

# codex alimentarius commission



FOOD AND AGRICULTURE  
ORGANIZATION  
OF THE UNITED NATIONS

WORLD  
HEALTH  
ORGANIZATION



JOINT OFFICE: Viale delle Terme di Caracalla 00100 ROME Tel: 39 06 57051 www.codexalimentarius.net Email: codex@fao.org Facsimile: 39 06 5705 4593

**Agenda Item 4**

**CX/FH 00/4  
July 2000**

## **JOINT FAO/WHO FOOD STANDARDS PROGRAMME**

### **CODEX COMMITTEE ON FOOD HYGIENE**

#### **Thirty-third Session**

**Washington DC, U.S.A., 23 –28 October 2000**

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

**(Prepared by Canada with the assistance of Chile, Denmark, France, India, Japan, Mexico, the Netherlands, Sweden, United Kingdom, and the United States of America)**

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, Eleventh Edition, pages 23-24*) to: Mr S. Amjad Ali, 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](mailto: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](mailto:Codex@fao.org) **before 10 September 2000.**

#### **Background:**

In response to the growing concerns about fresh fruits and vegetables as a source of food-borne illness, the Codex Committee on Food Hygiene (CCFH) at its 30<sup>th</sup> Session proposed initiating work on a Code of Hygienic Practice for the Primary Production, Harvesting and Packaging of Fresh Produce and requested Canada to prepare a draft discussion paper with the assistance of a drafting group.

The Drafting Group developed a Discussion Paper which was presented at the 31<sup>st</sup> Session of the CCFH. The Committee strongly supported the initiation of this work in view of the significant food safety issues associated with fresh fruits and vegetables and agreed that Canada in cooperation with the drafting group would develop a Proposed Draft Code of Hygienic Practice for the Primary Production and Packing of Fresh Fruits and Vegetables for circulation at step 3.

The Drafting Group developed the Proposed Draft Code of Practice which was circulated at Step 3 and presented at the 32<sup>nd</sup> session of the CCFH. In preparing the Code, the Drafting Group focussed on developing

areas in the primary production and packing of fresh fruits and vegetables that are not fully covered in the General Principles of Food Hygiene.

At the 32<sup>nd</sup> session of the CCFH, the Committee discussed the appropriateness of consolidating this Code with the Proposed Draft Code of Hygienic Practice for Pre-Cut Raw Vegetable Products Ready for Human Consumption prepared by France. The Delegation of France supported by several other delegations proposed to merge the Codes as they overlap in many areas. Several delegations opposed merging the two Codes as the risks to be addressed within primary production and in the processing industry for pre-cut vegetables were different. The Committee decided that the two codes should be kept separate at this stage and that the drafting groups for the Codes should work in close collaboration.

At the same session, the Committee emphasized the importance of the annex on sprouts and asked the Delegations of Japan, Denmark, the Netherlands and USA to prepare a working document for consideration at the next meeting.

Although several delegations supported the advancement of the document to Step 5, the Committee recognized that there were many other issues that could not be fully addressed during the session. The Committee returned the document to Step 3 and agreed that the drafting group led by Canada would redraft the Code on the basis of the comments received and discussions held during the session.

On April 10 to 14, 2000 the delegation of Canada in collaboration with the delegation of France chaired a *ad hoc* Drafting Group meeting in Ottawa, Canada, on the Proposed Draft Code of Hygienic Practice for the Primary Production and Packaging of Fresh Fruits and Vegetables and the Proposed Draft Code of Hygienic Practice for Pre-cut Fruits and Vegetables. The meeting was an excellent opportunity to enhance collaboration between the two drafting groups and ensure consistency between the two Codes.

The comments received and discussions held at the last CCFH session were carefully considered in the re-draft of this present Proposed Draft Code. A Proposed Annex for Sprout Production was developed as a supplement to this Code and includes additional recommendations to cover the hygienic practices specific to the primary production of seeds for sprouting and the production of sprouts for human consumption.

