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FOOD AND AGRICULTURE
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JOINT FAO/WHO FOOD STANDARDS PROGRAMME **CODEX COMMITTEE ON FOOD HYGIENE**

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PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR THE PRIMARY PRODUCTION, HARVESTING AND PACKING OF FRESH FRUITS AND VEGETABLES AT STEP 3

Governments and interested international organizations are invited to submit comments or information on the attached Draft Code at Step 3 (see Annex) and should do so in writing in conformity with the Uniform Procedure for the Elaboration of Codex Standards and Related Texts (see *Procedural Manual of the Codex Alimentarius Commission, Tenth Edition, pages 20-21*) **to:** Mr Ali Amjad, Staff Officer, Food Safety and Inspection Service, US Department of Agriculture, Room 4861, 1400 Independence Avenue, S.W., Washington DC, 20250 USA, Fax: 1 (202) 720-3157, or email: uscodex@usda.gov with a copy **to:** Secretary, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, viale delle Terme di Caracalla, 00100 Rome, Italy, by Fax. +39(6)5705.4593 or email: Codex@fao.org **before 1 October 1999.**

Background Information

In response to growing concerns about fresh fruits and vegetables as a source of food-borne illness, the Codex Committee on Food Hygiene at its 30th Session¹ proposed initiating work on a Code of Hygienic Practice for the Primary Production, Harvesting and Packaging of Fresh Produce and assigned the Canadian delegation to prepare a discussion paper. The 45th Session of the Executive Committee while approving the elaboration of the Code as new work (ALINORM 99/3, para. 28 and Appendix 3) noted that careful attention needs to be paid to the effect of the increasing workload of this Committee.

Following consideration of this issue, the 31st Session of the Committee decided that the Delegation of Canada in cooperation with a drafting group² develop the discussion paper³ into a Proposed Draft Code which is hereby attached for comments at Step 3.

¹ ALINORM 99/13, para. 108.

² Argentina, Chile, Denmark, Guatemala, Honduras, India, Japan, Mexico, the Netherlands, Spain, Sweden, United Kingdom, and United States.

³ ALINORM 99/13A, paras 53-62.

Annex

**PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR THE PRIMARY
PRODUCTION, HARVESTING AND PACKING OF FRESH FRUITS AND VEGETABLES
AT STEP 3**

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INTRODUCTION

Scientific research over the last decades has shown that a diet rich in fruits and vegetables is protective against many cancers and lowers the occurrence of coronary heart disease. This recognition of the importance of routine consumption of fresh fruits and vegetables, together with a marked increase in the year-round availability of fresh fruits and vegetables from a global market, has contributed to the substantial increase in consumption of fresh fruits and vegetables over the past two decades. However, the recent increase in reports of food borne illness associated with fresh fruits and vegetables has raised concerns from public health agencies and consumers about the safety of these products which are not processed to eliminate pathogens.

1. OBJECTIVES OF THE CODE

This code addresses good agricultural practices and good manufacturing practices for all stages of the production of fresh fruits and vegetables from harvesting to packing. It provides a general framework of recommendations to allow uniform adoption by this sector rather than providing detailed recommendations for specific agricultural practices, operations or commodities. The fresh fruit and vegetable industry is highly complex. A wide variety of fresh fruits and vegetables are produced and packaged in highly diverse climatic and environmental conditions. Therefore, the code is, of necessity, a flexible one to allow for different systems of control and prevention of contamination for different groups of commodities.

2. SCOPE, USE AND DEFINITIONS

2.1 SCOPE

This draft code of practice covers general hygienic practices for the primary production, harvesting and packing of fresh fruits and vegetables for human consumption in order to produce a safe and wholesome product. Specifically, this draft code is applicable to fresh fruits and vegetables grown in the field (with or without cover) or indoors (hydroponic systems, greenhouses). It concentrates on microbial hazards and addresses physical and chemical hazards only in so far as these relate to GAP and GMP.

The code does not provide recommendations for handling practices to maintain the safety of fresh fruits and vegetables at retail, food services or in the home. It excludes food products for which there is a specific Codex Alimentarius Code of Hygienic Practices. [Specifically this draft code does not include sections covering the minimal processing of fruits and vegetables such as fresh-cut. A separate document is being developed on this aspect by the Delegation of France in cooperation with a drafting group. These last sentences will be removed upon adoption of this code.]

