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REVIEWED CODE OF PRACTICE FOR PREVENTION AND REDUCTION OF MYCOTOXIN CONTAMINATION IN CASSAVA AND CASSAVA-BASED PRODUCTS

(At Step 4)

(Prepared by Nigeria as Chair of the EWG)

1. Sequel to the collation and forwarding of the comments received on line by the Codex Secretariat and further comments collated on the CCCF15 webpage by the Chair of the EWG, a need for a review was firmly established.
2. Comments were received from Brazil, Canada, Chile, Egypt, EU, Iraq, Ghana, Kenya, Peru, Uganda, USA, ICUMSA, Republic of Korea, Thailand and IAEA. The comments received were generally supportive of progressing the advancement of the Code of Practice in the Codex Step Procedure.
3. However, a member country advanced a contrary opinion to the progression of the Code of Practice under two premises: that the Code of Practice dwell extensively on good agricultural practices at the expense of addressing reduction and prevention of mycotoxins; that the documents (Code of Practice) has information on cassava home use and production and not on prevention and reduction of mycotoxin contamination.
4. The member country was approached and discussion took place on the scope of work plan approved by the CAC which covers pre-planting, planting, harvesting and post harvesting processing including; fermentation, drying, storage, and distribution. The member country was also referred to the reported studies reflected in the past discussion papers and information note considered by CCCF12, CCCF13 and CCCF14, which eluded to the fact that soil contamination by fungi, which is a precursor to mycotoxins plays a major role in the development of mycotoxins in cassava roots.
5. The comments from Brazil, Canada and Uganda were quite helpful in improving the flow and sequencing of the document. All the verifiable technical inputs have been adopted and incorporated into the reviewed documents.
6. However, there is a need to highlight some of the comments for the general information of this committee:
 - a) Scope: The suggestion of Thailand for the inclusion of for human consumption in titling the document will be restrictive and work contrary to the scope of the approved work plan.
 - b) Introduction: The suggestion by EU to include Fumonisin as part of most frequently occurring mycotoxins in cassava and cassava based products could not be included as the report of scientific studies reported in discussion papers and information notes reflected that, though Fumonisin was isolated, its occurrence was not wide spread on cassava products and the level of concentrations on Fumonisin were not considered to be of any significant threat or consequence to public health so it could not be included.
 - c) The suggestion by EU to include *Asparagus minisclerotigenes* was adopted and broadened as it has been reported in three countries of two continents and possibilities of its further isolation in other regions could not be ruled out.

- d) The suggestion by Uganda for reclassification of sweet cassava roots ($\text{HCN} \leq 50\text{mg/kg}$) and bitter cassava ($\text{HCN} \geq 50$) if included will be contrary to the current classification of cassava in Codex, which classify sweet cassava as ($\text{HCN} \leq 50 \text{ mg/kg}$) and bitter cassava ($\text{HCN} \geq 100 \text{ mg/kg}$) so it could not be included. Also, Uganda observation on all-season harvesting of cassava roots is noted and appreciated, this is because cassava is not only a food crop but also in some countries a major economic crop for farmers and truly, harvesting is done throughout the year.
 - e) Thailand raised some comments bordering on scope in some of the paragraphs, as either not being relevant or restrictive, these paragraphs include – 10, 12, 13, 15, 20. However, they all spoke to the scope of the COP work as approved by CAC and information garnered and shared via distributed discussion paper and information notes at past CCCF sessions.
 - f) South Korea observation on period for shelf life presupposes that 2 week to 6 weeks are the shelf life of cassava. The COP was not referring to an absolute two (2) week shelf life, rather the two (2) – eight (8) weeks is referring to possible added shelf life if the recommended practice was adopted irrespective of initial shelf life or variety of cassava.
7. It is imperative to appreciate that the Code of Practice are recommended practices that have been proven elsewhere and in other regions scientifically to achieve desired results if adopted by farmers, producers and processors. So steps in COP are improvements on extant practices. This will address the request to widen or extend recommended period of commencing processing of harvested cassava from six (6) – twelve (12) hours after harvest to within twenty-four (24) hours as currently practiced; as the former have been proven to greatly reduce fungi contamination in cassava roots.
 8. In conclusion, it is recommended to insert somewhere in this document a recommendation that the COP should be read in conduction with COP on reduction and prevention of HCN in cassava and cassava products.
 9. The reviewed CoP is premised on the information available in CX/CF 21/14/12, Appendix II as instructed by CCCF14 and updated with comments made by members and it is hereby presented with track changes as Appendix I to this document.

