
**Code of Good Agricultural Practices (GAP)
fruits and vegetables products**

Foreword

This Ethiopian code has been prepared under the direction of the Technical committee for fruit and vegetable (TC-13) and published by Ethiopian Standard Agency (ESA).

The practices in this Code of GAP are aimed towards prevention and minimization of risk occurrences which include those of food safety, environmental impact, worker health, safety and welfare, and product quality in the primary production and post harvest handling of fresh produce intended for human consumption. It is envisioned that compliance of farmers with this set of practices will enhance the trade and competitiveness of the country's agricultural products as well as promote consumer protection against food safety hazards.

In preparing this Ethiopian Standard reference has been made to the following:

PNS/BAFS 49:201_ Code of Good Agricultural Practices (GAP) for Fruits and Vegetables Farming, Philippine National Standard.

ASEAN Secretariat 2006. Good Agricultural Practices (GAP) for production of fresh fruits and vegetables in the ASEAN Region.

CAC/RCP 53, Code of Hygienic Practice for Fresh Fruits and Vegetables.

Acknowledgement is made for the use of information from the above publications.

Code of Good Agricultural Practices (GAP) for Fruits and Vegetables Farming

1. Scope

This Ethiopian code of practice covers the general hygienic practices for the production and primary processing of fresh fruits and vegetables cultivated for human consumption, particularly those intended to be consumed raw. Specifically, this code is applicable to fresh fruits and vegetables that are field-grown with or without cover, or those grown under protected facilities such as hydroponic systems or greenhouses.

This code does not apply to production of sprouts, fresh cut products and other products that are covered by separate production or certification standards.

2. Normative references

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3. Definitions

For the purpose of this code, the following terms and definitions shall apply:

3.1

agricultural inputs

any incoming material (e.g. seeds, fertilizers, water, agricultural chemicals, plant support, etc.) used for the primary production of fresh fruits and vegetables.

3.2

agricultural worker

any person that undertakes one or more of the following: cultivation, harvesting and packing of fresh fruits and vegetables.

3.3

antimicrobial agents

any substance of natural, synthetic or semi-synthetic origin which at low concentration kills or inhibits the growth of microorganism but causes little or no host damage.

3.4

biological control

the use of competing biological (such as insects, microorganisms and/or microbial metabolites) for the control of mites, pests, plant pathogens and spoilage organisms.

3.5

biopesticide

a pesticide that is manufactured from biological sources.

3.6

biosolids

sludge and other residue deposits obtained from sewage treatment plants and from treatments applied to urban and industrial wastes (food industry or other types of industries).

3.7

cleaning

the removal of soil, dirt, grease or other foreign matter.

3.8

clean water

water that does not compromise food safety in the circumstances of its use.

3.9

composting

a managed process where organic materials are subjected to moisture, heat and microorganisms for a specified period to produce a product known as compost.

3.10

contamination:

food safety context

the introduction or transfer of a food safety hazard to produce or to the inputs that contact produce, such as soil, water, chemicals, equipment and people.

environmental context

the introduction or occurrence of a hazard into the environment.

3.11

domestic animals

animals that are raised as family pets or as a source of food for the family –for example dogs, cats, cows, chickens, ducks, birds, sheep, monkeys, mice, rabbits.

3.12

farm animals

animals that are raised for agricultural and commercial purposes- for example, cows, arabaos, sheep, chickens and ducks.

3.13

fertigation

the application of nutrients through irrigation.

3.14

fertilizer

includes any substance – solid or liquid – or any nutrient element or elements – organic or inorganic–singly or in combination with other materials, applied directly to the soil for the purpose of promoting plant growth, increasing crop yield or improving their quality.

3.15

FPA certified pesticide applicator (Agricultural category)

refers to one who has attended training course and passed an examination administered for such purpose of safe use including storage, disposal of pesticide by the FPA.

3.16**food safety hazard**

any chemical, biological or physical substance or property that can cause fruit and vegetables to become an unacceptable health risk to consumers.

3.17**fumigation**

the application of a chemical to control pests in the soil or substrate, such as insects, diseases and weeds.

3.18**hazard**

a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health and environmental effect/s.

3.19**integrated pest management**

a pest management approach that uses all available pest control methods including but not limited to judicious use of pesticides, to optimize a crop's ability to resist the pest with the least hazard to man and the environment.

3.20**manure**

animal excrement which may be mixed with litter or other material, and which may be fermented or otherwise treated.

3.21**maturity index**

a method used to measure or predict the maturity of fruit and vegetables.

3.22**maximum residue limit (MRL)**

the maximum concentration of a pesticide residue (expressed as mg/kg) recommended by either Codex Alimentarius Commission or national competent authority to be legally permitted in or on food commodities and animal feeds. MRLs are based on GAP data and foods derived from commodities that comply with the respective MRLs are intended to be toxicologically acceptable.

3.23**obsolete chemical**

a chemical that is no longer suitable for use. For example approval for use of the chemical may be withdrawn, the chemical is older than the use by date, the container may be damaged and the chemical soiled.

3.24**organic material**

a material originating from plants and animals and not from synthetic sources.

