Improving the quality and safety of fresh fruits and vegetables: a practical approach manual for trainers

Prepared by:

Maya Piñeiro
Luz Berania Díaz Ríos
Food Quality and Standards Service
Food and Nutrition Division

Food and Agriculture Organization of the United Nations
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This manual contains materials to conduct workshops to improve the quality and safety of fresh fruits and vegetables.
CONTENTS

Introduction .............................................................................................................................................. iv
Acknowledgements ................................................................................................................................... v
Training materials - Word and Excel documents ........................................................................................ vi
Annexes .................................................................................................................................................... vii
Presentations ............................................................................................................................................. viii
Internet links ............................................................................................................................................. ix
Documents (only for the CD-ROM) ........................................................................................................ xi
Definitions ................................................................................................................................................ xii
Photo gallery (only for the CD-ROM)

GENERAL OUTLINE

Background information ........................................................................................................................... 2
Objectives ................................................................................................................................................. 2
Users of the Manual .................................................................................................................................. 3
Outline of the Manual............................................................................................................................... 3
Format ...................................................................................................................................................... 5
Guidelines to train the trainers .................................................................................................................. 5

TECHNICAL CONTENT

Section I. Introduction to the workshop

Activity 1. Demonstrate the use of the manual for trainers

Section II. Importance of the horticultural sector in Latin America & the Caribbean

Activity 1. Presentation and discussion of results from the pre-workshop questionnaire

Section III. Quality maintenance and enhancement throughout the fresh fruits and vegetables chain

Part I. The concept of quality as applied to fresh fruits and vegetables

Activity 2. Quality determination procedures

Part II. Applying the principles of post-harvest management to maintain the quality and safety of fresh fruits and vegetables

Activity 1. Importance of appropriate logistics and post-harvest handling for fresh fruits and vegetables

Activity 2. Guidelines for action plans to maintain the quality of fresh fruits and vegetables

Section IV. Applying food safety principles to the fresh fruits and vegetables chain

Part I. Introduction

Activity 1. Importance of safety in horticulture: implications for demand and trade

Activity 2. Codex Food Safety Standards

Part II. Programs for safety assurance of fresh fruits and vegetables

Activity 1. Hazard analysis in production and post harvest handling of fresh fruits and vegetables

Activity 2. Hazard identification and control measures. Field visit

Section V. The importance of certifications and other quality schemes for the horticultural sector

Activity 1. Component parts of certifications

Activity 2. Implementing GAP in countries exporting fresh fruits and vegetables in response to market requirements

Activity 3. Country analysis of strengths and weaknesses to address certification and GAP as national priorities

Activity 4. Establishment of an action plan
**INTRODUCTION**

The Food and Agriculture Organization (FAO) is the main United Nations agency specialized in all aspects related to food quality and safety, along the different stages of production, harvest, post-harvest handling, storage, transport, processing and distribution of food. FAO adheres to the food chain approach in managing food safety and quality as a recognition of the responsibility of all actors in the food chain for the supply of food that is safe, healthy and nutritious.

FAO is working on a strategic framework in food safety and quality based on the following three main elements:

**a) Universal adoption of a risk-based approach to food safety.** The risk approach is scientifically based and requires efficient and appropriate notification systems for food-borne diseases. Food safety relies on the food chain notion which incorporates a cross sector analysis encompassing health related risks for human beings, animal and plants and related topics, such as biosecurity.

**b) Emphasis on prevention of food contamination at source, resulting from regulations and food control systems,** including development and dissemination of good practices/safety assurance systems throughout the food chain, based on Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP) and the Hazard Analysis and Critical Control Point (HACCP) system.

**c) Adoption of a holistic approach to food safety that encompasses the whole food chain (from farm or sea to plate, as it is sometimes known) – and adheres to the FAO definition of a food chain approach in which responsibility for the production of safe food is shared by all actors along the entire food chain.**

The Food Quality and Standards Service of the Food and Nutrition Division of FAO is active in building capacities in food quality and safety through:

- provision of scientific advice on standards setting;
- institutional building and strengthening;
- reviewing food standards;
- harmonization of standards and regulations with Codex and other international standards;
- training technical and managerial staff in food safety disciplines;
- applied research on specific food related issues.

The present Manual has been prepared as part of the activities undertaken by FAO’s Food Quality and Standards Service, in an effort to strengthen the institutional capacities, both public and private, of Member Countries’ to develop and implement quality assurance and food safety programmes for fresh fruits and vegetables, that are environmentally sustainable and benefit all actors in the chain. While some examples and data used in this manual are taken from the Latin America and Caribbean countries, the manual content is valid for all countries wishing to develop a comprehensive programme for the improvement of the safety and quality of fresh fruits and vegetables.

Comments and suggestions to improve this Manual will be much appreciated and will assist FAO in its efforts to provide authoritative advice and reference materials to its member countries.

Food Quality and Standards Service (ESNS)
Food and Nutrition Division. FAO

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PHOTO GALLERY

Miguel Angel Martínez Téllez-Photos taken during the Subregional Workshop to Train the Trainers, Organized by FAO in Chile, March 2003

Photos taken during the Subregional Workshop to Train the Trainers, organized by FAO in Guatemala, July 2003

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CASE STUDIES

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SECTION II

Material 2.1  A simple horticultural chain model.
Material 2.2  Reference reading. Opportunities and challenges for the Latin American & Caribbean horticultural sector.

SECTION III

Material 3.1  The concept of quality from the standpoint of different actors in the chain.
Material 3.2  Reference reading. The concept of quality in the horticultural sector.
Material 3.3  Procedures for quality determination.
Material 3.4  Components of a quality standard for fresh fruits and vegetables.
Material 3.5  Reference reading. Importance of appropriate handling and logistics in post harvest of fresh fruits and vegetables.
Material 3.6  National importance of post–harvest of fruits and vegetables.
Material 3.7  Reference reading. Guidelines for an action plan for quality maintenance and enhancement and improving the efficiency of post–harvest handling systems for fresh fruits and vegetables.
Material 3.8  Case Study. Action plan to assure the quality and improve the efficiency of post–harvest handling systems for Physalis (Cape gooseberry).

SECTION IV

Material 4.1  Case study. Importance of safety in horticulture: implications for demand and trade.
Material 4.2  Reference reading. Importance of food safety in horticulture.
Material 4.3  Codex Food Safety Standards.
Material 4.4  Supplementary standards.
Material 4.5  Reference reading. Programs for safety assurance of fresh fruits and vegetables.
Material 4.6  Hazard analysis in production and post–harvest handling of fresh fruits and vegetables.
Material 4.7  Case study. Action plan to assure safety of Physalis (Cape gooseberry) as fresh produce for export markets.
Material 4.8  Reference reading. Guidelines for action plans to assure safety of fresh fruits and vegetables.
Material 4.9  Hazard identification and control measures. Field visit.

SECTION V

Material 5.1  Reference reading. Implications of certification for the Latin American & Caribbean horticultural sector.
Material 5.2  Working document. Codes of Practice.
Material 5.3  SWOT analysis.
Material 5.4  Action plan, Multiplication plan.
ANNEXES

GENERAL OUTLINE

Workshop plan.
Pre-workshop questionnaire.
Terms of reference for participants.
Workshop evaluation form.

TECHNICAL CONTENTS-LIST OF TRAINING MATERIALS (Only for the CD-ROM)

SECTION III

Material 3.8 Tables for the case study. Action plan to assure the quality and improve the efficiency of post-harvest handling systems for Physalis (Cape gooseberry)-Excel files.

SECTION IV

Material 4.6 Hazard analysis in production and post-harvest handling of fresh fruits and vegetables.
Material 4.7 Tables for the case study. Action plan to assure safety of Physalis (Cape gooseberry)-Excel files.
Material 4.9 Hazard identification and control measures. Field visit.

SECTION V

Material 5.2 Working documents. Codes of Practice.
Material 5.3 SWOT analysis.
PRESENTATIONS (Only for the CD-ROM)

SECTION I
Presentation 1.1 Introduction to the workshop.

SECTION III
Presentation 3.1 The concept of quality applied to fresh fruits and vegetables.
Presentation 3.2 Maintaining the quality and safety of fruits and vegetables throughout the post-harvest handling chain.
Presentation 3.3 Case study. Quality assurance program for export markets for Physalis (Cape gooseberry).

SECTION IV
Presentation 4.1 Importance of safety in fresh fruits and vegetables.
Presentation 4.2 Codex Standards on safety.
Presentation 4.3 Contamination hazards in fresh fruits and vegetables.
Presentation 4.4 Good Agricultural Practices (GAP).
Presentation 4.5 Good Manufacturing Practices (GMP).
Presentation 4.6 Standard Operating Procedures (SOPs).
Presentation 4.7 HACCP applied to primary production.
Presentation 4.8 Case study. Safety assurance of Physalis (Cape gooseberry) for export purposes.

SECTION V
Presentation 5.1 Importance of certification and other quality assurance schemes for the horticultural sector.
Presentation 5.2 Case Study. FDF Program, Chile.
Presentation 5.3 Case Study. PIPAA Program, Guatemala.
INTERNET LINKS

SECTION II

FAOSTAT. Agriculture data
http://apps.fao.org/page/collections?subset=agriculture

Tropical Fruits Projections to 2010

World Markets for Organic Fruit and Vegetables – Opportunities for Developing Countries in the Production and Export of Organic Horticultural Products
http://www.fao.org/docrep/004/y1669e/y1669e00.htm

SECTION III


Manual: Handling and Processing of Organic Fruits and Vegetables in Developing Countries
http://www.fao.org/DOCREP/004/AC300E/AC300e00.htm

Food Quality and International Trade. FAO (2001)
http://www.fao.org/ag/ags/Agst/gtz.html.htm


Codex Standards for fresh fruit and vegetables
http://www.codexalimentarius.net/standards_search.asp

SECTION IV

http://www.codexalimentarius.net/standards_search.asp

International Code of Conduct on the Distribution and Use of Pesticides. FAO

CODEX ALIMENTARIUS: Database for Pesticide Residues in Food
http://apps.fao.org/cgi-bin/nph-db.pl?subset=FoodQuality

Regional and National Workshops on Analysis of the National Food Safety Regulations and Procedures for their Harmonization with Codex Standards. Documents and Final Report (Spanish)
http://www.rlc.fao.org/prior/comagric/codex/r10065/0065.htm

Regional and National Workshops on Training Multipliers in GMP and HACCP System. Documents and Final Report (Spanish)
http://www.fao.org/Regional/LAmerica/prior/comagric/co dex/r10065/cronograma.htm

Regional and National Workshops on Training Multipliers in GAP. Documents and Final Report (Spanish)
http://www.fao.org/Regional/LAmerica/prior/comagric/co dex/r10065/cronograma.htm

EAN-UCC Specification for the Identification and Traceability of Fruit, Vegetables and Potatoes
http://www.eanbelgium.be/PAGE/traceability.htm

http://www.fao.org/docrep/W8088E/W8088E00.htm

Manual for Fresh Fruit and Vegetables Quality & Safety Assurance and Control. (Spanish)
http://www.oirsa.org.sv/Publicaciones/MCA/Manualparaelcontrolyaseguramiento.htm
Improving the Safety and Quality of Fresh Fruits and Vegetables: a Training Manual for Trainers. University of Maryland
http://www.jifsan.umd.edu/gaps.html

GAP Manual for the Fresh Horticultural Export Sector (Chile)-Spanish
http://www.fdf.cl

Integrated Production Systems

University of California. Good Agricultural Practices
http://ucgaps.ucdavis.edu/index.cfm

University of California. Statewide Integrated Pest Management Programme
http://www.ipm.ucdavis.edu/default.html

http://www.hort.cornell.edu/extension/commercial/vegetables/issues/foodsafety.html

Cornell Integrated Crop and Pest Management Guidelines for Vegetable Crops
http://www.nysaes.cornell.edu/recommends/

Natural Resource, Agriculture and Engineering Center. Cornell University - List of Publications
http://www.nraes.org/publications/horticulture.html