RECOMMENDATIONS

10. CCCF is invited to consider the updated COP as set out in Appendix I and determine its readiness for advancement in the Step Procedure and if not, to identify key issues that would need further consideration in order to progress with the development or finalization of the COP at CCCF16 (2023).

APPENDIX I

PROPOSED CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF MYCOTOXINS CONTAMINATION IN CASSAVA AND CASSAVA-BASED PRODUCTS (For comments)

1. INTRODUCTION

1. Mycotoxins are fungal toxins that can pose health and economic consequences. The most frequently occurring mycotoxins in cassava and cassava-based products are aflatoxins and ochratoxin As. Aflatoxins (AFs) are highly potent toxins that are reported in a wide variety of agricultural products. They are mainly produced by *Aspergillus flavus*, *Aspergillus parasiticus*, ~~and~~ *Aspergillus nomius* and *Aspergillus minisclerotigenes*. Aflatoxins are among the most potent carcinogenic, teratogenic, and mutagenic compounds known. The major aflatoxins commonly found in agricultural commodities are aflatoxin B1, B2, G1, and G2, of which aflatoxin B1 is the most potent. Depending on the host species, these mycotoxins can act as nephrotoxins, hepatotoxins, immunotoxins, neurotoxins, teratogens, or carcinogen, however, the kidney is the primary target for toxicity.
2. The prevalence of several species of fungi that are implicated in mycotoxin production usually differs from one region to another. The fungi which can be found in soil and dust, residues of cultivated crops, stored cassava and cassava-based products at processing or storage facilities are usually associated with pre-harvest and/or post-harvest contamination of cassava and cassava-based products. Mould presence is associated with regions having climate and soil conditions that permit both small or large scale cassava cultivation.
3. The severity of pre-harvest fungal infection and propagation largely depends on the prevailing environmental and climatic factors, which may differ from year to year and from region to region. It also depends on the presence of inoculums, and the farming practice adopted. The degree of damage of the crop by rodents, insects and other organisms also influences the severity of contamination ~~severity~~. Good agricultural practices (GAP) and good manufacturing practices (GMP) could play a major role in reducing the ~~reduction of~~ severity of contamination. Risk of postharvest fungal infection and production of mycotoxins in stored grain increases with the storage duration ~~of storage~~ as indicated in the *Code of practice for the prevention and reduction of mycotoxin contamination in cereals* (CXC 51-2003).
4. There are many cultivars and species of cassava; however, they fall under one of two categories, bitter and sweet varieties, depending on the cyanogenic glucoside levels. The bitter and sweet varieties have high (≥ 100 /mg/kg) and low (≤ 50 mg/kg) HCN content, respectively. Cassava is usually processed and consumed in various forms, which may differ across countries. Generally, one ~~target objective~~ of cassava processing is to reduce its cyanogenic glucoside content to the lowest level possible. The intermittent presence of certain mycotoxins in cassava and cassava-based products destined for human food and animal feed use is to be expected. Therefore, it is important to diligently monitor products and processes for indications of the various conditions that promote fungal contamination and mycotoxin accumulation as indicated in the *Code of practice for the prevention and reduction of mycotoxin contamination in cereals* (CXC 51-2003).
5. This Code of Practice provides relevant information for all countries to contemplate in their efforts to prevent and reduce mycotoxin contamination in cassava and cassava based products.
6. The effectiveness of this Code of Practice will be determined by regulatory authorities, agriculture extension workers, farmers, producers, processors, distributors and food business owners in each country by considering the general principles and examples of GAP and GMP provided in the Code. As well, ~~Other~~ local crops, climate, and agronomic practices ~~as well~~ should be examined to facilitate implementation of these practices where applicable. This Code of Practice is expected to apply to all cassava and cassava-based products relevant to human dietary intake and health, as well as international trade.
7. This Code of Practice provides information on general principles for the reduction of various mycotoxins in cassava and cassava based products; training and education of farmers, agricultural workers, processors, manufacturers, and distributors.