3.25

packing

the action of putting fresh fruits and vegetables in a package. This may take place in a field or in the establishment.

3.26

pest

an unwanted animal or plant that affects the production, quality and safety of fruit and vegetables – for example, insects, diseases, weeds, rodents and birds.

3.27

pesticide

any substance or product, or mixture thereof, including active ingredients, adjuvant and pesticide formulations, intended to control, prevent, destroy, repel or mitigate directly or indirectly, any pest. The term shall be understood to include insecticide, fungicide, bactericide, nematocide, herbicide, molluscicide, avicide, rodenticide, plant regulator, defoliant, desiccant and the like.

3.28

pesticide residue

any specified substance in food, agricultural commodities, or animal feed resulting from the use of a pesticide. The term includes any derivatives of a pesticide, such as conversion products, metabolites, reaction products, and impurities considered to be of toxicological significance.

3.29

potable water

water that is suitable for human consumption as approved by WHO or equivalent regulations.

3.30

pre-harvest interval (PHI)

refers to the number of days between the last spraying and harvest. It is derived from a supervised pesticide residue trial where the pesticide is applied at the recommended rates and the residue levels are analyzed. Each pesticide active ingredient or AI has its own PHI.

3.31

primary processing

the part of a food processing plant that receives raw materials and prepares them for further processing, e.g. by cleaning, milling or separating.

3.32

re-entry period

refers to the period of time immediately following the application of a pesticide during which unprotected workers should not enter a field.

3.33

risk

the chance of something happening that will impact upon a hazard (for example, food safety). It is usually

measured in terms of likelihood and consequences.

3.34

sanitize

reducing the level of microorganisms through using chemicals, heat and other methods.

3.35

sensitive areas

areas at high risk of environmental harm from chemicals, water, nutrients, waste, and soon, originating from property activity. Examples include biodiverse areas, other crops, livestock areas, water sources, marine areas, wetlands, native fauna and flora, soils, neighboring properties and public areas.

3.36

site

a defined area on the property – for example, a production site.

3.37

soil additives

products or materials that are added to the soil to improve fertility, structure or control weeds. Examples are animal manure, sawdust, compost, seaweed, fish-based products.

3.38

traceability

the ability to follow the movement of produce through the specified stages of production and distribution.

4. Recommended practices

4.1 Site history and management

Suitability of the agricultural site for food production and primary processing

4.1.1 Management of site activities conforms to country environmental legislation covering air, water, noise, soil, biodiversity and other environmental issues.

4.1.2 In the case of new site(s), the risk of causing environmental harm within or outside the site should be assessed for the proposed use. Risk assessment should consider the prior use of the site and potential impact of adjacent sites to the new site(s).

4.1.3 If results of the evaluation of the production or adjoining sites lead to the conclusion that potential hazard exist, the sites should be further evaluated through analysis and characterization of the identified contaminants.

4.1.4 If the contaminants are found to be at unacceptable levels, the site should not be used for production and primary processing until corrective or control measures are carried out.

4.1.5 Whenever remedial action is required to manage the risk, the action taken should be monitored to ensure that contamination of the produce is eliminated or kept within acceptable levels.

Production site and property map

4.1.6 A property lay-out map within the site should be prepared to indicate the locations of the following:

- crop production area;

- primary processing area;
- sources of water used on the farm (well, reservoir, rivers, lakes, farm ponds, etc.);
- chemical pesticides and fertilizer storage and mixing areas;
- tools and equipment cleaning and disinfection areas; storage area for tools and equipment;
- water storage, distribution networks, drainage, and discharge points of waste water;
- solid waste disposal area;
- composting areas;
- property buildings, structures and road networks;
- toilet facilities and hand-washing areas; and
- environmentally sensitive and highly degraded areas (e.g. saline/sodic soil)

4.1.7 Each production area, in case of multiple production areas in a site, should be identified by a name or Code, and must be indicated in the property map.

4.2 Planting material

Selection of planting materials considers soil and site suitability/compatibility

4.2.1 Aside from yield quantity and quality as basic considerations, varieties to be grown should be selected based on market requirements, grower preference and adaptability to the locality. Other considerations may include soil type and nutrient levels, water availability, prevailing temperatures and humidity, insect pest population dynamics, and presence of inocula of major pathogens.

4.2.2 For efficient chemical, water and other input utilization, planting materials may be selected based on their nutrient and water use efficiencies, and pests and diseases resistance.

4.2.3 Crop varieties/species known to be toxic for human consumption are not grown.

Source of planting material, the necessary seed treatments and related documents

4.2.4 The seed and planting materials should be of high quality. Sourcing and/or procurement of seed and planting materials from the Accredited Seed Growers or Plant Nursery Operators are encouraged.

4.3 Soil and soil conservation

4.3.1 Recommended soil conservation measures such as: minimum tillage, contour planting, crop rotation, etc. should be integrated in the crop production practices in order to improve or maintain the soil structure and tilth, and minimize soil compaction and erosion.

4.3.2 Use of crop suitability maps to plan crop rotation and production programs is encouraged.

Use of soil fumigants to sterilize the soil

4.3.3 The use of chemical fumigants and alternatives to sterilize soils and substrates is justified. The farm should not use banned chemical fumigants and other practices not allowed under country environmental legislations.