OIRSA Publications-GAPs Guidelines
http://www.oirsa.org.sv/Publicaciones/VIFINEX/Publicaciones_VIFINEX.htm

Integrated Agricultural and Environmental Programme (PIPAA) - Guatemala MAGA/AGEXPRONT
www.agepront.org.gt; www.pipaa.com

SA 8000
http://www.cepaa.org

British Retail Consortium
www.brc.org.uk

The ETI Base Code
http://www.ethicaltrade.org

EUREPGAP Certification
http://www.eurep.org

Harmonized Framework - COLEACP

European Commission - Food Safety Initiative. White Paper
http://europa.eu.int/comm/food/index_en.htm

Development of a Framework for Good Agricultural Practices - 17th Session of the Committee on Agriculture (COAG) - FAO 2003
www.fao.org/unfao/bodies/coag/coag17/coag17-e.htm

Standard ISO 14000
www.iso.ch

European Initiative for Sustainable Development in Agriculture (EISA). A Common Codex for Integrated Farming
http://www.fao.org/prods/PP17501/EISA.htm

Ethical Trade Initiative. Natural Resources Institute. (UK)
http://www.nri.org/NRET/nret1.htm

Race To The Top
http://www.racetothetop.org/documents/about0.htm

Ecolabel
http://www.europa.eu.int/comm/environment/e_colabel

Tesco Protocol
www.tesco.com
## DOCUMENTS (Only for the CD-ROM)

<table>
<thead>
<tr>
<th>DOCUMENT</th>
<th>TYPE OF FILE</th>
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<tr>
<td><strong>Section IV</strong></td>
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<td>Code of Hygiene Practices for Fresh Fruits and Vegetables</td>
<td>PDF</td>
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<tr>
<td>Recommended International Code of Practice</td>
<td>PDF</td>
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<td>General Principles of Food Hygiene. Codex Alimentarius (CAC/RCP 1-1969, Reviewed 1997)</td>
<td>PDF</td>
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<tr>
<td>Recommended International Code of Practice for Packaging and Transport of Tropical Fresh Fruit and Vegetables (CAC/RCP 44-1995)</td>
<td>PDF</td>
</tr>
<tr>
<td>Manual de Procedimientos Operativos Estándares de Operaciones Sanitarias en el Cultivo, Cosecha y Empaque de Melón Cantaloupe. Martínez, M.A; Rodríguez, F.J. (2002). Centro de Investigación en Alimentos y Desarrollo, A.C. México</td>
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<tr>
<td>Improving the Safety and Quality of Fresh Fruits and Vegetables: a Training Manual for Trainers. University of Maryland</td>
<td>PDF</td>
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<tr>
<td><strong>Section V</strong></td>
<td></td>
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<tr>
<td>COLEACP-Harmonized Framework</td>
<td>PDF</td>
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<tr>
<td>European Commission-Food Safety Initiative. White Paper</td>
<td>WORD</td>
</tr>
<tr>
<td>EUREPGAP Protocol</td>
<td>PDF</td>
</tr>
<tr>
<td>Project TCP/IRA/0067: Management and Control of Pesticides, Animal Drug and Chemical Residues in Foodstuffs. FAO</td>
<td>PDF</td>
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<tr>
<td>Development of a Framework for Good Agricultural Practices 17th Session of the Committee on Agriculture (COAG)-FAO 2003</td>
<td>PDF</td>
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</table>
DEFINITIONS

Accreditation – the evaluation and formal recognition of a program, service, etc., by a competent and recognized authority.

Action plan – actions or recommendations to be accomplished to develop, improve or correct a program addressed to ensure the quality and safety of a product.

Agricultural inputs – all materials used in primary production of fresh fruits and vegetables (for example, seeds, fertilizers, water, agro-chemicals).

Certification – a procedure in which a “third party” gives a written guarantee that a product, process or service conforms to a standard. Certification can be seen as a way by which the actors in the chain (producers–traders–consumers) relate to each other to ensure the safety and quality of a product.

Clean water – water that does not impair food safety in the way in which it is used.

Cleaning – the removal of soil, food residue, dirt, grease or other objectionable matter.

Code of practice – voluntary document, containing general recommendations that allow its adoption by the sector to which it is addressed. It gives general recommendations on practices and operations to implement the established objectives.

Cold chain – maintaining suitable refrigeration temperatures throughout the handling chain of a product, to ensure its quality and safety.

Composting – a controlled process in which aerobic and anaerobic micro-organisms digest organic materials.

Contaminant – means any substance not intentionally added to food, which is present in such food as a result of the production (including operations carried out in crop husbandry, animal husbandry and veterinary medicine), manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such food or as a result of environmental contamination. The term does not include insect fragments, rodent hairs and other extraneous matter.

Contamination – the introduction or occurrence of a contaminant in food or food environment.

Disinfection – the reduction, by means of chemical agents and/or physical methods, of the number of micro-organisms in the environment, to a level that does not compromise food safety or suitability.

Food-borne disease (FBD) – any symptom or syndrome resulting from a disease transmitted to human beings by contaminated foods.

Food hygiene – comprises conditions and measures necessary for the production, processing, storage and distribution of food designed to ensure a safe, sound, wholesome product fit for human consumption.

HACCP – a system which identifies, evaluates and controls hazards that are significant for food safety.

Food safety – assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

Food suitability – assurance that food is acceptable for human consumption according to its intended use.

Good agricultural practices – practices of primary production improving on conventional production and handling methods, to ensure product safety, reducing the negative impact of production systems on the environment, fauna, flora and workers’ health.

Good manufacturing practices – post-harvest practices to prevent and control product safety hazards with reduced effects on the environment and on workers’ health.

Hazard – a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.
Hazard analysis – the process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and therefore should be addressed in the HACCP plan.

Micro-organisms – include yeasts, fungi, bacteria and viruses.

Pathogen – any micro-organism causing human diseases.

Potable water – drinking water complying with the World Health Organization’s (WHO) quality regulations for potable water.

Primary production – those steps in the food chain up to and including, for example, harvesting, slaughter, milking and fishing.

Quality enhancement – in this Manual, quality enhancement embraces activities relating to product handling to “enhance” its quality attributes using, for example, post-harvest technologies. Quality enhancement is a differentiating strategy to open market opportunities. Post-harvest only maintains and enhances primary quality; it does not make it.

Risk – a function of the probability of and adverse health effect and the severity of that effect, consequential to a hazard(s) in food.

Risk analysis – a process consisting of three components: risk assessment, risk management and risk communication.

Standardized Sanitary Operation Procedures (SSOPs) – fully recorded and detailed description of cleaning and disinfection procedures to ensure their correct implementation.

Traceability/product tracing – the ability to follow the movement of a food through specified stages (s) of production, processing and distribution.
GENERAL OUTLINE
GENERAL OUTLINE

BACKGROUND INFORMATION

International trade of fresh fruits and vegetables is a billion dollar business that has significantly increased in the last two decades. This trade is important for many developing countries and may account for an important share of their hard currency earnings.

Losses resulting from inadequate post-harvest handling, storage and distribution result in diminished returns for producing countries. In the last years, international markets have rejected exports of fruits and vegetables containing non-authorized pesticides, with pesticide residues exceeding permissible limits, with inadequate labelling and packaging requirements, with contaminants exceeding regulatory levels, without the required nutritional information and/or with inadequate general quality.

To reduce the risks from contamination associated with production and trade of fresh fruits and vegetables and to promote market opportunities, efforts are under way by governments and industry to develop and apply good practices throughout the food chain. Stress is placed on implementing Good Agricultural Practices (GAP) in production and harvest; Good Manufacturing Practices (GMP) especially during post-harvest and Quality and Safety Assurance Systems, such as HACCP, throughout the food chain to avoid and to control hazards.

The Food and Nutrition Division of FAO has given assistance to developing countries through technical cooperation projects and consultancies to develop food safety policies and to build local capacities for safety of fresh fruits and vegetables. In the last four years, several regional FAO workshops in Latin America have identified the need for integrated actions to address food safety and quality throughout the post-harvest chain and have shown the need for greater emphasis in the use of GAP and GMP in primary production of foods and vegetables.

To accomplish this, the Food and Nutrition Division of FAO, with inputs provided by the workshops, has implemented the Global Project “Global Inventory, Reference Materials and Food Safety Training Programme for Improving the Quality and Safety of Fresh Fruits and Vegetables”.

The objective is to strengthen (as a first step) the capability of Latin American and Caribbean countries to implement food safety and quality assurance programs for fresh fruits and vegetables, exchange information and provide train the trainers courses. Multipliers will replicate the experiences nationally and will enhance awareness on the relevance and importance of applying integrated approaches to quality and safety initiatives from the producer to the final consumer.

This Manual is a guide for training courses for trainers at the national level. The guidelines to train the trainers focus on the practical application of technical concepts, supporting the implementation of quality assurance and safety initiatives for fresh fruits and vegetables, from private and public institutions at the local, regional, national and governmental levels in each country. The Manual provides guidelines for practical and participative workshops, with the integrated and multidisciplinary approach required to ensure the success of quality assurance and food safety programs for fresh fruits and vegetables.

The contents were validated by different subregional workshops held in several Latin American and Caribbean countries with the final text incorporating recommendations and contributions resulting from these workshops.

OBJECTIVES

The Manual will strengthen the institutional capacities both public and private of member countries to develop and implement quality assurance and food safety programs for fresh fruits and vegetables, using the principles and practice of GAP, GMP and HACCP.

— Specific objectives

• Analyse the growing international importance of the horticultural sector in Latin America & the Caribbean, identifying challenges and future opportunities.

• Present an integrated approach to the quality and safety concepts as applied to production and trade of fresh fruits and vegetables.

• Clearly present the standards and regulations both voluntary and mandatory applicable to quality and safety issues.

• “Train the trainers” in the principles and practices of quality and safety issues throughout the food chain (emphasizing GAP, GMP and HACCP).
Identify country opportunities and difficulties in order to implement quality and food safety programs and suggest ways to overcome the problems.

— Outcomes

Trainers, once each subregional workshop is completed, will be able to:

- organize training courses, adapting the contents of the Manual, with suitable examples and exercises tailored to the private and institutional needs of each country;
- support the implementation of quality and safety initiatives from private and public institutions;
- lead teams attempting to consolidate strategies for national codes of practice, guidelines and quality and safety programs and initiatives in general.

USERS OF THE MANUAL

The Manual is addressed to private and public trainers, responsible for capacity building, research, project formulation, projects and programs in quality and safety of fresh fruits and vegetables. These trainers usually belong to:

- government institutions responsible for public policies (ministries, secretaries, etc.);
- research institutions;
- capacity building and extension-work institutions; quality standards organizations;
- quality certification organizations;
- institutions responsible for public regulations in food quality and safety;
- management and development organizations; institutions strengthening the fruit and vegetable sector; producers and traders associations.

OUTLINE OF THE MANUAL

The Manual contents are presented in 5 sections, totalling at least 40 hours and allowing time for review by the trainers.

Each section contributes to defining the programme for quality assurance and food safety for fresh fruits and vegetables throughout the food chain. Figure 1 outlines the workshop flow diagram.

Contents are in two parts. Part 1, introduces the Manual with general considerations for country courses. The remaining contents of the Manual, in five sections, are contained in Part 2.

— Section I. Introduction to the workshop

Contains the objectives, methodologies and scope of the workshop, pointing out to the trainers what is feasible and what is not feasible to achieve.

— Section II. Importance of the horticultural sector in Latin America & the Caribbean

Explores the trainer’s role in the fresh fruit and vegetables quality and safety system, stressing the multidisciplinary approach and the need to join private and public efforts for a successful outcome.

Issues relating to the dynamics of the horticultural sector are addressed to show the potential offered for the economic and social improvement of developing countries. The importance of quality and safety to provide and sustain opportunities for market access is stressed.

— Section III. Quality maintenance and enhancement throughout the fresh fruits and vegetables chain

Part I reviews the complexities and subtleties related to the concept of quality as applied to fresh fruits and vegetables, as well as the relationship among the actors involved and resulting in private and public standards and certification schemes (each one adding new and stricter quality requirements).