At the Drafting Group meeting the Delegation of India suggested the following addition at the end of the section Objectives of the Code in the Proposed Draft Code of Hygienic Practice for the Primary Production and Packing of Fresh Fruits and Vegetables:

*Further the economic status of the member country and also the traditional practices followed by many member countries also need to be accommodated in this Code so that objective of eliminating health hazards is achieved without hampering the traditional practices and also preventing it from becoming a technical barrier to trade.*

*In order to ensure that the proposed Code of Practices do not operate as a barrier to trade, the proposed Code will give credence to the past history of any health hazard and will insist upon only if there are absence of any past history.*

It was recognized the importance to reflect on the concern of India. However, the Drafting Group felt that this consideration was not unique to this Code. The Drafting Group agreed to identify this concern to the CCFH and seek direction on how to appropriately address it.

The Drafting Group also re-drafted the Proposed Draft Code of Hygienic Practice for Pre-cut Fruits and Vegetables in view of the comments and discussions made at the last Committee session. The many links between the two codes were highlighted and the common issues streamlined where possible. The Drafting Group discussed the possibility of consolidating the two Codes. Most of the delegations were favourable to merging the Proposed Draft Code of Hygienic Practice for Pre-cut Fruits and Vegetables with this Code. It could be done in the form of an Annex as the differences between the two Codes arise only after primary production.

# Proposed Draft Code of Hygienic Practice for the Primary Production and Packing of Fresh Fruits and Vegetables.

## Content

<b>PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR THE PRIMARY PRODUCTION AND PACKING OF FRESH FRUITS AND VEGETABLES.</b>	<b>3</b>
<b>INTRODUCTION</b>	<b>4</b>
<b>1. OBJECTIVES OF THE CODE</b>	<b>4</b>
<b>2. SCOPE, USE AND DEFINITIONS</b>	<b>4</b>
2.1 SCOPE	4
2.2 USE	5
2.3 DEFINITIONS	5
<b>3. PRIMARY PRODUCTION</b>	<b>6</b>
3.1 ENVIRONMENTAL HYGIENE	6
3.2 HYGIENIC PRODUCTION OF FRESH FRUITS AND VEGETABLES	7
3.2.1 <i>Agricultural input requirements</i>	7
3.2.1.1 Water for primary production	7
3.2.1.2 Water for irrigation and harvesting	7
3.2.1.3 Water for fertilizers, pest control and other agricultural chemicals	8
3.2.1.4 Hydroponic water	8
3.2.1.5 Manure, biosolids and other natural fertilizers	8
3.2.1.6 Soil	9
3.2.1.7 Agricultural chemicals	9
3.2.1.8 Biological control	9
3.2.2 <i>Indoor facilities associated with growing and harvesting</i>	9
3.2.2.1 Location, design and layout	9
3.2.2.2 Water supply	10
3.2.2.3 Drainage and waste disposal	10
3.2.3 <i>Personnel health, hygiene and sanitary facilities</i>	10
3.2.3.1 Personnel hygiene and sanitary facilities	10
3.2.3.2 Health status	10
3.2.3.3 Personal cleanliness	10
3.2.3.4 Personal behaviour	11
3.2.4 <i>Equipment associated with growing and harvesting</i>	11
3.3 HANDLING, STORAGE AND TRANSPORT	11
3.3.1 <i>Prevention of cross-contamination</i>	11
3.3.2 <i>Storage and transport from the field to the packing facility</i>	12
3.4 CLEANING, MAINTENANCE AND SANITATION	12
3.4.1 <i>Cleaning programs</i>	12
3.4.2 <i>Cleaning procedures and methods</i>	13
3.4.3 <i>Pest control systems</i>	13
3.4.4 <i>Waste management</i>	13
<b>4. PACKING ESTABLISHMENT: DESIGN AND FACILITIES</b>	<b>13</b>
<b>5. CONTROL OF OPERATION</b>	<b>13</b>
5.1 CONTROL OF FOOD HAZARDS	13
5.2 KEY ASPECTS OF HYGIENE CONTROL SYSTEMS	13
5.2.1 <i>Time and temperature control</i>	13
5.2.2 <i>Specific process steps</i>	13
5.2.2.1 Post-harvest water use	13
5.2.2.2 Chemical treatments	14
5.2.2.3 Cooling of fresh fruits and vegetables	14
5.2.2.4 Cold storage	14
5.2.3 <i>Microbiological and other specifications</i>	14
5.2.4 <i>Microbial cross-contamination</i>	14
5.2.5 <i>Physical and chemical contamination</i>	15
5.3 INCOMING MATERIAL REQUIREMENTS	15
5.4 PACKING	15
5.5 WATER USED IN THE PACKING ESTABLISHMENT	15
5.6 MANAGEMENT AND SUPERVISION	15
5.7 DOCUMENTATION AND RECORDS	15