4.4 Fertilizers and soil additives

4.4.1 To optimize nutrient use and minimize nutrient losses, the farm should apply fertilizers based on the quantitative information on soil nutrient based on soil analysis or leaf or sap analysis.

4.4.2 Fertilizers and soil additives should be judiciously selected to minimize the risk of contamination of produce, particularly with the heavy metals. Only duly registered fertilizers (inorganic and bio/organic) should be used.

4.4.3 In the case that potting mix (e.g. coco peat, peat moss, rice hull, compost) is used in the farm, the name of the source or supplier should be documented.

4.4.4 For hydroponic production systems the mixing, application and disposal of the nutrient solution is monitored and recorded.

Organic fertilizer

4.4.5 Composting areas should be separated from the crop production area and from drinking and farm water sources.

4.4.6 Untreated (undecomposed) organic materials must not be applied because the Presence of potential contaminants may affect the produce. Organic fertilizer materials should be treated prior to application.

4.4.7 Production procedures, such as: composting, solarization, heat drying, etc., Should be designed to reduce or eliminate pathogens in manure, biosolids and other natural fertilizers.

Human sewage

4.4.8 Human sewage whether processed or unprocessed must not be used for production of fresh fruits and vegetables.

Equipment maintenance

4.4.9 Equipment used for the application of fertilizers and soil additives should be maintained in good working condition and should be checked regularly by a technically competent person.

Storage facility and management

4.4.10 Areas or facilities for storage, mixing and loading of fertilizers and soil additives and for composting of organic materials should be constructed as far away as possible from the water source. These facilities should be properly maintained to minimize the risk of contamination of production areas and water sources.

4.4.11 For the storage of fertilizer materials:

- Storage area must be separated from other agro-chemical products to prevent cross contamination;
- The storage area should be well-ventilated and appropriately covered to protect inorganic fertilizers, such as powder, granules or liquids from sunlight, rain, humidity, and other atmospheric factors;
- Storage area should be free from waste, does not constitute a breeding place for rodents, and where spillage and leakage is easily cleared away;
- All inorganic fertilizers should be stored in a prescribed manner to avoid or minimize risk of contamination to water sources. For instance, liquid fertilizers must be banded and proximity of water courses and flood risks, etc. should be considered; and Fertilizers should not be stored with harvested crop or yield and plant propagation materials.

4.4.12 The utilization of inorganic fertilizer should observe First-In First-Out practice (FIFO).

Disposal of left-over fertilizers, used nutrient solutions and containers

4.4.13 Leftover fertilizers and unused nutrient solutions, if any, should be properly disposed.

4.4.14 Used inorganic fertilizer containers should be disposed according to approved label recommendations.

4.5 Water

Source of irrigation water

4.5.1 The risk of chemical or biological contamination of produce from the water used for irrigation, fertigation, application of chemicals, washing, treatments, cleaning, sanitation and other forms of handling the

produce should be assessed. Particular attention should be given especially for those crops that are grown close to the ground. Moreover, the proximity of water sources on possible sources of contamination (e.g. near the dumping site, near septic tanks, etc.) should be considered during assessment.

4.5.2 Where water testing is required to assess the risk of contamination, tests should be conducted at a frequency appropriate to the degree of potential risk from the water supply.

4.5.3 Where the risk of chemical and biological contamination of produce is significant, an alternative water source should be developed or necessary water treatment should be done.

Suitability of water quality for agricultural production

4.5.4 Irrigation use is based on crop water requirements, water availability, soil moisture levels, and consideration of environmental impact on and off the site. Water used for agricultural purposes should be of suitable quality for its intended use.

Quality of water used for fertilizer and pesticide application

4.5.5 Water used for the application of water-soluble fertilizers and agricultural chemicals in the field or indoor growing facility should not contain microbial, chemical and physical contaminants at levels that may adversely affect the safety of fresh fruits and vegetables.

Efficiency use and management of water

4.5.6 Water collection, storage, delivery and use should be managed.

4.5.7 The irrigation system is checked for operational efficiency during each use according to operator's instructions or other appropriate methods and maintained to ensure efficient delivery.

4.5.8 Water from toilets and drainage systems are disposed of in a manner that minimizes the risk of health and environmental harm on and off the site.

4.5.9 Water used from sources that may cause environmental harm to the land and soil, Water ways and sensitive areas should be managed or treated to minimize the risk of health and environmental harm.

Untreated sewage water

4.5.10 Untreated sewage water should not be used for irrigation or fertigation. Whenever Treated sewage water is used, water quality should comply with the WHO 1989 Published Guidelines for the Safe Use of Waste water and Excreta in Agriculture and Aquaculture, or the country's guidelines on the matter which is the Department of Environment and Natural Resources (DENR) Clean Water Act, specifically on use of Waste water. Otherwise, untreated sewage water should not be used during production and postharvest handling of produce.

4.6 Crop protection

Choice of crop protection products

4.6.1 Crop protection measures should be appropriate for the control of pests and based on the approval of the competent authority.