2.2 USE

This document follows the format of the Codex *Recommended International Code of Practice - General Principles of Food Hygiene*- CAC/RCP 1-1969, Rev 3 (1997) and should be used in conjunction with that document. It focuses upon hygienic issues that are specific to the primary production, harvesting and packing of fresh fruits and vegetables. The major issues are covered in section 3. In other sections, the *General Principles of Food Hygiene* have been expanded where there are issues specific to primary production, harvesting and packing.

2.3 DEFINITIONS-

Definitions of general expressions are included in the *General Principles of Food Hygiene*. For the purpose of this code, the following terms have the definition stated:

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.

Agricultural worker - any person that undertakes cultivation and harvesting of fresh fruits and vegetables.

Clean water - water that does not contain pathogenic microorganisms [at levels that compromise food safety].

Composting - a managed process in which organic materials are digested aerobically or anaerobically by microbial action.

Farm - any premise or establishment in which fresh fruits and vegetables are grown and harvested and the surroundings under the control of the same management.

Fresh fruits and vegetables - produce that are likely to be sold to consumers in an unprocessed or minimally processed (i.e. raw) form and are intended to be consumed raw.

Grower - the person responsible for the management of the primary production of fresh fruits and vegetables.

Harvester - the person responsible for the management of the harvesting of fresh fruits and vegetables.

Hazardous compound - any chemical compound which has the potential to cause adverse health effects.

Hydroponics - a general term for the production of plants without soil in a water medium.

Microbial hazards -microorganisms that have the potential to cause an adverse health effect.

Microorganisms -include yeasts, molds, bacteria, viruses and parasites. When used as an adjective, the term “microbial” is used.

Packer - the person responsible for the management of post-harvest processing and packing of fresh fruits and vegetables.

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

Packing establishment - any indoor establishment in which fresh fruits and vegetables receive post-harvest treatment and are packaged.

Potable water - water which meets the quality standards of drinking water such as described in the WHO Guidelines for Drinking Water Quality.

Primary production -those steps involved in the growing of fresh fruits and vegetables before harvesting such as planting, irrigation, application of fertilizers, application of agricultural chemicals, etc.

3. PRIMARY PRODUCTION AND HARVESTING

Fresh fruits and vegetables are grown and harvested under a wide range of climatic conditions, using various agricultural inputs and technologies, and on farms of varying sizes. Biological, chemical and physical hazards may therefore vary significantly from one type of production to another. In each primary production area, it is necessary to consider the particular agricultural practices that promote the production of safe fresh fruits and vegetables, taking into account the conditions specific to the primary production area, type of products, and methods used. Procedures associated with primary production and harvesting should be conducted under hygienic conditions and should minimize potential hazards to health due to the contamination of fresh fruits and vegetables.

3.1 ENVIRONMENTAL HYGIENE

Potential sources of contamination from the environment should be identified. In particular, primary production and harvesting should not be carried on in areas where the presence of potentially harmful substances would lead to an unacceptable level of such substances in or on fresh fruits and vegetables.

Growers should evaluate the previous uses of the sites (indoor and outdoor) as well as adjoining sites in order to identify potential microbial hazards. The potential for other types of contamination (e.g. from agricultural chemicals, hazardous wastes, etc.) should also be considered. The evaluation process should include the following:

- Previous usage of the site should be evaluated (e.g. crop grown, feed lot, hazardous waste site) to identify potential microbial hazards including faecal contamination and contamination by organic waste.
- Previous and present usage of the adjoining sites should be evaluated (e.g. crop grown, animal production, sewage treatment site) to identify potential environmental hazards that could be carried to the growing site.
- The access of farm and wild animals to the site should be assessed to identify potential faecal contamination of the soils and the risk of contaminating crop. Existing practices should be reviewed to assess the prevalence and likelihood of uncontrolled deposits of animal faeces coming into contact with crops. Domestic and wild animals should be excluded, as far as possible, from fresh produce growing areas during the growing and harvesting season.
- Potential for contaminating produce fields from leaking or overflowing manure storage sites and flooding from polluted surface waters should be assessed.