Part II illustrates critical processes associated with quality losses in post-harvest handling and provides examples of available technologies designed to extend post-harvest life and minimize losses. Guidelines for action plans to enhance quality in the post-harvest steps are presented. Specific attention is given to hazards associated with deterioration in quality attributes, particularly taste, smell, texture, consistence and post-harvest life.
General outline

Improving the quality and safety of fresh fruits and vegetables: a practical approach manual for trainers

SECTION I
Introduction to the Workshop

General Objective
To strengthen public and private institutional capacity for implementing fresh fruits and vegetables quality and safety programs, applying the principles and practices of GAP, GNP and HACCP.

SECTION II
Importance of the horticultural sector in Latin America

Objective: identify the social and economical importance of horticulture: challenges and opportunities.

SECTION III
Quality maintenance and enhancement throughout the fresh fruits and vegetables chain

Objective: provide a clear understanding of the quality and safety assurance programs. To provide a practical guidance on applying the principles of appropriate fresh fruits and vegetables management to maintain and optimize product quality, assure its safety and ensure efficiency in the chain.

SECTION IV
Applying food safety principles to the fresh fruits and vegetables chain

Objective: provide a clear understanding of the safety concept as applied to fresh fruits and vegetables and to understand the food safety regulatory framework. To provide a practical guidance to implement safety assurance programs to improve market performance and opportunities.

SECTION V
The importance of certifications and other quality schemes for the horticultural sector

Objective: share experiences from programs implemented by exporting countries to meet international regulations. Assess opportunities and weaknesses to improve compliance with international regulations. Define priorities for domestic markets.

Action Plans

FIGURE 1. WORKSHOP FLOW DIAGRAM

- Planning the workshop
- General Objective
- SECTION I
- SECTION II
- SECTION III
- SECTION IV
- SECTION V
- Action Plans

- The quality concept as applied to fresh fruits and vegetables.
- Importance of proper logistics and management along the fresh fruits and vegetables chain to enhance quality and safety.
- Post-harvest treatments to improve the efficiency of the chain and to maintain and optimize the quality.

- Food safety concepts and principles.
- Losses in fresh fruits and vegetables associated to chemical, biological and physical hazards.
- Food safety laws and regulations.
- Prerequisite programs (GAP, GMP, GHP, SOP).
- The HACCP approach applied to primary production.

- Codes of Practice implementation by importing countries (the wide concept of GAP).
- Importance of national code of practices to meet international regulations.
- Panel Discussion: SWOT Analysis.
— Section IV. Applying food safety principles to the fresh fruits and vegetables chain

Part I provides a clear understanding of the safety concept as applied to demand and trade of fresh fruits and vegetables and the requirements of Codex Alimentarius regarding food safety.

Part II focuses on safety assurance programs, including prerequisite programs (GAP, GMP, GHP, SOPs) and HACCP. Practical exercises, case studies and field visits allow the trainers to develop safety assurance programs applied to primary production based on the HACCP approach.

— Section V. Importance of certifications and other quality schemes for the horticultural sector

Reviews the impact of certification schemes enforced by dynamic import markets for fresh fruits and vegetables, with examples from Latin American experiences matching international regulations. These regulations cover quality attributes and safety requirements as well as others related to production methods, the environment and ethical matters. The last part deals with establishing action plans at all levels for food quality assurance and safety programs with responsibilities clearly attributed to participants.

FORMAT

Each section of the Manual has the same format, including:

Objectives, time frame for the section, capacity building plan, expected results, materials required and activities to be followed.

Capacity building training materials include reference literature for trainers, case studies, guidelines for field visits and work sheets.

The methodology used involves the participation of trainers in team discussions, brainstorming, analysis of case studies, document research, drafting action plans, etc.

Bibliographic references, at the end of sections, allow the trainers to explore in more detail the subjects covered, enlarging their knowledge and clarifying doubts. Specialized references provide specific support to trainers. Power Point presentations introduce concepts and conclusions to be reached, facilitating the presentation of the technical components.

Trainers can expand or reduce the sections catering to the audience and their expectations, selecting and adjusting activities, training materials and presentations accordingly.

A photographic gallery for training in GAP, GHP and GMP is annexed to the Manual.

It is suggested to keep the sections in order. Should changes be required, care should be taken to follow a logical order that does not impair the general understanding.

Participation in all five sections is essential to achieve the objectives of the workshop, as well as an intensive activity requiring considerable effort from both participants and trainers.

GUIDELINES TO TRAIN THE TRAINERS

The trainer should consider the following when planning country “train the trainers” courses:

— Budget

Special attention must be given to budgetary considerations for a course with a time frame of at least 40 hours. For national courses, proper attention must be given to lodging and transportation costs for participants from different areas, to ensure completion in a single and continuous workshop. Local courses allow for more flexibility by splitting modules and permitting a more adequate monitoring of advances and achievements.

Joint work by several public and private institutions, driven by common objectives, can relieve many of the budgetary constraints likely to occur, thereby enriching the workshop with inputs from outside lecturers who would supplement the trainer’s work.
Successful workshops start with planning. Fundamental to success is the adequate articulation for the private and public efforts. Therefore, as a first step trainers must contact public and private institutions capable of supporting the various workshop requirements: technical presentations, logistics, financial considerations, etc. Once the team is assembled, each member should be assigned clearly identified responsibilities to be completed within a specified time frame. Annex 1 gives an example of planning.

**Lecturers and other required technical support**

Trainers, already exposed to subregional training workshops, will be technically responsible for the workshop. However, sometimes it is very convenient to have the technical support and experience of other members of the institutions in the team or from external consultants. This is especially valuable when specific experiences have to be illustrated. In any case, joint work by the teams is essential to integrate and relate the subjects reviewed. Before the workshop, time should be allowed for meetings to adjust the contents of this Manual to local conditions.

**Selecting participants**

The number of participants, permitted for efficient workshops, should be between 25 and 30, with different backgrounds and from institutions working with fresh fruits and vegetables in training, technology transfer, innovation and technological development, research, standards, certification and project and programme development and execution. Additionally, the contents of the workshop can be adapted to specific training courses, addressing the special needs from producers, transport personnel, exporters, etc.

**Previous contacts with participants**

The operative team will invite the participants, in the most suitable way, to consider the following:

- The invitation must clearly show the relevance of the workshop in fulfilling a common objective or interest and the resulting benefits.
- It should emphasize institutional and participants’ commitments before, during and after the workshop.
- The invitation should be signed by relevant and respected figures from the horticultural sector with good summoning power.

To plan an appropriate agenda, the following reference documents should be taken as examples:

- Preworkshop Questionnaire (Annex 2)
- Terms of Reference (Annex 3)

**Selecting the appropriate location**

In addition to elements facilitating the workshop such as pleasant surroundings, adequate lighting, supporting equipment (multimedia data show projector, slide projector and screen); adequate communication facilities (fax, internet, telephone, computers and printer) and suitable transportation participants should meet in a more or less secluded location, away from distractions in order to help concentration. These elements may strain the budget; therefore participating institutions should be encouraged to provide them.

**Training materials**

A copy of this Manual must be given to each trainer together with relevant publications and reference materials for reading and studying. Sometimes it will only be necessary to provide the work sheets and document required for the activities.

**Other required materials**

- folder with paper sheets
- pencil and/or pen
- nametags
- registration form
- contact list for participants and trainers
The following must be available at all times:

- rota folio
- dry pens (for team work)
- digital projector (two, one replacement)
- slide projector
- screen (wide and in good condition)
- facilities for photocopying work sheets and handouts staplers, clips, etc.
- computer and printer

Necessary for initial steps:

- Results from the preworkshop questionnaire (completed by the participants).
- List of participants: name tags and folders.
- Opening ceremony: short and as simple as possible.
- Introduction to the workshop: explanation of contents and methodology.

— **Evaluation and final report**

Responsibilities for delivery and collection of the workshop evaluation forms must be previously defined. The final report, which evaluates the workshop, should include an analysis of the replies produced by the participants in order to allow for adjustments regarding future editions. See **Evaluation Form** (Annex 4), used in a subregional workshop.

— **Agenda**

The workshop must have an agenda, familiar to the participants beforehand. As an example, an agenda for subregional workshops is included.

— **Example of an agenda:**

**AGENDA**

**SECTION 1. Introduction to the Workshop**

Monday, March 10

8:00 am Participants’ registration. Workshop opening ceremony  
8:30 am Introduction of the participants  
9:00 am Agenda for the workshop, objectives and working methodologies  
10:00 am Break

— **Participants’ commitments**

As a follow-up to the workshop, participants should produce an action plan (with procedures and a time frame) to achieve specific commitments. Some commitments for a subregional workshop are:

- Design a country plan to multiply the training received (with dates for the workshop, beneficiaries and strategies to measure impact, etc.).
- Coordinate the country plan with different public and private agents.
- Train and evaluate the impact.
- Prepare a final project evaluation report showing results achieved.
- Prepare a proposal for a National Action Plan to implement a quality assurance and safety program for fresh fruits and vegetables.

To report advances in the implementation of the action plan (working schedule), as well as with the required support and consultancies, participants may contact the appropriate personnel.

Backstopping activities with the participants are useful to assess the impact of the workshop and the advances in the activities established in the plan.
## ANNEX 1. WORKSHOP PLAN

<table>
<thead>
<tr>
<th>Activities</th>
<th>Responsible</th>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
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<tr>
<td>Pre-workshop activities</td>
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<td>Preliminary contacts with host institutions</td>
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<tr>
<td>Assemble the team (workshop organizers)</td>
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<td>Define team members’ responsibilities</td>
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<tr>
<td>Prepare workshop draft programme</td>
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<td>Prepare workshop budget/sources of funding</td>
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<td>Contact lecturers and prepare terms of reference</td>
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<td>Prepare training materials</td>
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<tr>
<td>Prepare documents to be sent to the participants (invitation/preworkshop questionnaire)</td>
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<tr>
<td>Identify and invite participants</td>
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<td>Selection of participants</td>
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<td>Analysis of pre workshop questionnaire results</td>
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<td>Workshop’s logistic aspects (accommodation and facilities for the participants)</td>
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<tr>
<td>Equipment (digital projector, slide projector, screen, etc.)</td>
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<td>Printing name tags, registration forms, evaluation formats, etc.</td>
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<td><strong>Workshop activities</strong></td>
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<tr>
<td>Registration of participants and distribution of workshop materials</td>
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<td>Logistic aspects (accommodation/allowances for participants)</td>
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<td>Logistic aspects (equipment, etc.)</td>
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<td>Handing in evaluation forms and other documents</td>
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<td><strong>Post-workshop activities</strong></td>
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<tr>
<td>Prepare workshop report</td>
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<td>Prepare correspondence</td>
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<td>Monitor action plans</td>
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<td>Evaluate workshop impact</td>
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ANNEX 2: PRE-WORKSHOP QUESTIONNAIRE

Dear Participant: Please return this form completed, before the 00/00/00, to ……………………………… (e-mail address). The information provided will help to achieve the objectives of the workshop. Your cooperation is sincerely appreciated.

A. GENERAL INFORMATION

1. Name of the company, institution or centre: ………………………………………………………………………

Mailing address: …………………………………………………………………………………………………………………

E-mail address: …………………………………………………………………………………………………………………

Telephone number: …………………………………………………………………………………………………………………

Fax number: ………………………………………………………………………………………………………………………

Name: ……………………………………………………………………………………………………………………………

Position: ……………………………………………………………………………………………………………………………

Responsibilities relating to quality assurance and food safety: ……………………………………………………………

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Importance assigned to your participation in the workshop for the country and for the company/institution/centre:

……………………………………………………………………………………………………………………………………

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Expected results from the workshop

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B. ECONOMIC AND SOCIAL IMPORTANCE OF THE HORTICULTURAL SECTOR

This section gives the significance of the horticultural sector for the country and includes information on the:

- share in the gross products (country and/or agricultural gross products);
- share in employment generation (in production and handling);
- exports of horticultural produce (with the evolution in value of exports throughout several years);
- share of exports as a percentage of the total value of agricultural exports;
- evolution of cultivated land, production and the internal market; export markets for produce;
- land tenure in horticultural production (share of family owned and small-scale agriculture);
- evolution of specialized retail markets (expansion of supermarkets, hypermarkets, delicatessens, etc.);
- strengthening the organized trade relations between suppliers buyers (purchase under contracts, production planning, etc.); opportunities and challenges for growth and modernization in horticulture.
C. CURRENT COUNTRY INSTITUTIONAL CAPACITIES (PUBLIC AND PRIVATE) FOR SAFETY AND QUALITY IN HORTICULTURE

1. Relevant strengths for development and modernization of quality and safety issues in horticulture:

Participants are invited to enumerate relevant assets, such as existing strategies, policies, programs, institutional, governmental and entrepreneurial projects addressing quality and safety issues for fresh fruits and vegetables.