4.6.2 Growers should use agricultural chemicals that are registered for the cultivation of the specific fruit or vegetable and procured from licensed suppliers and approved by the competent authority in the country where the crop is grown and in the country where the produce is intended to be traded. The use of such agricultural chemicals must be in accordance with the approved label instructions for the intended purpose/s.

4.6.3 If the choice of chemical products is made by advisers, proof of their technical competence should be

made available such as certificates of trainings, education, experience and accreditation from competent authority.

- 4.6.4 The expiry dates of the chemicals to be procured should be considered. The expiration date is 2 years after the formulation date indicated on the label.
- 4.6.5 These should be applied at approved dosages to prevent residue levels exceeding the maximum residue limits (MRLs).
- 4.6.6 The produce shall be subjected to residue analyses to be conducted by an accredited laboratory.
- 4.6.7 Up-to-date information on chemical MRL standards for the country where produce is intended to be traded, is available from a competent authority.
- 4.6.8 If chemical residues in excess of the MRL are detected in the country where produce is traded, marketing of the produce is ceased. The cause of the contamination is investigated; corrective actions are taken to prevent re-occurrence, and a record is kept of the incident and actions taken.

Mixing of crop protection products

- 4.6.9 The mixing area should be located and chosen in such a way that the risk of contaminating the workers and the environment are minimized.
- 4.6.10 Mixing of agricultural chemicals should be carried out in a manner that will prevent ground and surface water contamination and the land in the surrounding areas.
- 4.6.11 The filling and mixing areas for the crop protection product should be equipped with appropriate tools for precise measurements and calibrations. The functionality of such should be checked before every cropping season by the grower/applicator. The filling and mixing areas should have floor brush, dust pan, plastic bags and absorbent materials such as sand. These materials should be placed in a fixed location within the specific area, to be used in case of spillage of crop protection product.
- 4.6.12 Emergency facilities in the event of accidental spill during mixing should be readily available.
- 4.6.13 Prepare only the necessary volume of spray solution to avoid surplus application mix.
- 4.6.14 Surplus application mixes are disposed of in a manner that does not present a risk of contaminating the produce.

Application of crop protection products

- 4.6.15 The person responsible for application should be technically competent. He should possess the relevant trainings and experience, education or preferably be duly accredited as such by a competent authority'().
- 4.6.16 The Integrated Pesticide Management (IPM) principles and techniques should be used whenever possible to minimize the use of pesticides. A rotation strategy for chemical application and other crop protection measures should be employed to avoid the development of pest resistance, i.e. use different chemical groupings (e.g. Organophosphates, synthetic pyrethroids, carbamates, etc.) of pesticides.
- 4.6.17 The tank mixing of more than two (2) chemicals should be avoided, unless recommended by FPA, or specified in the product label.
- 4.6.18 Growers/applicators should observe established Pre-harvest Intervals (PHIs) or the period between chemical application and harvest.
- 4.6.19 Appropriate warning signs should be placed on a newly applied or is being applied area.
- 4.6.20 Workers should use well-maintained protective clothing during applications and observe established Re-entry Periods.
- 4.6.21 Ground or aerial application of chemicals should be managed appropriately to minimize the risk of spray

drift to neighboring properties and environmentally sensitive areas. In such cases, areas applied with pesticides should be marked with appropriate warning signs for public safety.

Safety and Welfare of Authorized Worker/s during Application

- 4.6.22** Authorized farm workers should be trained on the proper handling (e.g. application) of crop protection products. (for TWG discussions).
- 4.6.23** Material safety data sheets (MSDS) or safety instructions from approved labels should be made readily available for reference.
- 4.6.24** First aid facilities (e.g. kits) should be readily available to treat workers of min or cuts and bruises and those that have been accidentally contaminated with chemicals prior to medical attention/treatment in a hospital.
- 4.6.25** First-aid and emergency instructions should be documented and conspicuously displayed in strategic locations.
- 4.6.26** Authorized workers who are directly handling and applying chemicals should undergo pre-employment, periodic/annual and exit medical check-up to ensure their health and welfare.

Storage of crop protection products

- 4.6.27** The crop protection product storage facility should comply with all the appropriate national or local regulations. It must have non-absorbent shelves such as metal or rigid plastic material to minimize the problem of contamination due to spillage.
- 4.6.28** Chemicals should be stored in a well-lighted, sound and secure structure, with access limited to the authorized personnel only. The structure should be located and constructed to minimize the risk of contaminating produce and should be equipped with emergency facilities in the event of a chemical spill, fire and other natural or man-made calamities.
- 4.6.29** Crop protection products should be stored in their original container with legible labels.
- 4.6.30** Proper segregation in the storage of crop protection products should be observed.

Maintenance and storage of equipment

- 4.6.31** Equipment used for chemical application should be maintained in good working condition. Such equipment should be checked by a technically competent person before each use.
- 4.6.32** Agricultural chemical sprayers should be calibrated as necessary, to maintain the precision of the application rate.
- 4.6.33** Mixing containers, sprayers and other equipment and tools used for chemical applications should be thoroughly washed after use, especially when used with different agricultural chemicals on different crops, i.e. to avoid contamination of the produce or damaging the crop. Washings should be contained for proper disposal.
- 4.6.34** Protective clothing should be separately washed from other clothing and stored properly for future use.