If previous uses cannot be identified, or the examination of the growing or adjoining sites leads to the conclusion that potential hazards exist, the sites should be analysed for contaminants of concern. If the contaminants are at excessive levels and corrective or preventative actions cannot minimize potential hazards, growers should not use these sites.

3.2 HYGIENIC PRODUCTION OF FRESH FRUITS AND VEGETABLES

3.2.1 AGRICULTURAL INPUT REQUIREMENTS

Agricultural inputs should not contain microbial contaminants at levels that may adversely affect the safety of fresh fruits and vegetables.

3.2.1.1 Agricultural water

- Growers should identify the sources of water used on the farm (municipality, re-used irrigation water, well, open canal, reservoir, rivers, lakes, farm ponds etc.). They should assess its microbial and chemical quality, and its suitability for intended use, and identify corrective actions to minimize contamination (e.g. from livestock, sewage treatment, human habitation).
- Where necessary, growers should have the water they use tested for microbial and chemical contaminants. The frequency of testing will depend on the water source and the risks of environmental contamination including intermittent or temporary contamination (e.g. heavy rain, flooding, etc.). If the water source is found to be contaminated, corrective actions should be taken to ensure that the water is of sufficient quality for its intended use.

Water for irrigation and harvesting

Water used for agricultural purposes (e.g. irrigation, pest control, etc.) should be of suitable quality for its intended use. Special attention to water quality should be considered for the following situations:

- Irrigation by water delivery techniques that expose fresh fruits and vegetables directly to water (e.g. sprinkler) especially close to harvest time.
- Irrigation of fruits and vegetables that have physical characteristics such as leaves and rough surfaces which can trap water.
- Irrigation of fruits and vegetables that will receive little or no post-harvest wash treatments prior to packing, such as field-packed produce.
- Direct water contact with fresh fruits and vegetables which occurs close to harvest.

Water for fertilizers, pest control and other agricultural chemicals

- Water used for the application of water-soluble fertilizers and agricultural chemicals in the field and indoors should not contain microbial contaminants at levels that may adversely affect the safety of fresh fruits and vegetables. Special attention to the water quality should be considered when using

fertilizer and agricultural chemical delivery techniques (e.g. sprinklers) that expose the edible portion of fresh fruits and vegetables directly to water especially close to harvest time.

Hydroponic water

Plants grown in hydroponic systems absorb nutrients and water at varying rates, constantly changing the composition of the re-circulated nutrient solution.

- Water used in hydroponic culture should be changed frequently, or if recycled, should be treated to minimize microbial and chemical contamination.
- Water delivery systems should be maintained and cleaned, as appropriate, to prevent microbial contamination of water.

3.2.1.2 Manure, sewage sludge and other natural fertilizers

The use of manure, sewage sludge and other natural fertilizers (e.g. organic materials, slaughter wastes, etc.) in the production of fresh fruits and vegetables should be managed to limit the potential for microbial contamination. Manure, sewage sludge and other natural fertilizers contaminated with heavy metals or other chemicals at levels that may adversely affect the safety of fresh fruits and vegetables should not be used. In order to minimize microbial contamination the following practices should be considered:

- Adopt proper treatment procedures (e.g. composting, pasteurization, heat drying, UV irradiation, alkali digestion or combinations of these) that are designed to reduce or eliminate pathogens in manure, sewage sludge and other natural fertilizers. The level of pathogen reduction achieved by different treatments should be taken into account when considering suitability for different applications.
- Growers who are purchasing manure, sewage sludge and other natural fertilizers that have been treated to reduce microbial or chemical contaminants should obtain documentation from the supplier that identifies treatments used and tests performed.
- If it is considered necessary to apply natural fertilizers to crops where the edible part would be in direct contact with the natural fertilizer, advanced treatments, such as pasteurization, that secure high pathogen reduction should be used.
- Manure, sewage sludge and other natural fertilizers which are untreated or partially treated may be used only if appropriate corrective actions are being adopted to reduce microbial contaminants such as maximizing the time between application and harvest of fresh fruits and vegetables.
- Minimize direct or indirect contact between manure, sewage sludge and other natural fertilizers, and fresh fruits and vegetables, especially close to harvest.
- Minimize contamination by manure, sewage sludge and other natural fertilizers from adjoining fields. If the potential for contamination from the adjoining fields is identified, preventative actions (e.g. care during application and run-off controls) should be implemented to minimize the risk.
- Avoid locating treatment or storage sites in proximity to fresh fruit and vegetable production areas. Prevent cross-contamination from runoff or leaching by securing areas where manure, sewage sludge and other natural fertilizers are treated and stored.

