or mixing of the finished product with either raw material or by products. To avoid cross-contamination of cassava flour, clear demarcation of areas for different functions such as cleaning area, storage of raw materials, finished product, packaging material and processing area is recommended.

Best recommended practices

- Install machines in such a manner that the product, including the movement of persons flows in one direction without any criss-crossing.
- Do not allow by- product (peels, water) to share the same outlet with the product. However, the two (peels, water) should move in one direction, parallel to each other.
- Separate the sections by either temporal structures or permanent wall.
- Clean the packaging area thoroughly and restrict movement of unauthorized persons using posters such as, "UN AUTHORIZED PERSONS NOT ALLOWED."
- Do not allow people to eat, smoke or sleep within the processing room.

KEY:

1. Raw material receiving area
2. Peeling area
3. Washing area
4. Grating area
5. Pressing/ dewatering area
6. Granulating area
7. Drying
8. Milling area
9. Packing area
10. Store
11. Office
12. Transportation & marketing

Figure 15: Floor plan

4.1.3 Facilities

Facilities such as water, lighting, toilets, changing rooms and dining room are prerequisites for any food processing plant.

Best recommended practices:

- Provide toilets with covers and keep these clean at all times.
- Construct toilets that face away from the processing plant.
- Provide hand washing facilities with soap and disinfectants at key areas such as toilets, production and packaging areas.
- Supply adequate portable water where applicable in plant facilities.
- Ensure adequate lighting in the stores, production room, changing rooms, plant compound and in other facilities.

4.2 Processing environment and equipment

4.2.1 Premises and surrounding environment

- Keep the surrounding environment clean at all times, free from dust, debris, litter, waste and garbage.
- Keep the grass short to discourage the harboring of pests such as rats.
- Where possible, construct a perimeter wall that clearly separates processing premises.

Figure 16: Clean processing floor and equipment before and after use to keep them free from dirt and dust

4.2.2 Processing equipment

- Keep processing equipment / machines free from dust and dirt
- Establish cleaning and maintenance programs.
- Clean equipment before and after use to prevent dust and dirt.

4.2.2.1 Maintenance

Maintenance is one of the main industrial activities required to prevent machine break down. This activity, if not properly done, could lead to flour contamination. As a preventive action the following shall be done:

- Keep spares that are not in use, including any metal parts, out of the production and packaging rooms at all times.
- Ensure that all metals are stored away after maintenance or machine repair.
- Clean equipment / machines after repair or maintenance and before use.
- Do not conduct welding within the production area.
- Use food grade grease for greasing
- Do not use oil during welding.

4.3 Personnel hygiene

Basic workers' hygiene is critical as pathogens can be transmitted from people to the product. Contamination can occur through hand contact, from dirty clothes, and coughing and sneezing. Processors shall provide adequate training on employee hygiene and monitor staff hygiene practices and health. Processors should provide protective clothing to the staff *(figure 16)*.

Best practices for workers' hygiene

- Train all workers in hygiene and sanitation.
- Ensure that all employees in direct contact with food have medical examination to prevent the spread of communicable diseases such as Tuberculosis (TB), typhoid and cholera, and keep [medical] records.
- Keep a record of training dates.
- Do not allow workers with open sores, infected wounds or serious illnesses (vomiting, diarrhea, fever) in the processing room. Keep records to track serious illnesses as required.
- Make washrooms and hand washing facilities available and easily accessible.
- Smoking, coffee and all forms of eating or drinking shall be conducted in a separate area away from production and packaging areas to avoid any contamination.

Figure 17: Workers must observe good hygienic practices

4.4 Pest control program

Animals, rodents, birds and insects are potential contaminants. Use effective control measures to reduce the risk of contamination. The most effective pest control program is prevention of pest through general cleanliness of the surrounding environment, proper disposal of garbage, having doors with tight fitting and windows with mesh.

Best management practices for pest control

- Keep the ground clean and free of wastes.
- Mow the grass around the facilities.
- Empty rubbish and waste regularly.
- Keep waste containers clean and covered to reduce flies.
- Keep birds and rodents out of the facilities to avoid contamination, including bird droppings. Build a perimeter wall to keep off pests such cats, domestic animals.