5.8 RECALL PROCEDURES ..... 15

6. **PACKING ESTABLISHMENT: MAINTENANCE AND SANITATION** ..... 16

7. **PACKING ESTABLISHMENT: PERSONNEL HYGIENE** ..... 16

8. **TRANSPORTATION** ..... 16

9. **PRODUCT INFORMATION AND CONSUMER AWARENESS** ..... 16

10. **TRAINING**..... 16

    10.1 AWARENESS AND RESPONSIBILITIES ..... 16

    10.2 TRAINING PROGRAMMES ..... 16

**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.

**1. OBJECTIVES OF THE CODE**

This code addresses good agricultural practices (GAPs) and good manufacturing practices (GMPs) that will help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables from primary production to packing. Particular attention is given to minimizing microbial hazards. The code 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 very complex. Fresh fruits and vegetables are produced and packed under diverse 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 and packing of fresh fruits and vegetables cultivated for human consumption in order to produce a safe and wholesome product: particularly for those intended to be consumed raw. Specifically, this draft code is applicable to fresh fruits and vegetables grown in the field (with or without cover) or in protected facilities (hydroponic systems, greenhouses). It concentrates on microbial hazards and addresses physical and chemical hazards only in so far as these relate to GAPs and GMPs.

The *Proposed Annex for Sprout Production* is a supplement to this code and includes additional recommendations to cover the hygienic practices that are specific for the primary production of seeds for sprouting and the production of sprouts for human consumption.

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. It focuses upon hygienic issues that are specific to the primary production 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 and packing. The *Proposed Annex for Sprout Production* provides additional recommendations specific for the primary production of seeds for sprouting and the production of sprouts for human consumption.

It is recognized that some of the provisions in this code may be difficult to implement in areas where primary production is conducted in small holdings, in developing countries and also in areas where traditional farming is practised. Therefore, the concerned government should cause awareness in the primary production of produce.

## 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/or harvesting of fresh fruits and vegetables.

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

*Biosolids* -sludge and other residue deposits from treatment applied to urban and industrial wastes (food industries or other types of industry).

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

*Cultivation*- any agriculture action or practise used by growers to allow and improve the growing conditions of fresh fruits or vegetables grown in the field (with or without cover) or in protected facilities (hydroponic systems, greenhouses).

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

*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 material* - any chemical compound which, at specific levels, has the potential to cause adverse health effects.

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

*Manure* - Mixture of animal excrements and litter that is more or less fermented.

*Microbial hazards* -pathogenic or other microorganisms at levels 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.

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

### **Definitions of Water:**

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

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

[Re-used irrigation water]

[Recycled water]

## **3. PRIMARY PRODUCTION**

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 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**

Where possible, potential sources of contamination from the environment should be identified. In particular, primary production should not be carried out 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 after harvest.

Where possible, growers should evaluate the previous uses of the sites (indoor and outdoor) as well as adjoining sites in order to identify potential microbial, chemical and physical 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 and present usage of the primary production area and the adjoining sites (e.g. crop grown, feed lot, animal production, hazardous waste site, sewage treatment site, mining extraction site) to identify potential microbial hazards including faecal contamination and contamination by organic waste and potential environmental hazards that could be carried to the growing site.
- The access of farm and wild animals to the site and to water sources used in primary production to identify potential faecal contamination of the soils and water 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.

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 have not been taken to minimize potential hazards, the sites should not be used until correction/control measures are applied.

## **3.2 HYGIENIC PRODUCTION OF FRESH FRUITS AND VEGETABLES**

### ***3.2.1 Agricultural input requirements***

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

#### **3.2.1.1 Water for primary production**

- 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.

#### **3.2.1.2 Water for irrigation and harvesting**

Water used for agricultural purposes (e.g. irrigation, pest control, application of chemical products) 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.

#### **3.2.1.3 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.

#### **3.2.1.4 Hydroponic water**

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

- 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.