SCOPE

8. This Code of Practice intends to provide national and local authorities, farmers, producers, manufacturers, distributors and other relevant bodies with information and guidance to aid in the prevention and reduction of mycotoxins ~~in~~ in cassava and cassava-based products. This guidance covers: ~~(i)~~ Good agricultural practices, ~~(ii)~~ Good manufacturing practices, Good storage Practices and Good distribution practices.

2. RECOMMENDED PRACTICES APPLICABLE TO PRE-PLANTING STAGE

9. A fertile soil should be selected and this is considered critical. ~~The M~~most preferred is a loamy soil with good drainage. The farmer should avoid planting in valleys, to avoid flooding. Flood water could transport fungal inoculum from an infected farm. Where possible, ensuring a proper planning for crop rotation ~~for~~in successive seasons ~~is vital~~. This will help in ~~the reduction of the~~ inoculum in the farm which may be present from post-harvest waste ~~after harvest~~ that harbours toxigenic fungal spores. Particular crops have been found to be susceptible to certain species of toxigenic fungi and rotating planting with these crops should be monitored and evaluated. Crops that are said to be of low susceptibility to toxigenic fungi should be used in rotation to reduce the cross contamination from the inocula.

2.1 Farm land clearing and preparation

10. After the land selection, it should be cleared and waste properly disposed of to avoid contamination of the cassava roots with inocula from infected weed or other crops. The soil should be loosened by **tilling with clean and suitable farm tools and equipment**, to reduce stress to cassava roots particularly during the enlargement period and also to encourage healthy root development. Farmers should promote Good Agricultural Practices (GAP) to avoid soil erosion. Soil tests ~~where possible~~ should be conducted, where possible, to determine whether determined and if there is a need to apply fertilizer and/or soil conditioners, in order to ensure adequate soil pH and plant nutrition to avoid plant stress. This should be done with the guidance of agricultural advisors.

2.2 Organic fertilizers

11. ~~They~~Organic fertilizers should be added during tilling to increase soil fertility or to address specific soil nutrient deficiencies. **Ridges or mounds** should be up to 0.75 m - 1 m apart. This should also be determined by the farming practice either with cassava alone or planted along with other crops. Healthy organic waste, such as pruning debris, peels and any other organic material, that are free from fungal infestation and disease-free, at the farm(s) should be used. Where needed, farmers should have access to homologated approved inorganic fertilizers.

2.3 Cassava variety (cultivar) selection

12. [Selection and use of improved, healthy, pest and diseases free cassava stems is important for good yield without rot. The following should be considered when selecting cassava variety:

ability to sproutgerminate, ability to store well in the soil, ability to resist fungi and other plant pathogens;

resistance to pests and diseases;

longer shelf life and high starch content and;

cassava cuttings that are free of ~~toxigenic~~ fungi should be planted].

3. RECOMMENDED PRACTICES APPLICABLE TO PLANTING AND PRE-HARVEST STAGE

3.1 Planting

13. [To achieve maximum yield, ~~the~~ stem cuttings of 25 cm in length ~~is~~are recommended for planting at a space of 1m x 1m; no dead stem should be planted. However, different producers may adopt slightly modified practices depending on cassava variety and the region. When cassava cuttings are to be planted, ~~the method, used used~~ depends on the climatic and rainfall conditions. Planting methods include:-

Horizontal Planting involves placing the plants 5 – 10 cm deep into the soil in *dry climates*;

Vertical Planting involves placing the cuttings vertically to avoid rot, especially *during the rainy season*, ~~while~~

Inclined Planting involves placing the cuttings at 45 degrees and leaving 2 - 3 nodes above the ground. This is recommended in areas with the least rainfall. Planting should be done when the ~~sun~~ heat from the sun is minimal or absent, such as early morning or in the evening.]