2. Relevant weaknesses that limit the development and modernization of quality and safety issues in horticulture:

Participants will enumerate country liabilities and obstacles occurring in safety and quality issues, such as: low institutional integration, inadequate technical capacities available, low entrepreneurial commitment and producers with low motivation.

3. Exemplify country strengths and weaknesses in horticulture quality and safety issues.

Participants will illustrate the opportunities resulting from quality assurance and safety programs in horticulture and the risks ensuing should these procedures be unsuccessful.
ANNEX 3: TERMS OF REFERENCE FOR PARTICIPANTS IN THE SUBREGIONAL WORKSHOP

OBJECTIVE

The aim is to strengthen the institutional capacities (both public and private) of the Latin American & Caribbean countries to implement programs for food safety and quality assurance in the area of fresh fruits and vegetables, using the GAP, GMP and HACCP approaches.

INVITATION

Government agencies, research organizations, cooperation agencies, capacity building and technology transfer institutes, non-governmental organizations (NGOs), production and trading boards and centres for technology promotion are invited to participate in the subregional workshop on quality assurance and safety of fresh fruits and vegetables. They are also invited to multiply national courses for trainers and to lead working teams in the country to assist in the implementation of quality assurance programs in horticulture.

PARTICIPANTS’ COMMITMENTS

1. Participants, as inputs to the workshop, will:

   • produce a concise country frame of reference for the horticultural sector (including recent growth rates, export markets, export volumes, outline of producers, relations between producers exporters);
   • identify country quality assurance activities and related governmental, institutional and/or entrepreneurial policies underway for the fresh fruits and vegetables sector;
   • describe briefly the assets and liabilities in implementing country quality assurance programmes in horticulture.

   The participants selected will forward the completed questionnaire before ................................. to: food-quality@fao.org; fax number +390657054593 (FAO, Rome).

2. Once the regional workshop is concluded, participants are committed to:

   • design a plan to multiply the training received in each country, (with dates, beneficiaries, impact assessing strategies, etc.); coordinate this plan with the relevant private and public agencies in each country;
   • complete the training courses and assess the impact;
   • prepare a final report evaluating process and results;
   • design a draft “Action Plan” to enforce a quality assurance programmes for fresh fruits and vegetables.

INSTITUTIONAL COMMITMENTS

Each participating institution should sign a letter of commitment, agreeing to support, within the established period, the training program activities.

COSTS AND FINANCING

FAO will cover the costs for lodging and meals for the public sector participants, attending national and subregional workshops.

SELECTING THE PARTICIPANTS

Five participants from each country will be selected. Selection will be based on institutional alignments with the objectives of the workshop and the endorsement of the required commitments.
## ANNEX 4 - SUBREGIONAL WORKSHOP: WORKSHOP EVALUATION FORM

Please answer the following questions in order to evaluate the workshop and to allow for improvements in future workshops.

### I. FACILITIES AND SET-UP

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Suggestions for future workshops:


### II. ORGANIZATION

5. How was the agenda organized (subjects and timing)?:

   - Excellent
   - Satisfactory
   - Not satisfactory

Comments:


6. Background and training materials received were:

   - Excellent
   - Satisfactory
   - Not satisfactory

Comments:


7. What is your opinion of the workshop?

   - Excellent
   - Satisfactory
   - Not satisfactory

Comments:


III. EXPECTATIONS

8. Up to what point has the workshop fulfilled your expectations?

- Completely □
- Partially □
- Scarcely □

Comments:

9. Can it be applied to your work?

- Completely □
- Partially □
- Scarcely □

Comments:

IV. CONTENTS

10. Was the time frame for each section adequate?

- Completely □
- Partially □
- Scarcely □

Comments:

11. Which topics were presented with the required degree of detail and which were not?

Comments:

12. What is your opinion of the workshop?

- Excellent □
- Satisfactory □
- Not satisfactory □

Comments:
V. LECTURERS

14. Topic: Importance of the horticultural sector in Latin America & the Caribbean

a. Knowledge

Excellent ❑  Satisfactory ❑  Not satisfactory ❑

b. Presentation skills

Excellent ❑  Satisfactory ❑  Not satisfactory ❑

c. Subject development

Excellent ❑  Satisfactory ❑  Not satisfactory ❑

d. Were the materials delivered suitable?

Completely ❑  Partially ❑  Scarcely ❑

e. Was the use of teaching resources adequate?

Completely ❑  Partially ❑  Scarcely ❑

f. Was participation encouraged?

Completely ❑  Partially ❑  Scarcely ❑

g. Did any of the subjects leave you unsure or uneasy?

Yes ❑  No ❑

If your reply is Yes, please specify:

………………………………………………………………………………………………………………………………………………

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15. Topic: Quality maintenance and enhancement throughout the fresh fruits and vegetables chain

a. Knowledge

Excellent ❑  Satisfactory ❑  Not satisfactory ❑

b. Presentation skills

Excellent ❑  Satisfactory ❑  Not satisfactory ❑

c. Subject development

Excellent ❑  Satisfactory ❑  Not satisfactory ❑

d. Were the materials delivered adequate?

Completely ❑  Partially ❑  Scarcely ❑
16. Topic: Applying food safety principles to the fresh fruits and vegetables chain

a. Knowledge

Excellent ☐  Satisfactory ☐  Not satisfactory ☐

b. Presentation skills

Excellent ☐  Satisfactory ☐  Not satisfactory ☐

c. Subject development

Excellent ☐  Satisfactory ☐  Not satisfactory ☐

d. Were the materials delivered adequate?

Completely ☐  Partially ☐  Scarcely ☐

e. Was the use of teaching resources adequate?

Completely ☐  Partially ☐  Scarcely ☐

f. Was participation encouraged?

Completely ☐  Partially ☐  Scarcely ☐

g. Did any of the subjects leave you unsure or uneasy?

Yes ☐  No ☐

If your reply is Yes, please specify:

........................................................................................................................................................................

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17. Topic: The importance of certifications and other quality schemes for the horticultural sector

a. Knowledge

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<th>Excellent</th>
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b. Presentation skills

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c. Subject development

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<th>Excellent</th>
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d. Were the materials delivered adequate?

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e. Was the use of teaching resources adequate?

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f. Was participation encourage?

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g. Did any one of the subjects leave you unsure or uneasy?

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<th>Yes</th>
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If your reply is Yes, please specify:

- ....................................................................................................................
- ....................................................................................................................
- ....................................................................................................................

GENERAL COMMENTS:

- ....................................................................................................................
- ....................................................................................................................
- ....................................................................................................................
- ....................................................................................................................

Your cooperation is appreciated.
SECTION I
Introduction to the workshop
INTRODUCTION TO THE WORKSHOP

OBJECTIVES

- Introduce the general framework of FAO’s Action Program for Prevention of Food Losses (PFL) and the specific “train the trainers” activities in this Manual
- Introduce participants to the agenda, objectives, and working methodologies of the workshop

CONTENTS

- Explain the contents of the workshop

ACTIVITIES

- Activity 1. Demonstrate the use of the Manual for Trainers
SECTION I. Introduction to the workshop

GENERAL INFORMATION

OBJECTIVES

• Introduce the general framework of FAO’s Action Program for Prevention of Food Losses (PFL), and the specific train the trainers’ activities in this Manual.
• Introduce participants to the agenda, objectives and working methodologies of the workshop.

TIME FRAME

45 minutes

METHODOLOGY

After briefly introducing the participants, the trainer presents the general scope of the project, the activities to train the trainers, explaining the background, objectives and outcome of the workshop. The trainer refers to the methodology of the workshop, the commitment expected from the participants (in agreement with the remarks of the general outline of the Manual). The presentation concludes with a demonstration of the contents of the Manual used in the training programs at the governmental, national, regional and local levels.

WORKING TIMES, BREAKS AND OTHER LOGISTICS ARE EXPLAINED AND AGREED UPON.

RESULTS

By the end of the session the participants will have:

• A clear understanding of the contents and methodology of the workshop and their expected commitment to ensure its success.

TRAINING MATERIAL

Presentation 1.1 Introduction to the workshop

Activity 1. Demonstrate the use of the Manual for Trainers

The trainer provides the participants with hard and CD-ROM copies of the training Manual, *Improving the quality and safety of fresh fruits and vegetables: a practical approach*, followed by a brief description and explanation of the Manual contents:

• objectives
• contents
• training plan
• methodology
• activities
• training materials

The trainer demonstrates the use of the CD-ROM with a projector and shows examples of the training materials included in the Manual, such as:

• Power Point presentations
• gallery of pictures
• recommended readings
• working documents
• activities
• complete documents
• internet links
• case studies

Finally, the trainer explains the importance of the training Manual as a tool to support the training programs at the governmental, national, regional and local levels.
SECTION II
Importance of the horticultural sector in Latin America & the Caribbean
GUIDELINES TO STUDY SECTION II

IMPORTANCE OF HORTICULTURAL SECTION IN LATIN AMERICA & THE CARIBBEAN

OBJECTIVES

- Analyse the growing economic and social importance of horticulture in Latin American countries.
- Single out market opportunities for producing and exporting fresh fruits and vegetables
- Stress the importance of implementing quality and safety assurance programs to support these opportunities

CONTENTS

- Social and economic significance of horticulture
- Opportunities and challenges for horticulture in Latin America

ACTIVITIES

Activity 1. Presentation and discussion of results from the pre-workshop questionnaire
SECTION II. Importance of the horticultural sector in Latin America & the Caribbean

GENERAL INFORMATION

OBJECTIVES

• Analyse the growing economic and social importance of horticulture in Latin American & Caribbean countries.
• Single out market opportunities for producing and exporting fresh fruits and vegetables.
• Stress the importance of implementing quality and safety assurance programs to support these opportunities.

TIME FRAME

2 hours

METHODOLOGY

Teamwork backed by discussions analysing the results of the preworkshop questionnaire and other documents distributed.

PLAN

The summarized replies from the pre-workshop questionnaire returned by the participants are introduced in a plenary session in relation to:

Section A. General information on participants and their institutions.
Section B. Profile for each country’s horticultural sector.
Section C. Current institutional situation, both public and private, to address safety and quality issues in horticulture.

For Section A “Introducing the Participants”, the participants will report on their institutional and personal role in the fresh fruits and vegetables quality and safety system by completing the appropriate worksheets supplied. This will facilitate understanding the complexities and relationships involved. For sections B and C, the trainer will briefly comment on some of the opportunities available in the markets for fresh produce, using Material 2.1 as a reading reference. Next, the participants grouped by country will identify possible contributions to implement quality and safety programmes in their countries to channel market opportunities. This exercise will use as reference material the summarized pre-workshop questionnaire and the institutional capacities available in each country.

EXPECTED RESULTS

By the end of this session, the participants will:

• identify the economic and social importance of the horticultural sector in each country and its potential to modernize;
• reference the trends and opportunities in fresh fruits and vegetables markets and identify challenges to overcome them for successfully channeling these opportunities;
• define the importance of implementing quality and safety programmes as tools to profit from market openings.