4.5 Waste management

- Install appropriate solid and liquid wastes management systems.
- Construct a soak away pit to manage all liquid waste and washing waters, channeling all drains from the processing area into it.

4.6 Weights and measures

Pack cassava flour in accordance with the Weights and Measures requirements of the destination country. It is fraud to pack less content of cassava flour in a package against the weight shown on the label.

4.6.1 Labeling

Labeling requirements include:

- The common name of the product (cassava flour) and the term "course" or "fine."
- Name, location and address of the manufacturer.
- Brand or trade name.
- Net contents by weight in metric units.
- Country of origin.
- Lot / batch identification.
- "Best Before" date.
- The statement "Human food."
- Storage instructions.

Figure 18: Packaged cassava flour

4.7 Quality control procedures and records

Quality control procedures and records are tools which are used to monitor the production of cassava flour at all levels (from receiving and handling of raw materials to storage of finished product) of production to ensure that quality attributes conform to the specification.

5. Questions & Answers on quality standards for cassava flour

There are some common questions and answers on standards for roots and tubers especially cassava flour.

Qn: What is a standard?

A standard is a document, established by consensus that provides rules, guidelines, or characteristics for activities or their results.

Q: Why are standards important?

Standards establish size or shape or capacity of a product, process, or system. They can specify performance of products or personnel. They also can define terms so that there is no misunderstanding among those using the standard.

Qn. What is accreditation?

Accreditation is the formal recognition by an approved competent third party that the relevant requirements of a specific task have been fulfilled after conducting a conformity assessment.

Qn. What is certification?

Certification is the procedure by which a third party gives written assurance that a product, process, or service conforms to specified requirements.

Qn. Why are accreditation and certification important?

Accreditation gives consumers and other stakeholders (traders, export marketers) confidence in the results, and ensures the quality of products.

To regulators, accreditation is both a basis for policy making and a means of market regulation. They ensure that their requirements for protecting society, including health and safety, environment, security, and other societal protection are met.

For industry, accreditation helps to ensure valid results during the development and production of products, strengthens domestic and international trade, and overcomes technical barriers to trade.

Qn. What is conformity assessment?

Conformity assessment is any activity concerned with determining, directly or indirectly, that relevant requirements are fulfilled. The key elements are inspection, testing or gauging, and verification. Conformity assessment is important as it helps:

- Exporting countries to protect their markets.
- Consumers to protect themselves against safety hazards and economic exploitation, and producers (manufacturers, farmers) to ensure that their products conform to standards.

Qn. How is the conformity assessment undertaken?

There are two types of conformity assessment regimes: the pre-market conformity assessment regime and the supplier conformity assessment regime. Pre-market conformity assessment regimes take the form of product approvals, product registrations, licenses, or inspections. Supplier declaration regimes rely on the manufacturer or supplier, rather than the regulatory agency, taking on the responsibility for complying with the relevant regulations. The conformity assessment regime selected for a particular regulatory system will depend on the following, among others:

- Nature of expected risks
- Availability of resources
- Availability of expertise
- Organizational level of regulated parties
- Impact on the economy
- Envisaged period of regulation (temporary or permanent measures).

Qn. What quality parameters are required for conformity assessment?

There are three main parameters: physical, chemical, and microbiological.

1. Physical parameters such as dimensions, temperature, pressure, electrical light intensity, etc.
2. Chemical parameters such as pesticide residues, active ingredients in chemicals, toxins, food nutrients, heavy metals, etc.
3. Microbiological parameters such as bacterial counts of different types, pathogens, viral loads, yeasts, and molds, etc.

Qn. What is regulation?

Regulation can be defined as any measure or intervention implemented under government authority that acts to control the behavior of individuals or groups that come within the domain of that authority. Regulation includes the primary laws and subordinate instruments developed by government and the rules issued by government and nongovernmental agencies under delegated powers.

Whilst regulation will continue to be an important tool for protecting public interests, it is recognized that regulations can become an obstacle to achieving the very economic and social well-being for which they are intended. Recognizing the potential gains from the pursuit of good regulatory practices, economies are coming under increasing pressure to adopt good regulatory practices as applied at both national and international level. As a result, many governments have established central agencies to oversee the development and review of regulation to avoid duplication and unnecessary excesses. Also they are adopting standardized and systematic analytical tools to aid their decisions in relation to the review of current regulations and the vetting of new regulatory proposals.