14. Avoid planting cassava on land where groundnut, maize, sugarcane or other highly susceptible crops were cultivated the previous year because such soils are likely contaminated with *Aspergillus flavus*, *Aspergillus parasiticus* and related species. The farmers should plant during the right month, based on geographical location.

3.2 Weed control

15. [The use of post emergence herbicide could be recommended immediately once weeds are spotted on the field. In some cases, pre-emergence herbicides could be used before planting to minimize weed growth. Small-scale farms could use hoes and cutlasses to remove weeds but care should be taken ~~not to induce prevent~~ mechanical injury ~~on~~ the plant. ~~Large-scale farms could use~~ ~~While~~ mechanised equipment ~~could be used in large-scale farms for weed removal~~. Note that, land preparation needs to be done properly to control the weeds at least for the first 3 months in order to achieve optimum yield].
16. Certain weeds can harbour toxigenic fungi- ~~The weeds can and~~ also increase plant stress when they are in competition for nutrients, during ~~the~~ plant development. Either manual or mechanical approaches can be used for weed control; approved herbicides could also be used.

3.3 Fertilizer application

17. The type and quantity of fertilizer to be used are based on the cassava variety and nature of the soil. Fertilizers could be applied at around 4 - 8 weeks after planting and 16 weeks after planting, and be applied 6 cm in width and 10 cm from the stems or leaves of the cassava plant. Also, it is advisable to conduct a soil test to determine the type of fertilizer to apply.

3.4 Pesticide use

18. Approved pesticides could be used to minimize insect damage and fungal infection around the crop. Predictive weather models could be used to plan the best application timing and mode of pesticide application. Ensure safe use of spraying equipment and observe the application instructions for the pesticide formulation used to prevent harmful residues. Where needed, ensure access to agrochemicals authorized for use.

3.5 Irrigation

19. Where irrigation is used, ensure that it is applied evenly and that all plants in the field have an adequate supply of water. Irrigation is a valuable method of reducing plant stress in some growing situations. Excess precipitation during anthesis (flowering) makes conditions favourable for dissemination and infection by *Fusarium spp.*; thus irrigation during anthesis and the maturation of the roots should be avoided.

4. RECOMMENDED PRACTICES APPLICABLE TO HARVEST STAGE

4.1 Mechanical / Manual Harvesting

20. [Harvesting should involve adequate planning in the areas of timing, age of products and methods to be used. Manual harvesting usually is labor intensive and expensive. For cost effectiveness in commercial operation, farmers are ~~inform~~ encouraged to consider using mechanical methods. In ~~the prevention of loss of order to maintain~~ quality and ~~quantity, amount of prevent crop wastage, the amount of~~ roots to be harvested should also be determined depending on market needs and demand].
21. If mechanized processing materials are available, it is advisable to harvest cassava immediately after the roots mature. Harvesting manually by hand is done by raising the lower portion of the cassava plant stem and cutting off a part of the stem, leaving a small portion at the base of the plant to serve as a handle to pull the cassava root out of the ground. Here, the cut portions of the stems are kept for reuse in the next planting season or sold to other cassava farmers. The leaves can also serve as animal feed.
22. Cassava should be harvested when the soil is slightly soft but has no excessive water, in order to easily remove soil from the roots and avoid contamination during peeling.

However, cassava roots may be harvested all through the different climatic seasons to meet the market demand, necessary measures should be taken to prevent or reduce damages to harvested cassava roots especially when the soils are hard.

4.2 Conveyance tools

23. Containers and conveyances (e.g. trucks) ~~to be~~ used for collecting and transporting the harvested roots from the field to ~~the further~~ processing facilities, and ~~to~~ storage facilities, should be clean, dry and free of crop residues, insects and visible fungal growth before use and re-use.