TRAINING MATERIAL

Material 2.1 Worksheet: A simple horticultural chain model.
Material 2.2 Reference reading: Opportunities and challenges for the Latin American horticultural sector.
Activity 1. Presentation and discussion of results from the preworkshop questionnaire

SECTION A. DEFINE THE PARTICIPANTS EXPECTATIONS

TIME FRAME

30 minutes

GUIDELINES FOR TRAINERS

Participants will be requested, in teams or individually, to:

1. Define their role as different actors in the horticultural chain (Material 2.1);
2. Define relationships to the quality and safety system in the fresh fruits and vegetables production - marketing - consumption chain (responsibilities for work done, purpose, chain links involved, etc.);
3. Define the expectations and the improvements expected from an active involvement in the workshop.

ACTIVITIES

The trainer will distribute to each participant, who will play precise roles in the fresh fruits and vegetables chain, worksheets with Material 2.1. This will help to understand the complexities involved in the fruits and vegetables safety system and the need for integrated and multidisciplinary work. The trainer will clarify each person's role as a citizen and as a consumer within the agro-industrial quality and safety system. Likewise, participants will be asked what is expected from the course, thereby allowing the trainer to direct the brainstorming sessions to achieve realistic results, with the general objectives in mind. On a rota folio the trainer will draw a simple model horticultural chain, showing the positions of each participant as an actor, to evidence the difficulties involved in the system.

SECTIONS B AND C. IMPORTANCE OF THEHORTICULTURAL SECTOR FOR EACH COUNTRY

TIME FRAME

75 minutes

GUIDELINES FOR TRAINERS

The trainer will open the session outlining “The opportunities for Latin American horticulture” and the results from sections B and C of the preworkshop questionnaire referring to general topics of each country's horticultural sector, and commenting on the strengths and weaknesses detected by the participants for implementing quality and safety programs.

The trainer will request the participants, grouped by country, to answer the following questions:

• How deeply is your institution involved in the quality and safety systems for fresh fruits and vegetables to potentiate opportunities?

• How would implementing a program for quality assurance and safety contribute to channel produce to market openings? (For this analysis, generalities should be considered: e.g. land tenure, family agriculture, available facilities for transportation and storage, etc.).

To conclude, each team presents its results and the trainer summarizes the general conclusions.

The trainer will prepare this session by reading the reference material Opportunities and Challenges for the Latin American Horticultural Sector, Material 2.2, along with the results of the pre-workshop questionnaire completed by the participants.
## MATERIAL 2.1. A SIMPLE HORTICULTURAL CHAIN MODEL

### SUPPORT SERVICE TO THE CHAIN

<table>
<thead>
<tr>
<th>POSITION</th>
<th>ROLES RELATING TO THE QUALITY AND SAFETY SYSTEM FOR FRUITS AND VEGETABLES</th>
<th>POSITION ON THE HORTICULTURAL CHAIN</th>
<th>EXPECTATIONS (WHAT DO YOU EXPECT TO IMPROVE IN YOUR WORK OR ACTIVITY?)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MATERIAL 2.2 REFERENCE READING FOR TRAINERS
“OPPORTUNITIES AND CHALLENGES FOR THE LATIN AMERICAN & CARIBBEAN HORTICULTURAL SECTOR”

— Supply trends

World production of fresh fruits and vegetables was estimated for 2002 in 1 244 million tonnes, with 772.7 tonnes regarding vegetables and 471.3 tonnes regarding fruits (FAOSTAT). In the last decades the overall rate of growth for vegetables has been more dynamic than for fruits, 5 percent compared to 2.38 percent. Latin America contributes 4.1 and 21 percent of the world production of vegetables and fruits, respectively.

Table 1 shows that fruits, such as pears, apples, mangos and papayas, have significantly increased production in the last ten years.

Table 1. Average Growth in Fruit Production

<table>
<thead>
<tr>
<th>Product</th>
<th>% World growth</th>
<th>% Latin America growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal fruits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apples</td>
<td>2.48</td>
<td>2.11</td>
</tr>
<tr>
<td>Grapes</td>
<td>1.07</td>
<td>1.88</td>
</tr>
<tr>
<td>Pears</td>
<td>5.41</td>
<td>5.72</td>
</tr>
<tr>
<td>Kiwi</td>
<td>0.24</td>
<td>1.87</td>
</tr>
<tr>
<td>Peaches and Nectarines</td>
<td>2.43</td>
<td>1.19</td>
</tr>
<tr>
<td>Tropical - Subtropical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citrus</td>
<td>2.13</td>
<td>1.49</td>
</tr>
<tr>
<td>Mangos</td>
<td>3.44</td>
<td>3.17</td>
</tr>
<tr>
<td>Pineapples</td>
<td>1.90</td>
<td>4.31</td>
</tr>
<tr>
<td>Papayas</td>
<td>4.76</td>
<td>7.28</td>
</tr>
<tr>
<td>Avocados</td>
<td>2.30</td>
<td>1.94</td>
</tr>
</tbody>
</table>


Latin America has a significant share in world production of four important tropical fruits: mango, pineapple, papaya and avocado. These represent an average of 75 percent of total production of tropical fruits and about 90 percent of exports of fresh produce. Latin America is also an important producer of citrus, as shown in Table 2.

For vegetables, Latin America had in the last decade an average growth rate of 3.57 percent, with significant increases in the production of tomatoes, asparagus, etc.

Table 2. Latin American share in world production of tropical fruits and citrus.

<table>
<thead>
<tr>
<th>Product</th>
<th>World (tonne)</th>
<th>Latin America (tonne)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>22 739 891</td>
<td>3 118 390</td>
<td>14</td>
</tr>
<tr>
<td>Papaya</td>
<td>4 863 045</td>
<td>2 284 222</td>
<td>47</td>
</tr>
<tr>
<td>Pineapple</td>
<td>12 760 205</td>
<td>3 370 376</td>
<td>26</td>
</tr>
<tr>
<td>Citrus</td>
<td>96 546 314</td>
<td>33 632 691</td>
<td>35</td>
</tr>
<tr>
<td>Avocado</td>
<td>2 293 598</td>
<td>1 544 290</td>
<td>67</td>
</tr>
</tbody>
</table>

Table 3. Average growth in the production of vegetables.

<table>
<thead>
<tr>
<th>Product</th>
<th>% World growth</th>
<th>Latin American growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>3.97</td>
<td>2.68</td>
</tr>
<tr>
<td>Onions</td>
<td>2.97</td>
<td>5.49</td>
</tr>
<tr>
<td>Peppers</td>
<td>3.06</td>
<td>2.08</td>
</tr>
<tr>
<td>Asparagus</td>
<td>8.08</td>
<td>7.53</td>
</tr>
<tr>
<td>Garlic</td>
<td>5.33</td>
<td>4.40</td>
</tr>
</tbody>
</table>


On the other hand, production of fruits and vegetables in several Latin American countries involves rural and family agriculture, concentrating poverty significantly. It has a high geographic dispersion, fragmented land property, low productivity, small scales of production, low levels of technology, difficulties in access to credit, to markets and to information sources and, in general, articulates poorly with the end consumer.

Even if difficult to estimate, family subsistence horticulture, contributes significantly to food safety and to improving the nutritional conditions of rural populations in many developing countries. In Chile, according to INDAP (2000), family agriculture covers about 25 percent of farmland and 45 percent of production resources (44 percent annual crops, 45 percent vegetables, 29 percent fruits, 41 percent grapes, 42 percent cattle, 33 percent sheep, 63 percent goats and 48 percent swine). For Guatemala, the development of export horticulture has been based on small-scale agriculture, from an average 0.6 ha per farmer in 1979 to 5 ha in 1993 (ECLA, 1995). Horticulture’s contribution to employment in Latin American countries varies significantly with the production systems in use and the sector’s own impetus. In Brazil fresh horticulture is responsible for the direct employment of 4 million (INTERTEXTO, Pesquisa de Campo, 2000); in Guatemala in 1993, canning and processing provided work to 2 145 people in 35 different companies (CEPAL, 1995) this share becoming more relevant as the sector becomes more dynamic, both to supply domestic and export markets.

— Trends in consumption

The last decade has witnessed profound changes in agro-industrial systems associated with foods, with the consumer as the driving force behind food supplies. Among others, urbanization and demographic growth, out-of-the-house female employment, increased income and more educated consumers have contributed to shifting production from bulk marketing to more segmented and individualized patterns. This has resulted in developing new products, flexible offers and new opportunities for products with added-value, such as fresh vegetables and fruits.

A distinction needs to be made between: conditioning processes, made ready for use; saving time products (precuts, individual dishes, readyto-cook and ready-to-eat); and transforming processes that result in products with longer shelf life and not requiring low conservation temperatures (mainly canned foods and chips). The market for these conditioning process products is far more dynamic due to consumer preferences for fresh convenience products nutritionally unaltered and healthful.

Fruits and vegetables, as a result of conditioning processes (storage, waxing, transportation, etc.), belong to these new and more dynamic products. In the USA consumption of baby carrots and ready-to-eat salads, has sharply increased in recent years (USDA, 2001).

Shifts in world trade of foods to products with more added-value, result in, among several other reasons, higher prices than for basic products1 with a higher demand elasticity. Table 4, shows per capita increases in the offer of fruits and vegetables (a measure of consumption), with higher increases for higher income countries.

Fruits and vegetables result from processes involving multiple and sequential investments in order to supply production on time, in form and place as required by the consumer (implying specialized transport and packaging, conservation, taxes and insurance, promotion, marketing profits, etc). Technological advances in transportation, for example, result in increased consumption.

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1 While exports of fresh fruits and vegetables increased in value on an average of 2.47 percent and in volume by 2.98 percent in the last decade, exports of cereals decreased by 0.57 percent in value and by 1.23 percent in volume. (FAOSTAT).
### World Supply of Fruits and Vegetables Kg /per capita/year

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Income</td>
<td>78</td>
<td>78</td>
<td>79</td>
<td>81</td>
<td>80</td>
<td>81</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>Medium Income</td>
<td>120</td>
<td>127</td>
<td>132</td>
<td>140</td>
<td>154</td>
<td>161</td>
<td>164</td>
<td>170</td>
</tr>
<tr>
<td>High Income</td>
<td>147</td>
<td>156</td>
<td>178</td>
<td>184</td>
<td>193</td>
<td>214</td>
<td>222</td>
<td>223</td>
</tr>
</tbody>
</table>

Source: FAO (From: Changing Structure of Global Food Consumption and Trade, USDA, 2001)

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### Importing markets

Consumer's trends in major importing markets, favors “innovative, different, convenient and healthy diet products”. In the USA, in 1997-1999, intake per capita of fruits and vegetables was 25 percent higher than in 1977-1979. From the mid-1970s, USA consumers have purchased less canned fruits and vegetables and more fresh products. Oranges, apples, grapes and bananas lead in fruits while potatoes, tomatoes, melons, carrots and lettuce are the vegetables most in demand (USDA, 2001).

In the USA market imports account for 14 percent of domestic consumption of fruits and vegetables (excluding bananas). Developed countries import 80 percent of fresh tropical fruits. It is expected that Europe will continue to be the largest importer, with 47 percent of imports for 2005. North America will remain as the second largest importing market, with increased imports of pineapples, mangos and papaya. The average annual growth for these products is expected to be 3.0-4.5 percent (FAO, 2002).

For products facing more competitive markets such as citrus and seasonal fruits opportunities for developing countries centre on increased productivity, continuous discovery of market opportunities, research and advances in agronomical research, pest control, post-harvest technology, handling and storage. Adequate balances will allow for continuous growth in production.

Markets for organic fruits offer additional opportunities to developing countries. Annual rate of sales for these products has increased by 20 30 percent in the last decade, with leading figures for the United States, Germany, the United Kingdom and Italy (FAO, 2002).

As long as income keeps increasing in developed countries, demand for fruits and vegetables will also increase. Globalization and associated changes in lifestyles, point to increased demands in developing countries, along the lines in the developed world. Availability, convenience and health demands will probably influence worldwide intake of fruits and vegetables in the future (Pollack, 2001-USDA).

---

### Latin American export markets

For many developing countries, exports of fruits and vegetables contribute significantly to earnings in hard currency. For Latin America, exports of fruits and vegetables increased in the last ten years by 4.54 percent. Graphic 1 shows countries with increases in exports higher than 8 percent in the last decade.