#### **3.2.1.5 Manure, biosolids and other natural fertilizers**

The use of manure, biosolids and other natural fertilizers in the production of fresh fruits and vegetables should be managed to limit the potential for microbial, chemical and physical contamination. Manure, biosolids and other natural fertilizers contaminated with heavy metals or other chemicals at levels that may 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, sun drying or combinations of these) that are designed to reduce or eliminate pathogens in manure, biosolids and other natural fertilizers. The level of pathogen reduction achieved by different treatments should be taken into account when considering suitability for different applications.
- Manure, biosolids 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.
- Growers who are purchasing manure, biosolids and other natural fertilizers that have been treated to reduce microbial or chemical contaminants should, where possible, obtain documentation from the supplier that identifies the origin, treatments used, tests performed and the results thereof.
- Minimize direct or indirect contact between manure, biosolids and other natural fertilizers, and fresh fruits and vegetables, especially close to harvest.
- Minimize contamination by manure, biosolids 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, biosolids and other natural fertilizers are treated and stored.

### **3.2.1.6 Soil**

Soils should be evaluated for potential microbial and chemical hazards (faecal contamination, agricultural chemicals, hazardous compounds). If the evaluation concludes that potential hazards may 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.

### **3.2.1.7 Agricultural chemicals**

- Growers should use only agricultural chemicals and antibiotics which are authorized for the cultivation of the specific fruit or vegetable and should use them according to the manufacturer's instructions for the intended purpose. [refer to the Codex Committee on Pesticide Residues].
- 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, the pest or disease against which it was used, the concentration, method and frequency of application, and records on harvesting to verify that the time between application and harvesting is appropriate.
- 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.

### **3.2.1.8 Biological control**

[Environmental] and consumer safety should be considered when using competing biologicals for microorganisms and/or their metabolites applied for the control of pests, mites, plant pathogens and spoilage organisms in fresh fruits and vegetables.

Growers should use only biological controls which are authorized for the cultivation of the specific fruit or vegetable and should use them according to the manufacturer's instructions for the intended purpose.

### ***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, design and layout**

- Premises and structures should be located, designed and constructed to avoid contaminating fresh fruits and vegetables and harboring pests such as insects, rodents and birds.

- Where appropriate, the internal design and layout should permit compliance with good hygienic practices for the primary production 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.

#### **3.2.2.2 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.

#### **3.2.2.3 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. [As far as possible,] such facilities should:

- As much as possible, 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, or suspected, to be suffering from, or to be a carrier of a disease or illness likely to be transmitted through fresh fruits and vegetables, should not be allowed to enter any food handling area if there is a likelihood of their contaminating fresh fruits and vegetables. Any person so affected should immediately report illness or symptoms of illness to the management.

#### **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 before starting work involving the handling of fruits and vegetables, each time they return to handling areas after a break, 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 and suitability of the food. Long or painted fingernails should be covered.

#### ***3.2.4 Equipment associated with growing and harvesting***

As required, growers and harvesters should follow the technical specifications recommended by the equipment manufacturers for their proper usage and maintenance. Growers and harvesters should adopt the following sanitary practices:

- 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 facilitate adequate cleaning, 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 or otherwise identified to prevent their use as harvesting containers.

### **3.3 HANDLING, STORAGE AND TRANSPORT**

#### ***3.3.1 Prevention of cross-contamination***

During the primary production 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 elsewhere in section 3 of this code and the following:

- At the time of harvest, consideration should be given to the need for additional management action where any local factor, for example adverse weather conditions, may increase the opportunity for contamination of the crop.
- Fresh fruits and vegetables unfit for human consumption should be segregated during 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/human 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.
- Transport vehicles should not be used for the transport of hazardous substances unless they are adequately cleaned, and where necessary disinfected, to avoid cross-contamination.

## **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 follows:

- 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 GMPs 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 of potable quality. [*Refer to Proposed Draft Guidelines for the Hygienic Reuse of Processing Water in Food Plants.*]

- 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 could 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. Application of disinfectants, followed by a wash as necessary, should be done to ensure that chemical residues do not exceed levels as recommended by [the Codex Committee on Food Additives and Contaminants].

- 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).
- 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 onto 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, where possible, 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 and to the Code of Hygienic Practice for the Transport of Food in Bulk and Semi-Packed Food.

**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 GAPs, 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 GMPs, 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 including the probability of microbial, chemical and physical contamination.
- 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.