3.2.1.3 Soil

Soils should be evaluated for potential microbial and chemical hazards (faecal contamination, agricultural chemicals, hazardous compounds). If the evaluation concludes that potential hazards exist, soils should be tested for contaminants of concern. If the contaminants are at excessive levels, a corrective action plan to eliminate the potential hazards should be implemented prior to planting. If the hazards cannot be eliminated, growers should not use these soils.

3.2.1.4 Agricultural chemicals

- Growers should use only agricultural chemicals which are acceptable for the cultivation of the specific fruit or vegetable and should use them according to the manufacturer's instructions for the intended purpose.
- Agricultural workers who apply agricultural chemicals should be trained in proper application procedures.
- Growers should keep records of agricultural chemical applications. Records should include information on the date of application, the chemical used, the crop sprayed and the pest or disease against which it was used, the concentration, method and frequency of application.
- Agricultural chemical sprayers should be calibrated regularly to control the accuracy of the rate of application.
- The mixing of agricultural chemicals should be carried out in such a way as to avoid contamination of water and land in the surrounding areas and to protect employees involved in this activity from potential hazards.
- Sprayers and mixing containers should be thoroughly washed after use, especially when used with different agricultural chemicals on different crops, to avoid contaminating fruits and vegetables.
- Agricultural chemicals should be kept in their original containers, labelled with the name of the chemical and the instructions for application. Agricultural chemicals should be stored in a safe place, away from production areas and harvested fruits or vegetables, and disposed of in a manner that does not pose a risk of contaminating crops.

3.2.2 INDOOR FACILITIES ASSOCIATED WITH GROWING AND HARVESTING

For operations where fresh fruits and vegetables are grown indoors (greenhouses, hydroponic culture, etc.) suitable premises should be used.

3.2.2.1 Location

- Premises and structures should be located, designed and constructed to avoid contaminating fresh fruits and vegetables and harboring pests.

3.2.2.2 Design and layout

- Where appropriate, the internal design and layout should permit compliance with good hygienic practices for the primary production and harvesting of fresh fruits and vegetables indoors, including protection against cross-contamination between and during operations. Each establishment should be evaluated individually in order to identify specific hygienic requirements for each product.

3.2.2.3 Water supply

Where appropriate an adequate supply of potable water with appropriate facilities for its storage and distribution should be available in indoor primary production facilities. Non-potable water should have a separate system. Non-potable water systems should be identified and should not connect with, or allow reflux into, potable water systems.

- Avoid contaminating potable water supplies by exposure to agricultural inputs used for growing fresh produce.
- Clean and disinfect potable water storage facilities on a regular basis.

3.2.2.4 Drainage and waste disposal

Adequate drainage and waste disposal systems and facilities should be provided. These systems should be designed and constructed so that the risk of contaminating fresh fruits and vegetables, agricultural inputs or the potable water supply is avoided.

3.2.3 PERSONNEL HEALTH, HYGIENE AND SANITARY FACILITIES

Hygiene and health requirements should be followed to ensure that personnel who come directly or indirectly into contact with fresh fruits and vegetables are not likely to contaminate them. Visitors should, where appropriate, wear protective clothing and adhere to the other personal hygiene provisions in this section.

3.2.3.1 Personnel hygiene and sanitary facilities

Personnel hygiene and sanitary facilities should be available to ensure that an appropriate degree of personal hygiene can be maintained. Such facilities should:

- Be located in close proximity to the fields and indoor premises.
- Be of appropriate design to ensure hygienic removal of wastes and avoid contamination of growing sites, fresh fruits and vegetables or agricultural inputs.
- Have adequate means of hygienically washing and drying hands.
- Be maintained under sanitary conditions and good repair at all times.

3.2.3.2 Health status

People known to be or suspected of being a carrier of a disease or illness likely to be transmitted through fresh fruits and vegetables, should not be allowed access to areas of the fields or indoor premises where there is a likelihood of contaminating fresh fruits and vegetables. Infections that have been transmitted in this way include jaundice, diarrhea, and vomiting. Any person so affected should immediately report illness or symptoms of illness to the management. Exclusion from fruit and vegetable handling areas in the fields or indoor premises should be considered in such cases.