4.3 Holding conditions

24. Prior to the processing step, cassava roots should not be exposed to the sun, high temperatures, mechanical damage, ~~etc. or other conditions, which could promote fungal contamination~~, since the roots still have high water activity suitable for microbial development. The water activity at this stage varies from 0.922 to 0.996. A continuous ~~flow progression~~ from harvest to final product should be planned, in order that the roots will not be stored for a long period. ~~T~~ the ideal time is 2 to 3 days, ~~and the excess should be taken to a suitable raw material storage room.~~
25. ~~Excess materials should be taken to a suitable raw material storage room.~~ Enhanced storage methods for roots help to extend shelf life of fresh roots by ~~Two (2) to Six (6)~~ weeks. Other storage methods such as using low temperatures can be combined with fungicide treatment or waxing and ~~are~~ suitable for ~~storing or exporting of~~ large amounts of roots. Food handlers that can afford ~~the needed~~ specialized equipment with the necessary technical skills may use improved storage methods to store fresh roots ~~thereby protecting for preservation.~~

5. RECOMMENDED PRACTICES APPLICABLE TO POST-HARVEST STAGES

5.1 Cassava-based products

26. Cassava roots can be processed into fermented or unfermented cassava-based products. These products, which depend on the region, have a wide range of applications including food for humans, animal feed, industrial uses such as fillers, and cloth starch among others. The processing steps by which these various products are arrived at differs and can be found in the *Code of practice for the reduction of HCN in cassava and cassava products* (CXC 73-2013). The approach here is to ~~discuss mention some of~~ the various steps ~~individually that may potentially influence fungal contamination~~ but not under any specific product ~~type name~~. Processing of cassava should be initiated within 8-12 ~~[within 24]~~ hours of harvest to avoid spoilage.

5.1.1 Washing

27. After harvest, if cassava root is to be processed immediately, it should be washed to remove the surface dirt and soil acquired microbes. The source of water is an important factor not to be ignored. ~~Potable W~~ water ~~fit for its intended purpose~~ should be used; ~~or~~ treat other sources of water ~~meant~~ for washing to avoid contamination. Proper washing is vital to ensure sand or mud is removed from all parts ~~especially the contours~~ of the root ~~especially the contours~~.

5.1.2 Peeling

28. ~~Immediately after washing, p~~ Peeled cassava roots should be processed ~~immediately~~ and should not be stored unprocessed. Peeling is either done manually using a knife or is done mechanically. It is done to remove the outer inedible portion of the cassava roots. Peeling should be carried out in a clean environment, and not in one where other crops have been stored, otherwise, ~~they will it may~~ serve as ~~a sources~~ of ~~contaminations~~ spores for the cassava.

5.1.3 Boiling

29. For ~~the cassava roots of~~ sweet varieties ~~cassava roots~~ that can be consumed after peeling or boiling, it is recommended to boil roots immediately after peeling and washing. This will expose any fungus to temperatures they cannot survive. ~~If not consumed immediately, adequate care should be taken to prevent fungal recontamination~~

5.2 Size reduction: Grating, pulping and slicing or chipping

30. ~~Where further processing of washed cassava roots includes any size reduction activities notwithstanding~~ Depending on the size of the roots to be processed, varieties of cassava, as well as available equipment, ~~grating of cassava roots can be done manually using a grater or mechanically to produce pulp. In many parts of Africa, a perforated metal sheet is used for manual grating. During grating, the cyanogenic glycosides are hydrolyzed by the enzyme, linamarase. Bitter cassava variety, which contain high amount of cyanogens must be grated. High cyanide cassava should not be chipped to produce cassava flour meant for human consumption.~~

~~adequate care must be taken to ensure such unit processing do not lead to fungal contamination.~~

31. ~~Chipping or slicing is done by cutting cassava into chips, which is dried and milled into flour. Usually low-cyanide (sweet) cassava variety is used, while other variety may be used for making animal feed.~~