Qn. How do the regulatory bodies ensure compliance?

The development of standards is only meaningful if these standards can be implemented. Additionally, implementation of standards is only meaningful if compliance can be demonstrated through conformity assessment.

After setting the standard the users (farmers, processors, traders, etc.) must be informed. Parameters to assess for conformity are then identified, conformity assessment capacity is built or outsourced, and finally an implementation date is set and communicated to stakeholders.

Qn. Are there any laws governing regulation?

Yes. The regulation of products is governed by different bodies, regionally and globally. The World Trade Organization's regulations, for example, apply globally.

According to Article 2.2 of the World Trade Organization's Technical Barriers to Trade (WTO TBT) Agreement, "…. Members shall ensure that technical regulations are not prepared, adopted or applied with the view to or with the effect of creating unnecessary obstacles to international trade. For this purpose technical regulation shall not be more trade restrictive than necessary to fulfil a legitimate objective..."

Qn. What are some of the good regulatory practices?

Good regulatory practices include:

- Developing regulations that are flexible
- Using risk management principles
- Being consistent in guidance and decision-making
- Being efficient in information and records management
- Measuring and maintaining performance and transparency
- Being accessible and reaching out reach out to stakeholders (consultations)
- Being aware of changing regional and global standards and other factors.

Qn. What principles govern good regulation?

Economic progress - Businesses have a right to do business and any regulatory actions must promote this and only intervene where there is a clear case for protection of human health and safety.

Education, advice, and guidance - The primary role of the regulator is to educate, advise, and provide guidance to the economic operators to enable them to comply. The regulatory institutions should ensure that advice and guidance is easily accessible and cheap to convey to the economic operators.

Risk assessment - Regulators often do not have sufficient resources. Risk assessment enables resources to be allocated to areas that pose a greater risk to human health and safety.

Proportionate action - Any enforcement actions taken need to be proportionate to the risk or level of non-compliance.

Openness - Regulatory institutions must make known what they expect of the economic operators and what the economic operators expect of them.

Integrity - Inspectors must act with integrity in undertaking monitoring and inspection activities (independently, impartially, and without bias).

Accountability - Inspectors must be accountable for all their actions.

What are the prerequisites for successful market monitoring and inspections?

Necessary powers and authority

Regulatory authorities should have the necessary powers and authority to monitor products placed on the market and take appropriate action to enforce compliance in case of non-compliance. Inspectors need to understand their powers as stipulated in their respective regulations.

Where the power to take action in case of non-compliance is limited, it may be necessary to collaborate with other regulatory institutions, including the Police in enforcing corrective actions.

Clearly defined essential requirements and compliance criteria

This is the basis of all your market monitoring and inspection decisions. Essential requirements as provided in the standards need to be clearly understood, including other criteria that may be contained in other relevant regulations.

Planning

Preparation is the key to success of any market monitoring and inspection program. It involves prioritizing or deciding which activities to undertake and how to allocate resources in order to maximize efficiency and effectiveness (impact). Resources must be concentrated where risks are high or non-compliance more frequent.
The key outputs from planning include a surveillance program (annual), the necessary resources and competencies for implementing the surveillance program, and clear monitoring and inspection criteria.

Qn. What is involved in regulating compliance to potato and cassava standards at the market and entry points?

This is done through regular market monitoring and inspection of cassava and potato and their products to ensure that the products placed on the market meet the requirements of the standards and other relevant regulations. Regulators make regular visits to commercial, production/manufacturing, and storage premises, and if appropriate, to places where cassava flour is used in bulk, for example, schools, hospitals, bakeries, and so on. They organize random and spot checks, taking samples of the products for laboratory examination and testing. They also gather required information from the person in possession of the product in order to take appropriate action.

Appropriate action includes bringing non-compliant products into compliance and applying sanctions where necessary to prevent circulation or withdrawal of non-compliant products from the market.

Qn. When and where is the inspection and surveillance intervention carried out?