## Proposed Annex for Sprout Production

### Content

ANNEX .....	18
<b>PROPOSED ANNEX FOR SPROUT PRODUCTION</b> .....	<b>18</b>
<b>INTRODUCTION</b> .....	<b>19</b>
<b>1. OBJECTIVES OF THE ANNEX</b> .....	<b>19</b>
<b>2. SCOPE, USE AND DEFINITION</b> .....	<b>19</b>
2.1 SCOPE AND USE .....	19
2.3 DEFINITIONS .....	19
<b>3. PRIMARY PRODUCTION OF SEEDS</b> .....	<b>20</b>
3.2 HYGIENIC PRODUCTION OF SEEDS .....	20
3.2.1.2 Manure and biosolids .....	20
3.2.4 <i>Equipment associated with growing and harvesting</i> .....	20
3.3 HANDLING, STORAGE AND TRANSPORT .....	20
3.5 ANALYSES .....	20
3.6 TRACEBACKS AND RECALLS .....	21
<b>4. ESTABLISHMENT FOR SPROUT PRODUCTION</b> .....	<b>21</b>
<b>5. CONTROL OF OPERATION</b> .....	<b>21</b>
5.2.2 <i>Specific process steps in sprout production</i> .....	21
5.2.2.1 Water use during sprout production .....	21
5.2.2.2 Initial rinse .....	22
5.2.2.3 Seed disinfection .....	22
5.2.2.4 Rinse after seed treatment .....	22
5.2.2.5 Pre-germination soak .....	22
5.2.2.6 Germination .....	22
5.2.2.7 Harvesting .....	23
5.2.2.8 Final rinse and cooling .....	23
5.2.2.9 Storage of finished product .....	23
5.2.3 <i>Microbiological and other specifications</i> .....	23
5.2.3.1 Testing of seed lots before entering production .....	23
5.2.3.2 Testing irrigation water and/or sprouts .....	23
5.2.4 <i>Microbiological cross-contamination</i> .....	24
5.3 INCOMING MATERIAL REQUIREMENTS .....	24
5.3.1 <i>Specifications for incoming seeds</i> .....	24
5.3.2 <i>Control of incoming seeds</i> .....	24
5.3.3 <i>Seed storage</i> .....	24
5.7 DOCUMENTATION AND RECORDS .....	25
<b>6. ESTABLISHMENT: MAINTENANCE AND SANITATION</b> .....	<b>25</b>
<b>7. ESTABLISHMENT: PERSONAL HYGIENE</b> .....	<b>25</b>
<b>8. TRANSPORTATION</b> .....	<b>25</b>
<b>9. PRODUCT INFORMATION AND CONSUMER AWARENESS</b> .....	<b>25</b>
<b>10. TRAINING</b> .....	<b>25</b>
10.1 AWARENESS AND RESPONSIBILITIES .....	25

## INTRODUCTION

In recent years the popularity of sprouted seeds has increased dramatically and are favoured by many for their nutritional value. However, the recent increase in reports of food borne illness associated with raw sprouts has raised concerns from public health agencies and consumers about the safety of these products

The microbial pathogens associated with sprouted seeds are for example *Salmonella* spp, pathogenic *E. coli*, *Listeria monocytogenes*, and *Shigella* spp. Outbreak investigations have indicated that microorganisms found on sprouts most likely originate from the seeds. Most seeds supplied to sprout producers are produced primarily for field planting where the good agricultural practices (GAP) necessary to prevent microbial contamination of seeds intended for sprouting are not followed. As a result, the seeds may be contaminated in the field or during harvesting, storage or transportation. Typically, the germination process in sprout production involves keeping seeds warm and moist for two to ten days. In these conditions, if low levels of microbial contaminants are present on seeds, they can quickly reach levels high enough to cause illness.

The scientific literature proposes seed disinfection treatments which can achieve different levels of pathogen reduction. There is currently no treatment available that can guarantee pathogen free seeds. Research is in progress to find efficient disinfection treatments which would provide sufficient pathogen reduction on seeds especially if pathogens are internalized.