As an example, Brazil, INTERTEXTO - Pesquisa de Campo (2000), shows increased fresh fruits exports from US$120 million to US$214.6 million in 1998-2001. In Mexico, 63 percent of agricultural exports are from horticulture (SAGAR, 2002). Chile is the first world exporter of table grapes and pears, second in apples and kiwi and fourth in peaches (ODEPA, 2000). These figures (reported by SENA, 2002) point to very interesting export dynamics in several Latin American countries struggling to profit from open opportunities in importing markets.

---

### Changes in distribution systems

The new dynamism of trade in fruits and vegetables in the 1990s, resulted in significant adjustments in distribution systems, concentrating both suppliers and retailers.

According to Reardon (2002), in Latin America the supermarket revolution took only 10 years compared with 60 in the USA. This has been a massive expansion, reaching consumers everywhere, in large cities as well as in small populations. The concentration of retail trade, both in developed and developing countries, is continually increasing, as exemplified by the market share of the four larger chains in the USA, which increased their market share from 15 percent in 1992 to 25 percent in 1999.

Supermarkets keep increasing their percentage in distribution of fresh foods. In Latin America, in less that a decade, super-
markets account for 30 percent of the market for fruits and vegetables in Argentina and Mexico and for 50 percent of the retail market in Brazil. Chilean supermarkets contribute only 38 percent of the retail market for fruits and vegetables.

**Graphic 1. Export growing rates for some Latin American & Caribbean countries**

Source for calculations FAOSTAT (1992-2002)

Supermarkets continue increasing their percentage in distribution of fresh foods. In Latin America, in less than a decade, supermarkets account for 30 percent of the market for fruits and vegetables in Argentina and Mexico and for 50 percent of the retail market in Brazil. Chilean supermarkets contribute only 3-8 percent of the retail market for fruits and vegetables. According to Reardon and Berdegue (2002), supermarkets control 42 percent (on a weighed average basis) of the retail market for fruits and vegetables. Twenty years ago this was less than 5 percent.

This concentration entails more demanding requirements in quality, safety, nutritional values, packaging, volume and changes in the price quality ratio while new coordination and communication practices are at work between supermarkets and suppliers, reducing the role traditionally played by intermediate traders.

Likewise, the growth in specialized supermarkets opens good opportunities for more specialized offers and for regional markets. Reardon and Berdegue (2002) showed that, for the 12 countries studied, Latin American has a US$24 billion market for fresh fruits and vegetables. Total exports, excluding bananas, round US$8.2 billion making the specialized markets two or three times larger than the fruits and vegetables market. To conclude, there are good opportunities in the large importing markets as well as in the regional domestic markets.

--- Afterthoughts

The dynamic demands in horticultural trade are expected to result in:

- development and modernization of the productive sector to meet the requirements in quality, varieties, volume, delivery, etc., required by local specialized markets and by export markets;
- strengthening the relationship between producers and traders.

On this second point, (Díaz, 1999) shows evidence that in horticultural markets, preference is given to medium-sized suppliers, with consistent capacity to deliver produce, with lower transaction costs and less risks. The following question regarding fruits and vegetables production systems in Latin America is worth considering:

*Are these producers and traders ready to remain competitive in these highly demanding, differentiated, dynamic, regulated and competitive markets, where not only quality attributes count (nutritional value, texture, appearance, etc.), but also safety assurance, and a continuous concern for the production systems involved, the post-harvest handling, the processing procedures, the environment and ethical issues?*
REFERENCE DOCUMENTS


FAOSTAT. Agriculture data. 
http://apps.fao.org/page/collections?subset=agriculture


http://www.fao.org/docrep/004/y1669e/y1669e00.htm


SECTION III
Quality maintenance and enhancement throughout the fresh fruits and vegetables chain
GUIDELINES TO STUDY SECTION III

QUALITY MAINTENANCE AND ENHANCEMENT THROUGHOUT THE FRESH FRUITS AND VEGETABLES CHAIN

OBJECTIVES

- To provide a clear understanding of the quality concept supporting the implementation of quality and safety assurance programs
- To provide practical guidance on applying the principles of appropriate fresh fruits and vegetables post-harvest management to maintain and optimize product quality, assure its safety and ensure efficiency in the chain

PART I. The concept of quality as applied to fresh fruits and vegetables
- Integrated concept of quality
- Standards and regulatory documents

PART II. Applying the principles of post-harvest management to maintain the quality and safety of fresh fruits and vegetables
- Critical procedures for post-harvest handling of fresh fruits and vegetables.
- Post-harvest treatments to improve the efficiency of the chain and to maintain and optimize quality

ACTIVITIES

- Part I
  Activity 1. The concept of quality as applied to fresh fruits and vegetables
  Activity 2. Quality determination procedures
- Part II
  Activity 1. Importance of appropriate logistics and post-harvest handling for fresh fruits and vegetables
  Activity 2. Guidelines for action plans to maintain the quality of fresh fruits and vegetables

QUALITY MAINTENANCE AND ENHANCEMENT THROUGHOUT THE FRESH FRUITS AND VEGETABLES CHAIN
SECTION III. Quality maintenance and enhancement throughout the fresh fruits and vegetables chain

GENERAL INFORMATION

OBJECTIVES

• To provide a clear understanding of the quality concept supporting the implementation of quality and safety assurance programs in the horticultural sector.

• To provide practical guidance on applying the principles of appropriate fresh fruit and vegetables post-harvest management, to maintain and optimize product quality, assure its safety and secure an efficient chain.

TIME FRAME

8 hours

METHODOLOGY

Teams discuss the reading references, presentations and case studies.

PLAN

In Part I, the trainer explains the complexities and subtleties underlying the concept of quality as applied to the agrifood sector, underlying its components, the implicit and explicit needs to which a product must conform and the implications of this new approach throughout the chain. Activity 1 will be used for this purpose, a simple definition of quality to which progressively new elements are incorporated to explain the complexity of the notion. The participants assembled in teams and with the support of reference materials, analyse the importance of processes for the quality of horticultural produce, considering relations between standardization, certification of quality attributes and accreditation of certification systems.

Part II considers the importance of appropriate post-harvest handling of produce to preserve quality as a differentiating factor and as a market opening tool.

The trainer will use Presentation 3.2, on the processes of respiration, transpiration and ethylene production, relating directly with the senescence of perishable produce. Using examples he will clearly identify the relations between primary causes of produce deterioration (biological/physiological/mechanical/physical) and other causes resulting from inadequate handling during harvest and post-harvest (transportation, packaging, storage, etc.). The trainer will briefly show some available technologies minimizing quality and safety losses and making the post-harvest handling of produce more efficient (reduced microbiological contamination, minimized water losses, reduced ethylene damage and insect control).

A case study, based on hazard analysis (damages) associated to quality losses, clarifies strategies to approach quality assurance programmes for fresh horticultural produce.

Finally, teams discuss the limitations detected in post-harvest of fresh fruits and vegetables for each country from the standpoint of infrastructure, available information, research and training of the actors in the chain.

EXPECTED RESULTS

By the end of the session the participants will,

From Part 1:
• have a clear understanding of the components of quality and the procedures involved to determine produce quality;
• have identified the relations between quality standardization processes, quality certification processes and accreditation of certification systems required for the successful implementation of quality and safety assurance programs.

From Part 2, identify:
• opportunities provided by post-harvest technologies to profit from market openings, reduce inefficiencies in the chain and improve competitiveness;
• critical procedures to maintain quality and safety of fresh fruits and vegetables, throughout the post-harvest handling chain; available post-harvest technologies that reduce risks associated with quality losses and safety of horticultural produce.
TRAINING MATERIALS

Part 1:
Material 3.1 The concept of quality from the standpoint of different actors in the chain.
Material 3.2 Reference reading. The concept of quality in the horticultural sector.
Material 3.3 Procedures for quality determination.
Material 3.4 Components of a quality standard for fresh fruits and vegetables.

Part 2:
Material 3.5 Reference reading. Importance of appropriate handling and logistics in post-harvest of fresh fruits and vegetables.
Material 3.6 National importance of post-harvest of fruits and vegetables.
Material 3.7 Reference reading. Guidelines for an action plan for quality maintenance and enhancement and improving the efficiency of post-harvest handling systems for fresh fruits and vegetables.
Material 3.8 Case study. Action plan to assure the quality and improve the efficiency of post-harvest handling systems for Physalis (Cape gooseberry), reference document for participants.

PRESENTATIONS

Presentation 3.1 The concept of quality applied to fresh fruits and vegetables.
Presentation 3.2 Maintaining the quality and safety of fruits and vegetables throughout the post-harvest handling chain.
Presentation 3.3 Case study. Quality assurance program for export markets for Physalis (Cape gooseberry).
Part I. The concept of quality as applied to fresh fruits and vegetables

Activity 1. The concept of quality as applied to fresh fruits and vegetables

GUIDELINES FOR TRAINERS

Participants will play the role of main actors in the chain-producer, conventional and specialized trader, consumer and supporting institutions and define the concept of quality from their own perspective (Material 3.1). During the brainstorming session the trainer will provide a better understanding of the notion and its components, assisted by a power point presentation (Presentation 3.1) and draw the relevant conclusions (taking into account the concept subjectiveness and complexities and identifying the different components of quality). Material 3.2 is a reference reading to assist trainers.

MATERIAL 3.1 THE CONCEPT OF QUALITY FROM THE STANDPOINT OF ACTORS IN THE CHAIN

Producers:

Conventional traders:

Specialized traders:

Consumers:

Supporting institutions:
QUALITY: WHAT IS IT?

Richard J. Schonberger claims that quality is like art, everybody praises it, “everybody recognizes it, but each one has its own understanding of what it is”. Objectively, quality is the aptitude of a good (product) or service to satisfy the needs of its users. ISO Standard 8402:1987 defines quality as “The totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs”.

This definition implies “consumer's satisfaction”, fulfilling their needs and expectations, in an organization committed to continuous improvement and effectiveness. The five important words associated with quality are then:

Aptitude, Satisfaction, Need, User and Continuous Improvement

It is therefore essential when producing quality products to know who will be the user(s) of the product and what are the specific and constantly changing needs to be addressed. For agrifood products, quality may be regarded as a complex characteristic of foods that determines its value and acceptability by consumers (22nd Regional FAO Conference for Europe, Oporto, 2000).

Quality components for foods are related to:

Characteristics of the food:
- hygienic quality and safety
- nutritional quality
- organoleptic quality

Use or service quality:
- convenience (easy to use)
- conservation

Psychosocial or subjective quality:
- satisfaction, pleasure

These characteristics define the options to satisfy implicit or explicit needs. According to Pons and Sirvardière (2002), implicit needs are essential and evident, for example for improving health or the safety of a product. Explicit needs are those conforming to the declared needs of an objective user.

Explicit need is the right of a consumer to choose the product rewarding his senses (smell, taste, sight, touch and ear).

Quality attributes for a product that fulfils needs and expectations of consumers (and other actors in the chain) belong to two main categories: attributes relating directly to the product, called “product attributes”, and attributes relating to production and processing, called “process attributes”. The first include those relating to taste, appearance, texture, consistency, smell, safety and some functional characteristics, such as post-harvest life and convenience. “Process attributes”, on the other hand, include among others, organic production, GMOs, environmental concerns and origin.

Therefore, as long as product quality is defined according to the needs of its user, it will remain strongly influenced by the principles, values, culture, ethics and religious values of individuals. All together, consumers may choose products not only by “product attributes”, but also by “process attributes” involving the way in which they are produced and processed: origin, environmental impact of production practices, etc. Consumers may pay a higher price for products conforming to these requirements or attributes.