Inspection and surveillance can be conducted at the following points:

- Entry points - Imported foods and chemical products are inspected for quality and safety, samples are retained for laboratory testing before they are released.
- Markets - Shops, supermarkets, stores, etc. are randomly inspected and where necessary, samples are taken for testing.
- Factories are inspected for Good Manufacturing Practices (GMP), Good Hygiene Practices (GHP), Hazard

Analysis Critical Control Point (HACCP), Certification to ISO 9001 Quality Management Systems (QMS), Product Certification, and Calibration of industrial measuring and testing equipment to ensure accuracy in measurement.

- Pre-delivery inspection (batch certification) - This involves inspection, sampling, and testing of consignments at suppliers premises for clients before delivery
- Follow up on complaints and information from the public.

Qn. How do I ensure that I comply with the standards on potato and cassava standards at production level of my cassava flour?

A. This involves ensuring you use the right raw material and then follow the processing requirements. The cassava flour should meet the safety and quality standards and the packaging and labelling should be properly done.

Raw material requirements: Ensure good raw materials are used in the process so as to produce good products. If substandard raw materials are used the end product may well be substandard "Garbage in, garbage out".

Process requirements: "Look after the critical parts of the process, the finished product looks after itself". Ensure good agriculture practices as regards soil, water, surfaces, and hands. Observe inputs such as planting materials and pesticides. Ensure good manufacturing practices by looking at provisions, training, documentation, and audits.

Safety requirements for cassava flour

- Total hydrocyanic acid, not to exceed 10 mg/kg
- Acid insoluble ash, % m/m on dry matter, max. 0.35
- Food additives
- Pesticide residues
- Heavy metals
- Mycotoxins: aflatoxins not more than 10 µg/kg
- Microorganisms
  - Escherichia. Coli, per g, absent
  - Salmonella per 25 g, absent
  - Yeast and mold, CFU/g, max. 1000

Quality requirements for cassava flour

- Not less than 90% shall pass through a 0.60 mm sieve for fine flour and not less than 90% shall pass through a 1.20 mm sieve for coarse flour
- Crude ash content, % m/m, Dry matter (DM), max. 3.0
- Moisture content, % by mass, max 12
- Crude fiber content, % m/m DM, max. 2.0
- Starch %, m/m, DM, min 60%

- Practically free from filth
- Free of bad flavors and odors
- Practically free from any living insects and foreign matter
- Have characteristic color: usually white, creamy, or yellow.

Labelling requirements for cassava flour

- Packages shall be legibly and indelibly marked
- The name 'Cassava flour' and the terms `Fine' or `Coarse'.
- Net weight
- Name, location, and address of the manufacturer
- Country of origin
- Lot identification number
- Best before date
- The statement "Human Food" shall appear on the package
- Storage instructions.

In conclusion, appropriate use of standards and other requirements can be used to enhance compliance to requirements and economic value of cassava and potato. Regulators are key players for delivering solutions.

6. Conclusion

Cassava is an important food crop in East Africa. It is grown by subsistence farmers for both cash and food security mainly because of its ability to withstand drought and low demand of inputs. Farmers have been processing cassava into various products such as flour, starch, chips and crisps in addition to selling the crop in its fresh form.

However, cassava flour has been the main product of preference for sale in both local and urban markets. Cassava flour seems to have a big market potential in East Africa and beyond. Currently, there are a number of groups which process cassava flour in East Africa. But the quality of the product is low and unsafe to attract markets.

Farmers and processors do not always comply with the existing standards for cassava flour due to lack of technical know-how of the general manufacturing practices (GMP), code of hygiene, and procedures for handling processes.

This training manual outlines the operational steps or procedures that guide the manufacturing safe and quality cassava flour. These practices shall be evaluated for effectiveness through monitoring and documentation in form of records. By following the simple descriptions of the technology and taking the necessary precautions, farmers and processors will be able to produce cassava flour of consistent quality at minimal cost. Consequently, the processors will be able to penetrate the markets earning greater incomes to sustain their livelihoods.