### 1. OBJECTIVES OF THE ANNEX

This present annex recommends control measures to occur in two areas: during seed production and during sprout production. During seed production, conditioning and storage, the application of GAPs and good hygienic practices are aimed at preventing microbial pathogen contamination of seeds. During sprout production, the seed disinfection step is aimed at reducing potential contaminants and the good hygienic practices at preventing the introduction of microbial pathogens and minimizing their potential growth. The degree of control in these two areas has a significant impact on the safety of sprouts.

### 2. SCOPE, USE AND DEFINITION

#### 2.1 SCOPE AND 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 the General Principles of Food Hygiene and Proposed Draft Code of Hygienic Practice for the Primary Production and Packing of Fresh Fruits and Vegetables. This annex covers the hygienic practices that are specific for the primary production of seeds for sprouting and the production of sprouts for human consumption in order to produce a safe and wholesome product.

#### 2.3 DEFINITIONS

*Seed producer* : any person responsible for the management of activities associated with the primary production of seeds including post-harvest practices.

*Seed distributor* : any person responsible for the distribution of seeds (handling, storage and transportation) to sprout producers. Seed distributors may deal with single or multiple seed producers and can be producers themselves.

*Sprout producer* : any person responsible for the management of the activities associated with the production of sprouted seeds.

*Spent irrigation water* : water that has been in contact with sprouts during the sprouting process.

### **3. PRIMARY PRODUCTION OF SEEDS**

Refer to the Draft Code of Practice for the Primary Production and Packing of Fresh Fruits and Vegetables. In addition:

#### **3.2 HYGIENIC PRODUCTION OF SEEDS**

When seeds are destined for sprout production, animals should not be allowed to graze the fields where seeds are grown (e.g., employing sheep for spring clip back of alfalfa).

##### **3.2.1.2 Manure and biosolids**

It is particularly important to prevent microbial contamination during the production of seeds because of the potential for pathogens to grow during the sprouting process. Consequently, manure, biosolids and other natural fertilizers [used during the growing season] should only be used when they have undergone treatments which achieve a high level of pathogen reduction.

##### **3.2.1.4 Agricultural chemicals**

Seed producers should only use chemicals (e.g., pesticides, desiccants) which are acceptable for seeds intended for sprout production.

##### **3.2.4 Equipment associated with growing and harvesting**

Prior to harvest, harvesting equipment should be adjusted to minimize soil intake and seed damage and should be cleaned from any debris or earth. Diseased or damaged seeds, which could be susceptible to microbial contamination, should not be used for sprout production.

#### **3.3 HANDLING, STORAGE AND TRANSPORT**

Seeds produced for sprout production should be segregated from product to be used as animal feed (e.g., for silage production) and clearly labelled.

Recognising that seeds are vulnerable to microbial pathogens during thrashing and drying, adequate care is needed to maintain sanitation in drying yards, and exposure of seeds to mist, high humidity and fog should be avoided.

#### **3.5 ANALYSES**

Seed producers, distributors, and sprout producers may test lots of seeds for microbial pathogens using internationally accepted analytical methods. Sprouting seeds before testing increases the possibility of finding pathogens that may be present. If lots of seeds are found to be contaminated, seeds should not be sold or used for sprout production. Because of the limitations associated with sampling methods and analytical tests, failure to find contamination does not guarantee that the seeds are pathogen free. However, if contamination is found at this stage, it allows seeds to be diverted or destroyed before entering sprout production. Seed producers, distributors and sprout producers should refer to the *Codex Principles for the Establishment and*

*the Application of Microbiological Criteria for Foods, CAC/GL 21-1977*, for guidance on establishing a sampling plan.

### **3.6 TRACEBACKS AND RECALLS**

Seed producers for sprout production should ensure that traceback records and recall procedures are in place to effectively respond to health risk situations. Procedures should enable the complete and rapid recall of any implicated seed and provide detailed information to assist in the identification and investigation of any contaminated seeds and sprouts. The following should be adopted:

- Seed production and distribution practices to minimize the quantity of seed identified as a single lot and avoid the mixing of multiple lots of different origins that would complicate traceback and provide greater opportunity for cross-contamination. Seed producers and distributors and sprout producers should maintain a record of traceability for each lot. The lot number, producer and country of origin should be indicated on each container.
- Seed producers should have a system to: effectively identify lots, trace the sites and agricultural inputs associated with the lots, and allow physical retrieval of the seeds in case of a suspected hazard.
- Where a lot has been recalled because of a health hazard, other lots that were produced under similar conditions (e.g., on the same sites or with the same agricultural inputs) and which may present a similar hazard should be evaluated for safety. Any lot presenting a similar risk should be recalled. Blends containing potentially contaminated seeds must also be recalled.
- Seeds which may present a hazard must be held and detained until they are disposed of properly.