3.2.3.3 Personal cleanliness

Agricultural workers who have direct contact with fresh fruits and vegetables should maintain a high degree of personal cleanliness and, where appropriate, wear suitable protective clothing and footwear. Cuts and wounds should be covered by suitable waterproof dressings when personnel are permitted to continue working.

Personnel should wash their hands when handling fresh fruits and vegetables or other material that comes in contact with them. Personnel should wash their hands at the start of fruit and vegetable handling activities, each time they come back in handling areas, immediately after using the toilet or after handling any contaminated material where this could result in contamination of fresh fruits and vegetables.

3.2.3.4 Personal behaviour

Agricultural workers should refrain from behaviour which could result in the contamination of food, for example: smoking, spitting, chewing gum or eating, or sneezing or coughing over fresh, unprotected fresh fruits and vegetables.

Personal effects such as jewellery, watches, or other items should not be worn or brought into fresh fruit and vegetable production areas if they pose a threat to the safety of the food.

3.2.4 EQUIPMENT ASSOCIATED WITH GROWING AND HARVESTING

For equipment, growers and harvesters should adopt the following:

- Equipment and containers coming into contact with fresh fruits and vegetables should be made of materials that are non-toxic. They should be designed and constructed to ensure that they can be adequately cleaned, disinfected and maintained. Specific hygienic requirements should be identified for each piece of equipment that is used and the type of fruit or vegetable associated with it.
- Containers for waste, by-products and inedible or dangerous substances, should be specifically identifiable, suitably constructed and, where appropriate, made of impervious material. Where appropriate, such containers should be lockable to prevent malicious or accidental contamination of

fresh fruits and vegetables or agricultural inputs. Such containers should be segregated to prevent their use as harvesting containers.

3.3 HANDLING, STORAGE AND TRANSPORT

3.3.1 PREVENTION OF CROSS-CONTAMINATION

During the primary production, harvesting and post-harvest activities, effective measures should be taken to prevent cross-contamination of fresh fruits and vegetables from agricultural inputs or personnel who come directly or indirectly into contact with fresh fruits and vegetables. To prevent the risk of cross-contaminating fresh fruits and vegetables, growers, harvesters and their employees should adhere to the recommendations presented in section 3 of this code and the following:

- Fresh fruits and vegetables unfit for human consumption should be segregated during production and harvesting. Those which cannot be further processed should be disposed of properly to avoid contamination of fresh fruits and vegetables or agricultural inputs.
- Harvest employees should not use harvesting containers for carrying materials (e.g. lunches, tools, fuel, etc.) other than harvested fruits and vegetables.
- Equipment and containers previously used for hazardous materials (e.g. garbage, manure, agricultural chemicals, etc.) should not be used for holding fresh fruits or vegetables or have contact with packaging material that is used for fresh fruits and vegetables without adequate cleaning and disinfecting.
- Care must be taken when packing fresh fruits and vegetables in the field not to contaminate containers or bins by exposure to soil, manure or animal faeces.
- Damaged containers that are no longer cleanable should be discarded.

3.3.2 STORAGE AND TRANSPORT FROM THE FIELD TO THE PACKING FACILITY

Fresh fruits and vegetables should be stored and transported under conditions which will minimize the potential for microbial, chemical or physical contamination. The following practices should be adopted:

- Storage facilities and vehicles for transporting the harvested crops should be built in a manner to minimize damage to fresh fruits and vegetables and to avoid access by pests. They should be made of materials that permit easy and thorough cleaning.
- Fresh fruits and vegetables unfit for human consumption should be segregated before storage or transport. Those which cannot be made safe by further processing should be disposed of properly to avoid contamination of fresh fruits and vegetables or agricultural inputs.
- Agricultural workers should remove as much dirt and mud as possible from fresh fruits and vegetables before they are stored or transported.
- Cleaning materials and hazardous substances such as agricultural chemicals should be specifically identifiable and kept or stored separately in secure storage facilities.

3.4 CLEANING, MAINTENANCE AND SANITATION

Premises and harvesting equipment should be kept in an appropriate state of repair and condition to facilitate cleaning and disinfection. Equipment should function as intended to prevent contamination of fresh fruits and vegetables.