32. Where cassava chips or slices are dried at farm level or in a processing facility, the chips or slices should be dried on a cleaned, dry, raised platforms and at least 100 meters away from probable sources of contamination, such as refuse dumps or filling stations. ~~Where~~ sun-drying is carried out, it should be done on drying mats such as raffia palm, bamboo, oil palm mat, banana leaves, amongst others, that would ensure good hygienic practice.
33. If chips or slices are dried artificially, the dryers should be cleaned, maintained, as well as protected from smoke and fuel contamination.
34. Unhygienic practices at this stage could serve as potential sources of fungal inoculation. The environment should be kept clean, and all the tools used for grating, pulping, slicing and chipping should be cleaned and washed after each use and adequately stored dry.

5.2.1 Fermentation

35. ~~The fermentation of cassava root~~ is primarily used ~~is~~ for further cyanide elimination, flavor development and product stability. Fermentation of cassava for traditional food processing is usually allowed to take a natural course, some optimization research has been carried out to the effect of using selected starter cultures, however this method is not widely used. The sack in which the grated pulp or the container in which the peeled root will be kept, allowing for 2 to 5 days fermentation should be kept clean at all times and especially well cleaned before use, to ensure it does not become a natural source of inoculum.

5.2.2 Dewatering

36. This process involves removing water from grated cassava roots and it is usually done by pressing. The dewatering process could last up to two days. Dewatering could be done before or after fermentation. Water removal should be optimal and care should be taken not to use contaminated processing materials such as sacks as they may become sources of fungi inoculation. Food grade sacks should be used. Adequate cleaning and sterilization of the sacks should be done frequently.

5.3 Cake breaking / granulating

37. The process involves feeding the cassava cake into a cassava grater that will break it into granules. ~~Wet~~ cakes can be sifted to remove lumps. Where a cassava grater is not available, a manual sifter ~~are~~ is most ~~times often used~~ used to break the cake and sift the granules at the same time. The grater should be clean and the ~~s~~ sacks containing cake or granules should not be placed on dirty surfaces (such as floors). Clean containers should be used to hold the wet granules to ensure product is not contaminated. Clean pans, bowls or sacks should be used in emptying the cakes.

5.4 Drying

38. This is a very important stage, fermented cassava pulp is usually spread in the open air to be dried under non-aseptic conditions, thus exposing them to insects and rodents as well as impurities carried in the air. Any of these could be sources of fungi inoculation. Drying should thereby be done in a controlled environment and monitored. Drying should be properly done to avoid moisture. High Microbial loads may be caused by use of unclean drying surfaces and materials such as sheets on raised platforms, so care must be taken to clean surfaces. Recommended temperatures should be; sun (30-40°C), Solar Dryer (50-60°C), Cabinet dryer (60-65°C) and Flash dryer (120-150). Drying cassava under the sun should be done during dry seasons only. Granules or chips should be properly spread per square meter of drying surface and should not be overloaded ~~so much~~ to allow for air circulation. Platforms for drying should be raised to prevent contamination such as dust, animals, and pests. Batches of granules not adequately dried should be spread out in a ventilated room until the product is dried. Drying surfaces and materials should be clean.

5.5 Milling

39. This process involves milling the dried granules or chips to a fine flour of ~~about~~ particle size of approximately 250 microns to 500 microns). Care should be taken to ensure the mill is not overloaded. The environment should be monitored to prevent cross contamination from dust. The dried flour should be stored in a clean moisture-proof container. The milling machine should be cleaned and washed after use.

5.6 Sieving

40. The sieve to be used in further processing steps should be stored properly and cleaned with potable water and completely dried before use.

5.7 Frying

41. Frying of gari among other fermented cassava products should be done at high temperatures and monitored. ~~This~~ further discouraging fungal proliferation.