Some quality attributes may be grasped by the consumer through the senses, while others cannot be assessed directly. Organoleptics fall into the first, while the second involves process attributes and those having to do with nutrition and safety. Consumers may judge the attributes of the product they intend to buy by taste, smell, sometimes size, all used to judge texture and taste. Other quality attributes, such as microbiological and chemical contaminants or the nutritional value, are in general not grasped through the consumer's experience or perception of the product and can only be conveyed by external indications, such as certifications or quality labels. Likewise are other process attributes, such as environmental impact, which can only be identified with attached labels or marks.
To conclude, in the agrifood sector the general concept of quality is complex and global, as a result of the diversity in horticultural produce and the inter-relations between links in the chain. The concept includes all attributes, characteristics and values that the consumer or buyer would expect of the product according to its use. A good quality product would certainly fulfill the expectations of the consumer or of the end user.

<table>
<thead>
<tr>
<th>Process Attributes</th>
<th>Product Attributes</th>
<th>Extrinsic indicators</th>
<th>Intrinsic indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Safety</td>
<td>Nutrition</td>
</tr>
<tr>
<td>Animal welfare</td>
<td>Pathogens</td>
<td>Nutritional value</td>
<td>Taste</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>Residues</td>
<td>Calories</td>
<td>Texture</td>
</tr>
<tr>
<td>Organic Production</td>
<td>Growth promoters</td>
<td>Fiber</td>
<td>Consistency</td>
</tr>
<tr>
<td>Traceability</td>
<td>Additives</td>
<td>Sodium</td>
<td>Juice content</td>
</tr>
<tr>
<td></td>
<td>Toxins</td>
<td>Vitamines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical contaminants</td>
<td>Minerals</td>
<td></td>
</tr>
</tbody>
</table>


WHY ARE NORMALIZATION AND QUALITY CERTIFICATION NECESSARY?

Given the complexities and subtleties mentioned, there is a need for agreement between the different actors to specify objectively the quality criteria for a product or service, standards and normative documents fulfilling this need. These are public and voluntary documents (as opposed to mandatory regulations) produced by a recognized institution and results from the consensus of the different actors involved to facilitate trade as a consequence of common understanding.

Standards or agreements (codes of practices, etc.) are specifications for the quality attributes of products, for their production systems, adaptation processes, post-harvest technologies, etc., that take into account the different components of quality.

Codex Alimentarius is the international body for food standardization, recognized in the Agreement on the Application of Sanitary and Phitosanitary Measures (SPS) of the World Trade Organization to protect human, animal and plants through international standards, guidelines, codes of practice and other documents. Codex also covers issues belonging to the Agreement on Technical Barriers to Trade (TBT), in particular labeling.

The continuing concern for guaranteed quality has resulted in quality assurance and safety programs, addressed to assure and certify the attributes of a product, through normative documentation covering its production and processing. These programs include inspection procedures ensuring implementation, while the overall process may result in a label or certification proving the conformance of the attributes to the relevant documents.

Quality assurance programs may be either compulsory, legislating on the safety requisites of products; or voluntary, through third party certification on quality management (ISO Standards 9000), environmental certification (Green Labels, ISO Standards 14000), ethical concerns (Basic Code/Social Auditing 8000), certifications of origin, certification of organic production and private certifications involving various quality, safety, ethical and environmental concerns.

Complying with these certifications, required by importing markets, exporting countries are making significant efforts to capture market openings, or often, just to remain in business. This results in developing and enforcing national codes of practice and in efforts to secure the recognition of these codes by the importing markets.

Likewise, the whole scheme of quality certification, employed by the consumers and other actors, requires a system accrediting its conformance to the applicable documents (codes of practice, protocols, etc.). Efforts are also underway to implement the accreditation of quality certification systems.

1 For additional information, refer to Improving the safety and quality of fresh fruits and vegetables: a training manual for trainers. University of Maryland, 2002.
The potential for developing country’s economies, resulting from production and trade in fruits and vegetables must be again stressed. Quality and safety assurance systems must take into account both financial objectives, for entrepreneurs or others associated to the business, and non-financial objectives allowing for the satisfaction of customers, producers, employees, social groups, ecologists, etc.

Often emphasis is placed, during the implementation phase of quality and safety assurance activities, in securing a certification of sorts by the end of the program. In an environment as dynamic as horticulture, just fulfilling quality standards as such may not ensure success. Therefore, the holistic approach to horticulture requires the satisfaction of the consumer, integrating operative and functional strategies, complying with legal frames, with the whole supported by innovation, learning, new knowledge, organizational agility and more competitiveness and skills on the part of the actors.
Activity 2. Quality determination procedures

GUIDELINES FOR TRAINERS

The trainer distributes to each team Material 3.3, summarizing the global concept of quality and the relations between quality standardization processes and certification-accreditation processes, already explained in Presentation 3.1. Once participants have studied the document, the trainer clarifies doubts and conducts the teams to a correct understanding of the issues.

Under Suggested Questions, some questions and answers from the trainer to the participants may be found. Material 3.4 is distributed to explain the structure and components of a product standard.

Once the contents of the worksheet are fully understood, the participants assemble by countries, to provide the following information:

- Identify the institutions responsible in each country for standardization activities and for quality and safety certification and accreditation systems for fresh fruits and vegetables.
- List the opportunities and difficulties for standardization.
- Show successful experiences, where standards have benefited the actors in the chain and identifying key issues for this success.

In the plenary session to follow, each team presents its answers and the trainer draws the appropriate conclusions.

SUGGESTED QUESTIONS

1. How can the quality attributes of a product be classified?
A/ Product attributes and process attributes. The former relate to the product itself (smell, taste, consistency, convenience, safety, etc.); the latter to processing (e.g. organic product, reduced environmental impact, GMOs).

2. What is the difference between an external indicator and an internal indicator for the quality attributes of a product?
A/ Internal indicators are those used directly by the consumer to judge the quality attributes of a product (e.g. taste, smell, texture, convenience). External attributes cannot be directly judged by the consumer: e.g. the safety of a horticultural produce.

3. What are the basic characteristics of a standard?
A/ • A public document, produced with the cooperation of as many actors as possible.
• Voluntary, as opposed to mandatory regulations. Issued by a recognized institution.
• Standards evolve, and should be revised from time to time, to include technical progress, market changes and regulatory advances.
• A common frame, agreed upon by all interested parties.
• Benefits the community as a whole.

4. What are the benefits from standardization?
A/ • Promotes cooperation among actors in the chain.
• Allows for differentiation in quality of processes and services.
• Provides a common language to all players in the chain.
• Supports the decision-making process of each actor in the chain.

5. What is the role of Codex Alimentarius in the international and national fruit and vegetables quality assurance and safety systems?
A/ • Multilaterally, Codex is responsible for food standardization processes as specified in the Agreement on the Applica-
6. **What are the main differences between private and public certification processes?**

**A/** Private certification may conform to criteria and conditions not approved by an official institution. Public certification, even by a private agent, must conform to criteria and conditions approved by an official institution.

7. **What standards become a mandatory regulation for trade of fresh fruits and vegetables?**

**A/** Standards relating to the safety of produce. In many countries, regulations aligned with Codex include the HACCP approach and informative labelling as regulatory aspects to be met by the produce to be traded.

8. **Identify the essential components of certification.**

**A/**
- Assures quality by conforming to a standard, document or buyer’s specifications.
- Is usually issued by a third party, clearly indicating the standardizing and the certifying institutions involved. The standardizing institution is not the certifying institution.

9. **Why are countries developing national codes of practice?**

**A/** The need to comply with the requirements of some importing countries, including not only specifications for the product, but environmental, ethical and safety concerns throughout production and post-harvest handling.

10. **Point out some advantages of certification.**

**A/**
- Allows for differentiation between product and/or service.
- Enhances the credibility of final consumers, distributors and clients.
- Facilitates or makes possible market access.
- Market permanence.

11. **What is the main relation between standardization, quality certification and quality accreditation processes for fruits and vegetables?**

**A/** Quality and safety assurance programmes are supported by standards, codes of practice and other documents resulting in certification, by public and private agents, of the different quality attributes of a product. Accreditation processes, on the other hand, assure that the certification schemes employed are transparent, efficient and trustworthy.
### Section III

**Improving the Quality and Safety of Fresh Fruits and Vegetables: A Practical Approach**

#### Quality Assessment Procedures

<table>
<thead>
<tr>
<th>Accreditation</th>
<th>Certification</th>
<th>Quality Attributes</th>
<th>Indices for Quality Attributes</th>
<th>Standards</th>
<th>Regulations</th>
<th>Some examples of different Certification schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public and/or private certification requires permanent auditing to verify compliance with standards and regulatory documents.</td>
<td>Guidelines for providing quality assurance in conformity with standards and regulatory documents. The former cover organizational characteristics, technical, and functional requirements (e.g., tests, inspections). The latter cover technical and functional requirements (e.g., tests, inspections).</td>
<td>Product Attributes: Appearance, Texture, Taste, Consistency, Flavor, Shelf life, Conveniences. Process Attributes: Nutritional Value, Safety, Organic Production, Environmental Protection, Women’s Welfare, Traceability, Integrated crop handling systems (ICMIP).</td>
<td>Quality attributes can either be judged directly by the consumer (e.g., visual inspection), or indirectly by an external auditor, such as an internal certification.</td>
<td>Standards include: Product Standards, Packaging Standards, Labelling Standards, Storage Standards, Transport Standards.</td>
<td>Standards may include: codes of practice, codes of conduct, codes of industry, codes of good practice, codes of good manufacturing practice (GMP), codes of good agricultural practice (GAP), codes of good hygienic practices (GHP).</td>
<td>Comprehensive private certification schemes, providing quality attributes (e.g., safety), process attributes (technical and environmental concerns) are under way like EUREFAP.</td>
</tr>
</tbody>
</table>

#### Accreditation System

**Public or Private Certification**

- Quality Attributes:
  - Product Attributes: Appearance, Texture, Taste, Consistency, Flavor, Shelf life, Conveniences.

- Standards:

- Regulations:
  - HACCP/GMP and sometimes GAP.

- Certification:
  - Target market access.
  - Private Certifications.

- Auditing:
  - To guarantee the quality of a product or service along the supply chain, from production to delivery. It is performed by independent third parties, recognized or not by public authorities.

- Quality:
  - Quality is a dynamic notion, setting the ground for producers and other actors in the chain, to continuously satisfy the needs and expectations of the consumer.

- Standards:
  - Harmonized standards exist to facilitate international trade. Standardization makes cooperation between actors in the chain, reduce barriers to trade, allowing for quality differentiation of produce/merchandise and protect the consumer.

- Regulations:
  - Standards for foods must be based on food safety, and also incorporate the HACCP approach, to ensure food safety.