3.4.1 CLEANING PROGRAMS

Cleaning and disinfection programs should be in place to ensure that any necessary cleaning and maintenance is carried out effectively and appropriately. Cleaning and disinfection systems should be monitored for effectiveness and should be regularly reviewed and adapted to reflect changing circumstances. Specific recommendations are as followed:

- Harvesting equipment and re-usable containers that come in contact with fresh fruits and vegetables should be cleaned, and, where appropriate, disinfected on a regular basis.

- Harvesting equipment and re-usable containers used for fresh fruits and vegetables that are not washed prior to packing should be cleaned and disinfected.

3.4.2 CLEANING PROCEDURES AND METHODS

The appropriate cleaning methods and materials will depend on the type of equipment and the nature of the fruit or vegetable. The following procedure should be adopted:

- Cleaning procedures should include the removal of debris from equipment surfaces, application of a detergent solution, rinsing with water, and, where appropriate, disinfection.

3.4.3 PEST CONTROL SYSTEMS

When primary production is carried out in indoor establishments (e.g. greenhouses), the recommendations of the *General Principles of Food Hygiene*, section 6.3 should be followed with respect to pest control.

3.4.4 WASTE MANAGEMENT

Suitable provision must be made for the storage and removal of waste. Waste must not be allowed to accumulate in fresh fruit and vegetable handling and storage areas or the adjoining environment. Storage areas for waste should be kept clean.

4. PACKING ESTABLISHMENT: DESIGN AND FACILITIES

Refer to the *General principles of Food Hygiene*.

5. CONTROL OF OPERATION

5.1 CONTROL OF FOOD HAZARDS

Refer to the *General principles of Food Hygiene*.

5.2 KEY ASPECTS OF HYGIENE CONTROL SYSTEMS

5.2.1 TIME AND TEMPERATURE CONTROL

Refer to the *General principles of Food Hygiene*.

5.2.2 SPECIFIC PROCESS STEPS

5.2.2.1 Post-harvest water use

Water quality management will vary throughout all operations. Packers should follow good manufacturing practices to minimize the potential for the introduction or spread of pathogens in processing water. The quality of water used should be dependent on the stage of the operation. For example, clean water could be used for initial washing stages, whereas water used for final rinses should be with potable water.

- Post-harvest systems that use water should be designed in a manner to minimize places where product lodges and dirt builds up.
- Where appropriate, effective disinfectants should be used to minimize cross-contamination during post-harvest use. The disinfectant levels should be monitored and controlled to ensure that they are maintained at effective concentrations.
- Where appropriate, the temperature of the post-harvest water should be controlled and monitored.
- Recycled water should be treated and maintained in conditions that do not constitute a risk to the safety of fresh fruits and vegetables. The treatment process should be effectively monitored and controlled.
- Recycled water may be used with no further treatment provided its use does not constitute a risk to the safety of fresh fruits and vegetables (e.g. use of water recovered from the final wash for the first wash).

- The final wash should rinse residual disinfectants off of fresh fruits and vegetables except when disinfectant residues are necessary to prevent spoilage.
- Ice should be made from potable water. Ice should be produced, handled and stored to protect it from contamination.

5.2.2.2 Chemical treatments

- Packers should only use chemicals for post-harvest treatments (e.g. waxes, fungicides) in accordance with the General Standards on Food Additives or with the Codex Pesticide Guidelines. These treatments should be carried out in accordance with the manufacturer's instructions for the intended purpose.
- Sprayers for post-harvest treatments should be calibrated regularly to control the accuracy of the rate of application. They should be thoroughly washed in safe areas when used with different chemicals and on different fruits or vegetables to avoid contaminating the produce.

5.2.2.3 Cooling of fresh fruits and vegetables

- Condensate and defrost water from evaporator type cooling systems (e.g. vacuum cooling, cold rooms) should not drip on to fresh fruits and vegetables. The inside of the cooling systems should be maintained clean.
- Potable water should be used in cooling systems where 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.
- Forced-air cooling is 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 avoid contaminating fresh produce.