Disposal of crop protection products and other contaminated wastes

- 4.6.35** Empty chemical containers should not be re-used and should be safely secured until these are disposed. Empty containers should never be used for food and drink related purposes.
- 4.6.36** Empty chemical containers are disposed of according to relevant country regulations and in a manner that minimizes the risk of contaminating produce. Official collection and disposal systems are used where available.
- 4.6.37** Crop protection product containers should be rinsed three (3) times prior to disposal and should be

disposed according to label directions.

4.6.38 Expired or banned chemical should never be used for crop protection purposes. Obsolete chemicals are disposed of through official collection systems or in legal off-site areas.

4.6.39 Tank washings should be disposed appropriately to avoid contamination of the produce and minimize the risk of environmental harm within and outside the site.

4.6.40 All pesticide-contaminated wastes shall be disposed in a designated sanitary landfill, if available.

4.6.41 Fuels, oils and other unusable non-agri-chemicals should be disposed properly to avoid the risk of contaminating the produce.

Environmental safety

4.6.42 To prevent possible ecological imbalance, growers should use biological controls that are authorized for the cultivation of specific fruit or vegetable and should be used in accordance with the approved instructions for the intended purpose/s.

4.6.43 Farm activities comply with country regulations covering protected plant and animal species to ensure that protected species are not damaged.

4.6.44 To conserve native plant and animal species, access and activity is managed in significant remnant native vegetation areas, wildlife corridors, and vegetation areas on and near the banks of waterways.

4.6.45 Measures are used to control feral animals and environmental pests.

4.6.46 The generation of offensive odour, smoke, dust, and noise is managed to minimize the impact on neighboring properties.

4.7 Harvesting and handling produce From harvest to storage prior to transport

4.7.1 Harvesting

4.7.1.1 Practices that are critical to managing produce safety and quality during production, harvesting and postharvest handling are identified for the crop grown.

4.7.1.2 Appropriate maturity indices should be the bases in determining the harvest time.

4.7.1.3 Appropriate harvesting technique should be employed in harvesting to optimize the quality and other desired characteristics of produce during harvest or post harvest phases.

4.7.1.4 Harvesting time should be done in accordance to commodity requirements. Harvesting under the rain should be avoided. Fresh fruits and vegetables that are unfit for human consumption should be segregated during harvesting. Those which cannot be made safe by further processing should be disposed properly to avoid contamination of the uncontaminated produce.

4.7.1.5 Containers used for harvesting should be suitable and clean before use. Liners should be used to protect the produce, particularly when containers have rough surfaces.

4.7.1.6 If the containers are recycled, these should be properly cleaned or discarded accordingly if found unfit for use.

4.7.1.7 Harvested produce should not be placed in direct contact with the soil or floor in the handling, packing or storage areas.

4.7.2 Packaging

4.7.2.1 Produce should be graded and packed according to market requirements.

4.7.2.2 When packing of fresh fruits and vegetables is done in the field, contaminated containers or bins exposed to the sources of contaminants (i.e. manure) should be avoided.

4.7.2.3 Protective materials should be used whenever appropriate to protect the produce from rough

surfaces of containers and exposure to sunlight leading to excessive moisture loss.

4.7.3 Pre-transport

- 4.7.3.1 Harvested produce should be placed under shade or any covered area if transport is delayed.
- 4.7.3.2 Any ice used for pre-cooling the produce and used at point of harvest must be made with potable water and handled under sanitary conditions to prevent produce contamination.
- 4.7.3.3 After grading and classification, the produce should be packed in suitable containers. To minimize mechanical damage, packed containers should not be stacked on top of each other unless the containers are designed for stacking.
- 4.7.3.4 If the harvested and packed produce stored on farm, storage areas must be clean and, if applicable, temperature and humidity controls are maintained.
- 4.7.3.5 Produce that are packed and handled directly in the field, orchard or greenhouses must be removed from the field and transported to the processing area as quickly as possible in order to prevent post-harvest losses and contamination.

4.8 Transport

- 4.8.1 All field-packed produce must be covered during transport in order to prevent contamination.
- 4.8.2 Refrigerated transport vehicles should be covered with temperature settings that will minimize quality loss of the produce.
- 4.8.3 Containers filled with produce are not placed in direct contact with soil where there is a significant risk of contaminating produce from soil on the bottom of containers.
- 4.8.4 Pallets and transport vehicles should be checked before use for cleanliness, chemical spills, foreign objects and pest infestation. Pallets should be thoroughly cleaned and covered with protective material or rejected if there is a significant risk of contaminating produce. Transport vehicles should be cleaned if there is a significant risk of mechanical damage and contaminating produce.
- 4.8.5 Produce should be transported separately from goods that are potential sources of chemical contamination and causes of biological and physical hazards. Moreover, mixing of non-compatible produce during transport should be avoided.
- 4.8.6 For long delays before transport, produce should be kept at the lowest possible temperature condition.
- 4.8.7 When farm vehicle used for transporting harvested produce are also used for other purposes, it should be cleaned prior to hauling to avoid contamination of the produce.