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Appendix I: Quality control parameters and records

	Parameter	How to check	Acceptance criteria	When to check	Who does it?
	1. Cassava flour				
1.1	Moisture	• Use a moisture meter • Use hand balling	<12 percent	After milling and before packaging	• Supervisor • Technician
1.2	Foreign matter	• Physical observation • Spike out to check if it has sand or remains of dead insects • Check if the flour is moldy	Free from any living insects and foreign matter	After milling and before packaging	Supervisor
1.3	Cyanide	Submit to the laboratory for analysis	10 mg/kg	Finished product	Supervisor
1.4	Sensory properties	• Smell the flour for off-flavors and odors • Check color (white, cream or yellow)	Free of off-flavors and odors	Finished product	• Supervisor • Technician
	2. Raw materials				
	2.1 Fresh cassava roots				
2.1.1	Appearance	• Break a root and observe for white sap • Break a root and observe for sponginess of the flesh hollow center • Get information from the supplier	White sap and firm flesh	When buying the roots	Purchasing officer
	2.2 Dried cassava chips				
2.2.1	Moisture content	Use moisture meter	<12 percent	After drying, storage and ready for use in the production of cassava flour	• Marketing officer • Supervisor
2.2.2	Foreign matter	• Physical observation • Sample the chips and check if it has sand, soil, glass droppings or remains of dead insects • Check if the chips are moldy	Free from foreign matter and mold	After drying, storage and ready for use in the production of cassava flour	• Marketing officer • Supervisor
2.2.3	Sensory properties	• Smell the chips for off-flavors and odors • Check color	• Free of off-flavors and odors • Color should be characteristic of the variety (white, cream or yellow)	After drying, storage and ready for use in the production of cassava flour	• Marketing officer • Supervisor
	3.0 Packaging and labeling				
3.1	Physical observation	Check if the packaging materials are clean, do not have dust, and are not leaking	Food grade and clean material	Check before use	• Supervisor • Technician

3.2	Weight	• Checking using a scale (electronic) is preferred to see if the flour packed meets the Weights and Measures requirements • Weighing equipment has to be calibrated by Weights and Measures Unit (Ministry of trade and Industries).	Net weight	After packaging	Supervisor
3.3	Labels	Check if the labels have the mandatory information as required by the standards for cassava flour.	• Common name • Brand name • Name, location and address of manufacturer • Country of origin • Lot / batch identification • Best before date • The statement "Human Food" • Storage instruction	Before marketing	Supervisor

Appendix II: Hygiene management

Cleaning	How to do it	When do you do it	Who does it?
Compound	Sweeping, burning, slashing and empting waste bins	Daily and general cleaning once a week	Cleaner /gardener
Building and premises	• Clean premises and buildings to remove dust, cobwebs, debris and waste • Drain the compound in case of stagnant water	Weekly When this occurs	Cleaner
Facilities (chippers, graters, presses and mills)	Scrubbing with water, air blowing, and dry mopping to remove dirt and other waste materials	Daily after and before use	• Machine operator • Cleaner
Floors, walls and roofs	Sweeping, scrubbing, mopping	Floor daily and the walls and roof weekly	• Casual workers • Supervisor
Storage			
Raw materials	• Clean and sorted raw materials stored separately from unclean raw materials • Dry chips bagged and stored on the pallets in separate room	After receiving, cleaning After receiving	Workers Supervisor
Spares	Separate room using shelves	Common practice	Management
Personnel hygiene			
Health	• Train all workers in hygiene and sanitation. • Medical examination of all employees in direct contact with food against communicable diseases such as Tuberculosis (TB), typhoid and cholera and records to be kept. • Workers with open sores, infected wounds or serious illnesses (vomiting, diarrhea, fever) should not be allowed in the processing area.	As required i.e. for every new employee and once or twice a year for continuing employees Medical examination once a year Daily checks	Manager
Cleanliness	• Provide workers with uniforms, boots, nose and mouth and guides changing rooms. • Provide washrooms and hand washing facilities at key areas of production. • Smoking, coffee and lunch breaks should be conducted in a separate area away from production and packaging areas to avoid any contamination. • Provide a canteen for meals.	Daily checks	Supervisor

Pest control	• Keep the surroundings clean and free of wastes and grass around the facilities mowed • Ensure rubbish containers / facilities are kept away from the processing area and are emptied and cleaned properly to avoid or reduce flies. • Exclude bird and rodents from the processing room to avoid their droppings in the food • Perimeter wall to keep off pests such cats , domestic animals is recommended	Cleaning daily and general cleaning weekly Keep rubbish pit far from the processing area daily Use wire mesh on the windows, tight fitting doors and rat traps	Owner of the processing plant

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