## **4. ESTABLISHMENT FOR SPROUT PRODUCTION**

Refer to the General principles of Food Hygiene. In addition:

### **4.2.1 Design and layout**

Where appropriate, the internal design and layout of sprout establishments should permit good food hygiene practices, including protection against cross-contamination between and during operations. Storage, seed rinsing and disinfection, germination and packaging areas should be physically separated from each other.

## **5. CONTROL OF OPERATION**

Refer to the *General principles of Food Hygiene*. In addition:

### **5.2.2 Specific process steps in sprout production**

#### **5.2.2.1 Water use during sprout production**

Water quality management will vary throughout all operations. Sprout producers should follow GMPs 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. Because of the potential for pathogen proliferation during the sprouting process, clean water could be used for

initial washing stages, whereas water used later in the sprout production process (i.e., for the rinse following the seed disinfection and subsequent operations) should be of potable quality or at least clean water that is free of pathogens.

#### **5.2.2.2 Initial rinse**

The seeds should be rinsed thoroughly before the disinfection treatment to remove dirt and increase the efficiency of the disinfection treatment.

- Seeds should be rinsed and thoroughly agitated in large volumes of clean water, in such a way to maximize surface contact. The process should be repeated until most of the dirt is removed and rinse water remains clear.

#### **5.2.2.3 Seed disinfection**

Due to the difficulty of obtaining seeds which can be guaranteed as pathogen free, it is recommended that seeds be treated prior to the sprouting process. Although there may be other options, liquid disinfection is the treatment that is generally used. During the disinfection treatment sprout producers should adhere to the following:

- Seeds should be well agitated in large volumes of disinfectant to maximise surface contact.
- The duration of treatment and the concentration of disinfectant used should be accurately measured and recorded.
- Strict measures should be in place to prevent re-contamination of seeds after the disinfection treatment.

#### **5.2.2.4 Rinse after seed treatment**

As appropriate, seeds should be thoroughly rinsed after the disinfection treatment with potable water or at least clean water that is free of pathogens. Rinsing should be repeated sufficiently to eliminate disinfectant.

#### **5.2.2.5 Pre-germination soak**

Soaking is often necessary to improve germination. When soaking, the sprout producer should adhere to the following:

- All containers used for soaking should be cleaned and disinfected prior to use.
- Seeds should be soaked in water for the shortest possible time to minimize microbial growth.
- This step may also employ disinfectants.
- After soaking, seeds should be rinsed thoroughly with potable water or at least clean water that is free of pathogens.

#### **5.2.2.6 Germination**

During germination, keep the environment and equipment clean to avoid potential contamination. All equipment should be cleaned and disinfected before each new batch.

- Only potable water should be used.
- When used, soils should be treated (e.g., pasteurized) to achieve a high degree of microbial reduction.

#### **5.2.2.7 Harvesting**

All equipment should be cleaned and disinfected before each new batch. Harvesting should be done with cleaned and disinfected tools dedicated for this use.

#### **5.2.2.8 Final rinse and cooling**

A final water rinse will remove hulls, cool product, and may reduce microbial contamination on sprouts. The following should be adopted:

- As appropriate, sprouts should be rinsed in cold potable water to lower sprout temperature and slow down microbial growth.
- Water should be changed, as needed (e.g., between batches), to prevent cross-contamination.
- Sprouts should be drained using appropriate disinfected equipment such as a food grade centrifugal dryer.
- If additional cooling time is necessary, steps should be taken to facilitate rapid cooling (e.g., placed in smaller containers with adequate air flow between containers).

#### **5.2.2.9 Storage of finished product**

- Sprouts should be kept under cold temperature (e.g. 5 °C) that will maintain product safety for the intended shelf life of the product. Regular and effective monitoring of temperature of storage areas and transport vehicles should be carried out.

### ***5.2.3 Microbiological and other specifications***

It is recommended that seed and sprouts or spent irrigation water be tested for the presence of pathogens.