4.9 Specific process steps

Post-harvest washing

- 4.9.1 Whenever required, the produce should be treated with approved protocols to minimize disease development and loss of quality.
- 4.9.2 Water used for washing the produce should be analyzed at least annually. The levels of water quality parameters should be maintained within accepted WHO thresholds or are accepted as safe for the food industry by the competent authority.
- 4.9.3 The water to be used for final washing of the edible parts of produce should have quality equivalents to potable water standard, although clean water can be used for the initial washings.
- 4.9.4 Where appropriate, the temperature of the post-harvest water should be controlled and monitored. The temperature monitoring record is kept for traceability.

- 4.9.5 Ice to be used for cooling purposes should be made from potable water. The productions, handling and storage of ice for postharvest purposes should follow appropriate safeguards to avoid contamination.
- 4.9.6 In the case that water is re-circulated or recycled for final washing of the produce, proper filtering and disinfection process should be done. The pH and microbial load should be routinely monitored. A routine cleaning schedule according to the usage should be maintained and documented.
- 4.9.7 Post-harvest systems that use water for washing the produce should be designed in a manner that minimizes product lodges and dirt buildup.

Post harvest treatment

- 4.9.8 Anti-microbial agents should only be used when absolutely necessary to minimize cross-contaminations during postharvest and when used for good hygienic practices. The level of anti-microbial agents should be monitored and controlled. Washing of fruits and vegetables should be done to ensure that chemical residues do not exceed levels as recommended by the Codex Alimentarius Commission.
- 4.9.9 The farm should only use approved and registered materials for post harvest treatments such as waxes, pesticides to include fungicides, and GRAS (Generally Regarded as Safe) chemicals. Post harvest treatment materials should be carried out in accordance with label instructions.
- 4.9.10 Sprayers for postharvest treatments should be calibrated regularly to control the accuracy of the application rate. After use, sprayers should be thoroughly washed in safe areas, particularly when different chemicals are used to avoid contamination of the produce.

Cooling system of fresh fruits and vegetables

- 4.9.11 When pre-cooling is required, it should be done in accordance to the requirements of specific fresh fruit(s) or vegetable(s). When appropriate, fresh fruits and vegetables should be maintained at low temperatures after pre-cooling to minimize microbial growth. The temperature of the cold storage should be controlled and monitored.
- 4.9.12 Condensate and defrost water from evaporator type cooling systems (e.g. vacuum cooling, cold rooms) should not drip onto fresh fruits and vegetables. The inner side of the cooling systems should always be clean.
- 4.9.13 Potable water should be used in cooling systems, particularly when water or ice is in direct contact with fresh fruits and vegetables (e.g. Hydro-cooling, ice-cooling). The water quality in these systems should be controlled and maintained.
- 4.9.14 Forced-air cooling involves the use of rapid movement of refrigerated air over fresh fruits and vegetables in cold rooms. Air-cooling systems should be appropriately designed and maintained to preserve quality and to avoid contaminating the fresh produce.

4.10 Off-farm facility for produce handling and/or storage

- 4.10.1 Floors should be designed with appropriate slopes, drainage channels and kept free and clear to ensure good drainage system.
- 4.10.2 Produce handling facilities and equipment such as process lines and machinery, floors, storage areas, pallets as well as floors and walls should be cleaned and/or maintained regularly to prevent contamination.
- 4.10.3 Rejected produce and waste material should be disposed properly in designated areas to prevent contamination of the produce.
- 4.10.4 Cleaning agents, lubricants, etc. should be kept in a designated area that is separate and apart from

packing area to avoid chemical contamination of produce.

4.10.5 Domestic animals should not be allowed to enter processing facilities to prevent contamination of the produce.

4.10.6 There must be monitoring and management systems for pest control to avoid or minimize pest infestation. Traps and baits should be identified in the building lay out map.

4.11 Personal hygiene and farm sanitation

Personal Hygiene

4.11.1 Workers should have appropriate knowledge or must be trained in personal hygiene practices.

4.11.2 Farm workers should comply with farm hygiene regulations such as observance of personal cleanliness and appropriate clothing (i.e. hand washing, wearing of jewelry and fingernail length and cleaning, etc) and personal behavior (i.e. no smoking, spitting, eating, chewing, etc).

4.11.3 Written instructions on personal hygiene practices should be provided to workers or displayed on prominent locations.

4.11.4 Fixed or mobile toilets and hand washing facilities should be available and accessible to the workers and should be properly maintained in good hygienic condition. These should be located in an appropriate area.

4.11.5 Where employers are required to provide medical and health cover, any serious health issue is reported to the relevant health authority.

Farm Sanitation

4.11.6 Measures should be taken in order to ensure that the cultivation area is free from possible sources of contamination (e.g. litter, etc.).

4.11.7 Packing, handling and storage areas that can be sources of contamination should be identified. Cleaning and sanitation procedures should be prepared and followed.

4.11.8 Appropriate cleaning and sanitation chemicals are selected to minimize the risk of these chemicals causing contamination of produce.

Equipment, containers and materials

4.11.9 Containers used for harvesting, handling and packing produce must never be used for hauling or storing agricultural chemicals, lubricants, oil, cleaning chemicals, plant or other debris, tools, etc.