6. STORAGE

42. Storage facilities should be cleaned before materials are brought in, to remove dust, fungal spores, crop residues, animal and insect excreta, soil, insects, foreign material such as stones, metal and broken glass, and other sources of contamination. Sheds, silos, bins and other building materials intended for cassava and cassava-based products storage should be dried and well ventilated. Provide protection from ground water, moisture condensation, rain, entry of rodents, and insects whose activity makes the commodities more susceptible to mould infection. Ideally, storage areas should be able to prevent wide temperature fluctuations. Temperature and humidity can be monitored and controlled where possible
43. For bagged cassava products, ensure that bags are clean, dry, non-toxic and stacked on pallets or incorporate a water impermeable layer between the bags and the floor. The bags should facilitate aeration and be made of non-toxic food-grade materials that do not attract insects or rodents and are sufficiently strong to resist storage for longer periods as indicated in the *Code of practice for the reduction of mycotoxin contamination in cereals* (CXC 51-2003).
44. Determine moisture content of the lot, and if necessary, dry the product to the suitable moisture content recommended prior to storage. Fungal growth is closely related with water activity (a_w), commonly defined in foods as the water that is not bound to food molecules that can support the growth of bacteria, yeasts, and fungi. Although the appropriate moisture content for fungal growth on various crops is different, the maximum a_w to avoid fungal growth is basically the same. It is recognized that fungal growth is inhibited at a_w of less than 0.70. In addition, safe storage guidance may be provided to reflect the environmental situation in each region.

7. PACKAGING

45. Cassava-based products mainly in the form of flour or granules may be stored in sacks, sealed prior to distribution and sales in the market. Packaging materials should be made of materials which should not easily absorb moisture when packed and sealed.

8. TRANSPORTATION

46. Transport containers, including vehicles such as trucks and railway vessels, ~~(boats and ships)~~ should be dry and free of old crop dust, visible fungal growth, musty odour, insects and any contaminated material that could contribute to mycotoxin levels in lots and cargoes of cassava and cassava-based products. As necessary, transport containers should be cleaned and disinfected with appropriate substances (which should not cause off-odours, flavour or contaminate the cassava and cassava-based products) before use and re-use and be suitable for the intended cargo. The use of registered fumigants or insecticides may be useful. At unloading, the transport container should be emptied of all cargo and cleaned as appropriate.
47. Shipments of cassava and cassava-based products should be protected from additional moisture by using covered or airtight containers or tarpaulins. Minimise temperature fluctuations and measures that may cause condensation to form on the cassava and cassava-based products, which could lead to local moisture build-up and consequent fungal growth and mycotoxin formation.
48. Avoid insect, bird and rodent infestation during transport by the use of insect-and rodent proof containers or insect and rodent repellent chemical treatments if they are approved for the intended end use of the cassava and cassava-based products.

9. PERSONNEL HYGIENE

49. ~~The competence and hygiene of Farmers, agricultural and workers,~~ hired workers should be trained and farmers on workplace and personal hygiene measures at each process step such as ~~adequate measures from~~ planting, harvesting, packing and storage techniques, ~~should be~~ to ensure quality cassava and cassava based products. Training and re-training should be done to ensure adherence with best practices. ~~Keep a record of training dates.~~ Processors should provide required training on workplace employee hygiene and keep a record of training dates. ~~Personal protective clothing should be provided~~ for the staff. Measures to monitor staff hygiene practices and health status should be put in place. ~~Keep r~~ Records should be kept to track serious illnesses and to avoid cross contamination. ~~Make w~~ Washrooms and hand washing facilities should be made available and easily accessible. ~~Separate Areas for~~ eating areas, drinking and smoking, ~~coffee and all forms drinkings~~ should be kept separate from processing and packaging areas to avoid any contamination.

10. INSTRUCTION FOR STORAGE AND PRODUCT USE

50. Specific storage instructions for the cassava-based products should be provided on the packaging so as to ensure protection from unfavourable conditions, which may promote fungal growth and contamination. The instructions for storage and when opened should be in clear language and legible to maintain the product in a cool, dry, well-ventilated area. Educators should create awareness on product stacking in storage areas to avoid increased humidity and temperature, which encourages fungi growth.