#### **5.2.3.1 Testing of seed lots before entering production**

It is recommended that each new lot of seeds received at the sprouting facility are tested before entering production (i.e. before seed disinfection steps).

- The seed sample selected for testing should be sprouted prior to analysis to increase the potential to detect pathogens if present. Analysis may be performed on the sprouted seeds or the water used to sprout the sample.
- Seed samples for microbial analysis should not be subject to any disinfection treatment at the sprouting facility.

#### **5.2.3.2 Testing irrigation water and/or sprouts**

Current seed treatments cannot guarantee total elimination of pathogens. Further, if even a few pathogens survive treatment, they can grow to high numbers during sprouting. Therefore,

producers should have in place a sampling/testing plan to regularly monitor for pathogens at one or more stages after the start of germination.

- Analyses can be performed during the germination process (e.g., spent irrigation water or sprouts) and/or finished product may be analysed after harvest.
- Testing spent irrigation water is a good indicator of microbial conditions of sprouts. It is homogeneous and is simpler to analyse. Further, sampling spent irrigation water (or sprouts) during germination allows earlier results compared to testing finished product.
- Because of the sporadic nature of seed contamination, it is recommended that producers test every production lot.

#### ***5.2.4 Microbiological cross-contamination***

Sprout producers should adhere to the following:

- The traffic pattern of employees should prevent cross-contamination of sprouts. For example: The employees should avoid going back and forth to various areas of production. The employees should not go from a potentially contaminated area to the germination and/or packaging area unless they have washed their hands and changed to clean protective clothing.

### **5.3 INCOMING MATERIAL REQUIREMENTS**

#### ***5.3.1 Specifications for incoming seeds***

- Sprout producers should recommend that seed producers adopt good agricultural practices and provide evidence that the product was grown according to section 3 of this Annex and the *Draft Code of Practice for the Primary Production and Packing of Fresh Fruits and Vegetables*.
- Sprout producers should obtain certificates of analysis for microbial pathogens of concern, if available, from seed producers or distributors for each incoming lot.

#### ***5.3.2 Control of incoming seeds***

Seed containers should be examined at their arrival to minimize the potential for introducing obvious contaminants in the establishment.

- Seed containers should be examined for physical damage (e.g., holes from rodents) and signs of contamination (e.g., stains, rodent, insects, faeces, urine, foreign material, etc.). If found to be damaged, contaminated or potentially contaminated, its contents should not be used for sprout production.
- If seed lots are analysed for the presence of microbial pathogens of concern, these should not be used until result of analysis are available.

#### ***5.3.3 Seed storage***

Seeds should be handled and stored in a manner that will prevent damage and contamination.

- Seeds should be stored off the floor, away from walls and in proper storage conditions to prevent mould and bacterial growth and facilitate pest control inspection.
- Open containers should be stored in such a way that they are protected from pests and other sources of contamination.

#### **5.7 DOCUMENTATION AND RECORDS**

Refer to the *Draft Code of Practice for the Primary Production and Packing of Fresh Fruits and Vegetables*. In addition:

Written records that accurately reflect product information and operational controls should be available to demonstrate the adequacy of the production activities.

- Upon receipt of seeds, records should be maintained of the seed supplier, the lot number and the country of origin to facilitate trace back and recall procedures.
- Records should be legible, permanent and accurate. Records should include written procedures, controls, limits, monitoring results and subsequent follow-up documents. Records must include: seed sources and lot numbers, water analysis results, sanitation checks, pest control monitoring, sprout lot codes, analysis results, production volumes, storage temperature monitoring, product distribution and consumer complaints.
- Records should be kept long enough to facilitate trace back and food borne illness investigation, if required. This period will likely be much longer than the shelf life of the product.

#### **6. ESTABLISHMENT: MAINTENANCE AND SANITATION**

Refer to the *General principles of Food Hygiene*

#### **7. ESTABLISHMENT: PERSONAL 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*. In addition:

##### **10.1 AWARENESS AND RESPONSIBILITIES**

Refer to the *Draft Code of Practice for the Primary Production and Packing of Fresh Fruits and Vegetables*. In addition:

- The producer should have a written training program routinely reviewed and updated. Systems should be in place to ensure that food handlers remain aware of all procedures necessary to maintain the safety of sprouts.