4.11.10 Equipment, reusable harvesting containers, harvesting tools that comes in contact with fresh fruits and vegetables are made of non-toxic materials, easily cleaned and disinfected. These implements and the farm vehicle should be regularly maintained at least once a year.

4.11.11 Equipment, containers and materials should be stored in a separate area away from chemicals, fertilizers and soil additives storage areas. Measures should be taken to minimize contamination from pests.

4.11.12 Containers for waste, by-products and inedible or dangerous substances should be specifically identifiable, suitably constructed and, where appropriate, made of impervious materials. Where applicable, such containers should be lockable to prevent malicious or accidental contaminations of fresh fruits and vegetables or agricultural inputs. Such containers should be segregated and identified so that they will not be used as harvesting containers.

Buildings and Structures

4.11.13 Building and structures used for production, packing, handling and storage of produce should be designed and constructed according to building standards and maintained to minimize the risk of

contaminating the produce. Lights bulbs should be shatter proofs in areas where produce, packing containers and materials are exposed. In the event of bulb shattering, exposed produce is rejected while equipment, packing containers and materials are cleaned.

4.11.14 There should be a separate designated packing area, where the produce are handled and prepared to prevent cross-contamination.

4.11.15 Sewage, waste disposal and drainage systems are constructed to minimize the risk of contaminating the production site and water supply.

Animals, Pest and Disease Control

4.11.16 Except for fruit bearing trees, domestic and farm animals must be restricted from the production site and from areas where produce are harvested, packed and temporarily held.

4.11.17 Measures should be taken to prevent the introduction of pests and diseases within the cultivation, handling, packing and storage areas.

4.11.18 Baits and traps used for pest control should be positioned and maintained in strategic areas to minimize the risk of contaminating the produce, packing containers and other handling materials. The location of baits and traps should be included in the building lay out map.

4.12 Worker's health, safety and welfare

Training

4.12.1 Employers and workers must have appropriate knowledge or must have proper training on their areas of responsibility that are relevant to good agricultural practice.

4.12.2 Based on the area of responsibility of the workers, appropriate knowledge or training should be available on the following areas:

- vehicles, equipment and tool operation;
- accident and emergency procedures;
- safe use of chemicals;
- personal hygiene; and
- proper handling of produce.

4.12.3 Personnel working in packing houses should be able to practice good handling practices and Good Hygienic Practices (GHP); and aware of their role and responsibility in protecting fresh fruits and vegetables from contamination and deterioration. Packers should have the necessary knowledge and skills to enable them to perform packing operations and to handle fresh fruits and vegetables in a way that the potential for microbial, chemical and physical contamination are minimized.

4.12.4 There are documented, understandable and verbally communicated instructions made to the workers enabling them to know how to act in accident and emergency situations. These instructions should be available in the predominant languages of the workforce and should be displayed in conspicuous places.

4.12.5 Safe manual handling practices are followed to minimize the risk of injury from lifting heavy objects and excessive twisting and reaching movements.

4.12.6 New workers should be informed about the risks associated with health and safety when starting at the worksite.

Worker welfare

4.12.7 In case living quarters are provided by an employer, the structure must be suitable for human habitation

and contain basic services and facilities.

4.12.8 The farm should employ workers at least 18 years old.

4.13 Waste management and energy efficiency

4.13.1 A farm should have an operational waste management plan and should be properly followed. Consumption of electricity and fuel should be monitored and reviewed for efficient and optimized operation in which power and fuel bills may be of assistance.

4.13.2 Machinery and equipment should be serviced to maintain operational efficiency.

Traceability and recall

Records of production, processing and distribution should be maintained for two (2) years to facilitate a food borne illness investigation and recall, if any.

4.13.3 Growers and/or packers should always update all relevant information on agricultural activities such as the site of production, suppliers' information on agricultural inputs, lot numbers of agricultural inputs, irrigation practices, use of agricultural chemicals, water quality data, pest control and cleaning schedules for indoor establishments, premises, facilities, equipment and containers.

4.13.4 A record should also be kept on the following specifics: date of supply, quantity of produce and destination for each consignment of produce.

4.13.5 Growers and packers should have programs to ensure effective lot identification. These programs should be able to trace the sites and agricultural inputs involved in primary production and the origin of incoming material at the packing establishment in case of suspected contamination.

4.13.6 Packed containers must be clearly labeled with an identification to enable traceability of the produce to the farm or site where the produce is grown.

4.13.7 When produce is identified as being contaminated or potentially contaminated, the produce is isolated and distribution prevented or if sold, the buyer is immediately notified.

4.13.8 The cause of any contamination is investigated and corrective actions are taken to prevent re-occurrence and a record is kept of the incident and actions taken.

4.14 Documentation and Records

Site history and management

4.14.1 In case of new sites, a record should be kept for all potential hazards identified during the assessment. Whenever remedial action is required to manage the risk, a record should be kept on the action taken and the results thereof.

4.14.2 In case of multiple production areas in a site, the name or code of each production area should be indicated in all documents and recorded.