5.2.2.4 Cold storage

- When appropriate, fresh fruits and vegetables should be maintained at low temperatures after cooling to minimize microbial growth. The temperature of the cold storage should be controlled and monitored.
- Condensate and defrost water from the cooling system in cold storage areas should not drip on to fresh fruits and vegetables. The inside of the cooling systems should be maintained in a clean and sanitary condition.

5.2.3 MICROBIOLOGICAL AND OTHER SPECIFICATIONS

Refer to the *General principles of Food Hygiene*.

5.2.4 MICROBIAL CROSS-CONTAMINATION

Refer to the *General principles of Food Hygiene*.

5.2.5 PHYSICAL AND CHEMICAL CONTAMINATION

Refer to the *General principles of Food Hygiene*.

5.3 INCOMING MATERIAL REQUIREMENTS

Refer to the *General principles of Food Hygiene*.

5.4 PACKING

Refer to the *General principles of Food Hygiene*.

5.5 WATER USED IN THE PACKING ESTABLISHMENT

Refer to the *General principles of Food Hygiene*.

5.6 MANAGEMENT AND SUPERVISION

Refer to the *General principles of Food Hygiene*.

5.7 DOCUMENTATION AND RECORDS

Appropriate records of processing, production and distribution should be kept long enough to facilitate a trace back and food borne illness investigation, if required. This period could be much longer than the shelf life of fresh fruits and vegetables. Documentation can enhance the credibility and effectiveness of the food safety control system.

- Growers should keep current 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.

- Packers should keep current all information concerning each lot such as information on incoming materials (e.g. information from growers, lot numbers), data on the quality of processing water, pest control programmes, cooling and storage temperatures, chemicals used in post-harvest treatments, and cleaning schedules for premises, facilities, equipment and containers, etc.

5.8 RECALL PROCEDURES

Refer to the *General principles of Food Hygiene*.

In addition:

- Growers and packers should have trace-back programmes to ensure effective lot identification. This system 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.

- Growers' information should be linked with packers' information so that the system can trace products from the distributor to the field. Information that should be included are the date of harvest, farm identification, and the persons who handled the fresh fruits or vegetables from the primary production site to the packing establishment.

6. PACKING ESTABLISHMENT: MAINTENANCE AND SANITATION

Refer to the *General principles of Food Hygiene*.

7. PACKING ESTABLISHMENT: PERSONNEL HYGIENE

Refer to the *General principles of Food Hygiene*.

8. TRANSPORTATION

Refer to the *General principles of Food Hygiene*.

9. PRODUCT INFORMATION AND CONSUMER AWARENESS

Refer to the *General principles of Food Hygiene*.

10. TRAINING

Refer to the *General principles of Food Hygiene* except for section 10.1 and 10.2.

10.1 AWARENESS AND RESPONSIBILITIES

Personnel associated with growing and harvesting should be aware of good agricultural practices, good hygienic practices and their role and responsibility in protecting fresh fruits and vegetables from contamination or deterioration. Agricultural workers should have the necessary knowledge and skills to enable them to carry out agricultural activities and to handle fresh fruits and vegetables and agricultural inputs hygienically.

Personnel associated with packing should be aware of good manufacturing practices, good hygienic practices and their role and responsibility in protecting fresh fruits and vegetables from contamination or

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 minimizes the potential for microbial, chemical, or physical contamination.

All personnel who handle cleaning chemicals or other potentially hazardous chemicals should be instructed in safe handling techniques.

10.2 TRAINING PROGRAMMES

Factors to take into account in assessing the level of training required in growing, harvesting and packing activities include:

- The nature of the fruit or vegetable, in particular its ability to sustain growth of pathogenic microorganisms.
- The agricultural techniques and the agricultural inputs used in the primary production and harvesting including the probability of contamination or microbial growth.
- The task the employee is likely to perform and the hazards and controls associated with those tasks.
- The manner in which fresh fruits and vegetables are packaged including the probability of contamination or microbial growth.
- The conditions under which fresh fruits and vegetables will be stored.
- The extent and nature of processing or further preparation by the consumer before final consumption.

Topics to be considered for training programmes include, but are not limited to, the following:

- The importance of good health and hygiene for personal health and food safety.
- The importance of hand washing for food safety and the importance of proper hand washing techniques.
- The importance of using sanitary facilities to reduce the potential for contaminating fields, produce, other workers, and water supplies.