Planting material

4.14.3 Whenever a planting material is produced within the farm or from non- accredited farm sources, chemical used for treatment and purpose of the treatment should be documented.

4.14.4 In case planting materials are procured from accredited nurseries or seed producer, the name and specifics of the cultivar, the name of the supplier, and the date of procurement should be record.

Fertilizers and soil additives

4.14.5 A record of fertilizers and soil additives obtained should be kept with the following specifics: source, product name, and date and quantity obtained

- 4.14.6** The application of fertilizers and soil additives, chemical fumigants and alternatives to sterilize soils and substrates should be recorded, detailing the following: date, name of the product or material used, treatment location, application rate, application method, and operator name.
- 4.14.7** Records of procurement, inventory and utilization of inorganic fertilizers should be maintained and updated regularly. These should include: source, product name, date and quantity, expiration date (for liquid fertilizers) and the nutrient composition of the materials.
- 4.14.8** Treatment of organic fertilizer materials prior to application should be documented. The method, date and duration of the treatment should be recorded. The level of pathogen reduction (*E. coli* and *Salmonella* should be zero) achieved by different treatments should be documented and supported by laboratory analyses.
- 4.14.9** The farm should maintain a documented maintenance program for the equipment used for the application of fertilizers and soil additives.

Water

- 4.14.10** Documentation should be kept for any occurrence of significant hazards during the assessment of source of irrigation water. If contamination occurs, corrective actions should be carried out and actions taken should be properly documented.
- 4.14.11** Where available, a record of the water testing results should be kept.
- 4.14.12** If water treatment is done, a record of the treatment method/s used and the monitoring results should be kept.
- 4.14.13** A record is kept of irrigation use, detailing crop, date, location, volume of water applied or duration of irrigation, unit area, and name of person who managed the irrigation activity.

Crop protection

- 4.14.14** A record of procured chemicals should be kept, with the following details: chemical name, supplier of the chemical, date of purchase, expiry dates, and quantity procured.
- 4.14.15** After application, the following should be recorded: name of applicator, name of product/s used, application rate, frequency of application, method of application, date of application and PHI.
- 4.14.16** If chemical residues in excess of the MRL are detected, the cause of the contamination is investigated, corrective actions are taken to prevent re-occurrence, and a record is kept of the incident and actions taken.
- 4.14.17** In order to avoid expired chemicals, a record or inventory of stored chemicals should be kept with the following details: chemical name, date and quantity obtained, expiry date and date when completely used or disposed of.
- 4.14.18** Records of maintenance and calibration activities for agricultural chemical sprayers should be kept. The records must always be accessible during inspection of the farm.

Harvest and Postharvest treatment

If applicable, farm storage areas temperature and humidity are recorded.

- 4.14.19** Application of postharvest agrichemical should be recorded and maintained with the following information:
- produce identity (i.e. lot or batch of produce)
 - location of application
 - application dates

- pest or disease treated (common name)
- type of treatment
- product trade name/formulation
- product quantity applied
- operator's name

4.14.20 Documented records should be kept for the cleaning and maintenance of produce handling facilities and equipment.

Animals, Pest and Disease Control

4.14.21 Actions taken for animal, pest and disease control and monitoring must be recorded.

Workers' health, safety and welfare

4.14.22 A record of personnel orientation training on personal hygiene practices, risks associated with and health safety and programs relevant to good agricultural practices should be kept.

4.14.23 Records should indicate that the required instructions or training program are in place and copies of attendance certificates or a signed list of workers who attended the training course(s) must be compiled.

Waste management

4.14.24 Disposal of rejected produce and waste materials should have documented records.

4.14.25 Farm waste management plan should be properly documented including the: types of waste products generated by property activities, practices to minimize waste generation, reuse or recycling of waste, and storage and disposal of waste.

4.14.26 Out of date documents are disposed and only current versions of documents relevant to good agricultural practice are used.

4.14.27 Written and/or documentary accounts should be kept which enables the official or officially recognized certification body/authority to trace the origin, nature and quantities of all raw materials bought and the use of such materials. In addition, written and/or documentary account should be kept of the nature, quantities, and consignees of all agricultural products sold. Quantities sold directly to the final consumers should preferably account on a daily basis.

Internal self-inspection

4.14.28 The grower should conduct a documented annual internal self-inspection. Effective corrective actions should be implemented if necessary.

Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010. ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1998.

ESA's objectives are:-

- ❖ Develop Ethiopian standards and establish a system that enable to check whether goods and services are in compliance with the required standards,
- ❖ Facilitate the country's technology transfer through the use of standards,
- ❖ Develop national standards for local products and services so as to make them competitive in the international market.

Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational institutions, research institutes, government organizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.

Orders For all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch (Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed in from our website.

ESA has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of ESA.

International Involvement

ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the international Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM). It is a founding member of the African Regional Organization for standardization (ARSO).

More Information?

Contact us at the following address.

The Head Office of ESA is at Addis Ababa.

☎ 011- 646 06 85, 011- 646 05 65

☎ 011-646 08 80

✉ 2310 Addis Ababa, Ethiopia

E-mail: info@ethiostandards.org,

Website: www.ethiostandards.org



National Standards Mark