- Certification:
  - Allows for product differentiation. Private certifications are based on documents that may be recognized or not recognized by public authorities.
### Section III

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**

**IMPROVING THE QUALITY AND SAFETY OF FRESH FRUITS AND VEGETABLES: A PRACTICAL APPROACH**

**MATERIAL 3.4. COMPONENTS OF A QUALITY STANDARD FOR FRESH HORTICULTURAL PRODUCE**

---

#### Table: Guiding Quality Factor, Structure of the Standard, Example

<table>
<thead>
<tr>
<th>GUIDING QUALITY FACTOR</th>
<th>STRUCTURE OF THE STANDARD</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is standardized?</td>
<td>Varieties, species and use of produce (fresh/processed)</td>
<td>This standard establishes the requirements to be met by common mango (Magnifier indices L.), to be consumed fresh.</td>
</tr>
<tr>
<td>2. QUALITY REQUIREMENTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarify the language of the standard (optional)</td>
<td>Definitions</td>
<td>This section clarifies the language and terms used in the standard to help understand its contents by all interested parties.</td>
</tr>
<tr>
<td>2.1. General Requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Whole fruits with proper variety shape</td>
<td></td>
</tr>
<tr>
<td>Consistency</td>
<td>Fresh looking with a firm consistency</td>
<td></td>
</tr>
<tr>
<td>Sanitary</td>
<td>Healthy, free of insects and/or diseases, affecting internal quality</td>
<td></td>
</tr>
<tr>
<td>Integrity</td>
<td>Cuts, mechanical damage, abnormal external humidity</td>
<td></td>
</tr>
<tr>
<td>Freshness</td>
<td>Must not show indication of dehydration</td>
<td></td>
</tr>
<tr>
<td>Odd flavors and taste</td>
<td>Free of odd flavors and tastes</td>
<td></td>
</tr>
<tr>
<td>Filth</td>
<td>Free of filth</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>Free of contaminants</td>
<td></td>
</tr>
<tr>
<td>2.2. Maturity Requirements</td>
<td>Specification on the conditions determining fruit maturity (inside changes as relating to outside color, if existing). Color tables.</td>
<td>Color grading according to different maturity stages</td>
</tr>
<tr>
<td>Maturity Index supports decision making process of actors</td>
<td>Minimum requirements relating to specific criteria.</td>
<td>Consistency, TSS, pH, Titratable acidity, etc., relating to each specified maturity index. Minimum soluble solids content in the pulp should be over 12° Brix.</td>
</tr>
<tr>
<td>2.3. Classification</td>
<td>This section defines the classification criteria for the product in different categories.</td>
<td>Irrespective of size/color, common mango is classified into:</td>
</tr>
<tr>
<td>Quality Categories</td>
<td></td>
<td>Class Extra: Product must conform with the minimum requirements of point 3.1. and be free of all defects affecting the inside quality of the fruit. Surface stains resulting from latex, shading, blemishes, are acceptable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class I: Same defects mentioned in Category Extra are acceptable, if they do not cover more than 10 % of the surface.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class II: Same defects mentioned in Category Extra are acceptable, if they do not cover more than 15 % of the surface.</td>
</tr>
<tr>
<td>3. REQUIREMENTS CONCERNING CLASSIFICATION BY CALIPERS</td>
<td>Likely size range (as weight of the fruit)</td>
<td></td>
</tr>
<tr>
<td>Size Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. REQUIREMENTS ON ALLOWANCES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 4. REQUIREMENTS ON ALLOWANCES

<table>
<thead>
<tr>
<th>Percentage of acceptance by not meeting the requirements of quality and size criteria</th>
<th>Quality allowances (categories), and size for each packaging unit</th>
<th>Class:</th>
<th>Size:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class extra: Admissible: up to 5% (in number or weight), not corresponding to the standards for this category, but belonging to Category I.</td>
<td>In all categories, up to 10% accepted by number or weight.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percentage of acceptance of not meeting the requirements of quality and size criteria</th>
<th>Quality allowances (categories), and size for each packaging unit</th>
<th>Class I: Admissible: up to 10% (in number or weight), not corresponding to the standards for this category, but belonging to category II.</th>
<th>The size immediately above or below the one shown in the package.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II: Admissible up to 10% (in number or weight), not corresponding to the standards for this category, nor to the general requirements (2.1.), except fruits with severe bruises.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 5. PRESENTATION REQUIREMENTS

<table>
<thead>
<tr>
<th>Uniformity of quality, caliper and color requirements for each packaging unit and package requirements</th>
<th>Uniformity</th>
<th>Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contents of each packaging unit must be uniform and contain only same origin, variety, quality and maturity index products. Visible contents must represent the whole.</td>
<td>Fruits must be packaged to properly protect the product. New, clean and quality materials must be used on the inside to avoid any internal or external damage.</td>
<td></td>
</tr>
</tbody>
</table>

| General packaging conditions apply or reference is made to the appropriate packaging standard. | Contents of each packaging unit must be homogeneous, with fruits belonging to the same variety, category, color and size. Visible contents must represent the whole. |

### 6. LABELING OR MARKS

<table>
<thead>
<tr>
<th>Clarification on labeling requirements</th>
<th>Packages for retail sale</th>
<th>CODEX STAN 1-1985, Rev. 2-1999. Labeling must show: name of product, variety and commercial identification.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packages not for retail sale</td>
<td>Clear and not erasable letters, must be read on the outside or in the shipping documents: identification, nature of the product, origin, commercial identification (category, size, units contained, net weight, maturity index)</td>
<td></td>
</tr>
</tbody>
</table>

### 7. CONTAMINANTS

<table>
<thead>
<tr>
<th>Safety</th>
<th>Heavy metals</th>
<th>Comply with Codex maximum levels for heavy metals.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticide Residues</td>
<td>Comply with Codex the maximum levels for residues.</td>
<td></td>
</tr>
</tbody>
</table>

### 8. HYGIENE

| Safety | It is advisable that the product is prepared and handled conforming to the International Recommended Code on Principles for the Hygiene of Foods and other relevant Codex documents. |

### SAMPLING

| Applicable specification on sample size for evaluation of quality criteria. | Table 2 should be consulted for sample size. To test for maturity and physical and chemical properties tests are run on the juice extracted from 5 fruits from each color. |

### TESTING

| Shows methods for the quantitative determination of each quality criteria. | Test methods for weight, consistency, pulp content, TSS, pH, titratable acidity. |

### APPENDIX

| Acknowledgements, general information and other standards. | Standard NTC 756 for sampling; DE 083/02 Packaging Specifications. |
Part II. Applying the principles of post-harvest management to maintain the quality and safety of fresh fruits and vegetables

Activity 1. Importance of appropriate logistics and post-harvest handling for fresh fruits and vegetables

The trainer shows the importance of adequate post-harvest handling of fresh fruits and vegetables, pointing out the physiological processes of quality loss and their causes. The trainer makes recommendations and proposes post-harvest technologies that maintain quality (Presentation 3.2).

The theoretical foundations lead to a brainstorm to:

Identify the opportunities made available by post-harvest technologies for development and updating the horticultural sector.

Reference Material 3.5 assists the trainer in focusing the conclusions.

Participants, in teams, define the strengths and weaknesses to channel detected market opportunities using the worksheet (Material 3.6). Results are discussed in a plenary session and the teams answer:

From your role as active actors in the horticultural chain, what would be your contributions to sort out some of the detected difficulties?

The trainer concludes, commenting on the importance of the ongoing commitment of all players and the supporting institutions in making post-harvest technology a tool to update and create opportunities in the horticultural sector and to ensure quality and safety of fresh fruits and vegetables.

MATERIAL 3.5 REFERENCE READING FOR TRAINERS

IMPORTANCE OF APPROPRIATE HANDLING AND LOGISTICS IN POST-HARVEST OF FRESH FRUITS AND VEGETABLES

The positive developments in horticulture in several Latin American countries in the last decades in Chile, and more recently in Mexico and Brazil, result from comparative advantages, a suitable institutional frame and favourable internal and external conditions. On the other hand, the incorporation of technological innovations opened new prospects for production and exports (Trejo, 1997). The contribution of post-harvest technologies (e.g. advances in maritime transport) has also been significant in developed countries (USA), allowing produce to reach foreign ports in less time, with the same quality and at reduced costs.

Trejo points out that Chilean horticulture, as long as it did not incorporate technological advances in production, harvest and in post-harvest, remained far from the foreign markets trading circuits and with quality problems preventing its access to distribution channels.

— Technological innovation in the production of quality fruits and vegetables

The role of technology is vital in production, harvest and post-harvest processes. Technology applied to production aims at obtaining produce with a certain quality, with all peripheral actions pooled to preserve, maintain and upgrade/maximize the quality attributes of the produce obtained.

Production technologies rendering possible different varieties, more diversified produce, improved yields, reduced quality losses from pathogens, using fewer chemicals and improved nutritional value are essential for a more dynamic offer of fresh produce.

Genetic engineering exemplifies how technology contributes to improving quality of carrots and tomatoes with higher contents of carotenoids and vitamin A; of melons with higher contents of sugar; and pineapples with higher levels of ascorbic acid, carotenoids and sugars.

Seen from post-harvest, genetic engineering has resulted in varieties of tomatoes and onions with longer post-harvest lives.

Once quality is obtained, concerns shifts to post-harvest processes and marketing logistics to maintain the quality and safety of fresh produce.
— **Optimization of the logistic process through post-harvest technology**

Logistics works for the client. From a logistical standpoint, efficiency means delivery to meet the client’s specifications.

Logistics entails transporting produce produced under good quality conditions and delivering this produce with good quality, in the required time and with optimized costs. With low quality produce, no matter how efficient logistics may be, the customer gets poor quality.

Some technological advances in post-harvesting have resulted in significant gains in logistics: for example, improvements in transport allowed exports of fruits with special temperatures and humidity in standardized packages, resulting in increased amounts being shipped. Time involved in logistics has also been reduced, resulting in higher efficiency in selection, classification, and optimization of loading and unloading.

Reduced times and more efficient operations result in quality produce reaching the consumer.

— **Post-harvest technology is essential to maintain quality and safety of horticultural produce**

The perishable condition of fresh fruits and vegetables calls for specific handling of produce once harvested and for additional precautions resulting from the higher susceptibility to both qualitative and quantitative losses. The former, harder to assess than quantitative losses, result in losses of nutritional and caloric values and, in general, in acceptability by the consumers. Post-harvest losses, depending on the produce and the way it is handled, may vary widely. Some estimates conclude that one-third of the world production of horticultural produce is not consumed.2

Therefore, innovations are fundamental for maintenance of quality and safety during post-harvest, with objective harvest indices, optimization of harvesting techniques and tools, optimization of more functional selections, classification, and packaging systems, fast cooling systems, standardization of packaging, improving the cold storage systems and transport of produce protected with canvas and thermal tents.

For example, post-harvest treatments to reduce water losses, such as curing, waxing, or plastic films; use of 1-MCP to reduce ethylene spoilage; use of hot water and steam for fungi and plant diseases are opportunities provided by post-harvest technologies to maintain quality and safety throughout the chain.

— **Post-harvest technology as a tool to access up-grade markets**

Post-harvest technology is a tool allowing access of horticulture produce to diversified import markets. Phitosanitary problems, such as the fruit flea, preclude many export products from developing countries to access developed markets. Appropriate quarantine post-harvest procedures such as refrigeration, steam treatments, hot water treatments and even irradiation, however, open new opportunities.

In the 1950s, advances in transport, permitting larger volumes of produce to be placed in far away markets, expanded trade. More recently, new opportunities were opened by modified atmospheres (combining often, not only control systems for CO2, Oxygen and Nitrogen, but systems to monitor levels of relative humidity and ethylene), essential in the maturation and senescence of fresh fruits and vegetables, extended post-harvest life by reducing the influence of factors associated in producing decay.

The increasing adoption of safety standards and regulations by importing markets is coupled with important advances in reducing microbiological contamination, for example: use of ozone as post-harvest treatment for vegetables, increasing efficiency in water disinfectants in post-harvest processing, research in irradiation to reduce risks of microbiological contamination, etc. These technologies open new trade opportunities.

— **Post-harvest technology as a tool for product differentiation**

With increasing competitive and concentrated markets, more important becomes the introduction of systems and technologies to manufacture produce differentiated by their presentation for positioning in these markets.

Each year, the USA market has more than 20 000 new products. An average store handles more than 5 000 products, with more than 500 in fruits and vegetables alone. Producing differentiated products is made clear by customers allowing only one-eighth of a second of their time for each product (Robbins, 2002). Innovations from vacuum packaging, modified

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atmospheres, controlled atmospheres, pasteurization, post pasteurization and sterilization contribute to differentiate the product, maintain quality and safety and offer longer post-harvest lives, all essential requisites to access high-value markets.

— Conclusions

The production of high quality fruits and vegetables and the maintenance and enhancement of this quality in post-harvest and distribution operations is associated with careful incorporation of technologies applied throughout the production, harvesting and post-harvesting stages. These technologies are crucial to ensure quality and safety. For small-scale producers, or when ready supplies of water and electricity are not available, simple alternative solutions should be considered. The principle is not to use sophisticated technologies, but to handle efficiently the produce throughout the chain. Only in this way will quality and safety be maintained and post-harvest losses be reduced.

These concerted efforts to use post-harvest technologies result in internationally competitive horticultural produce, traded in markets requiring continuous innovations and comparative advantages.
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Post harvest Infrastructure</td>
<td></td>
</tr>
<tr>
<td>2. Research and technological developments in post harvest</td>
<td></td>
</tr>
<tr>
<td>3. Availability and access to technological information on post harvest</td>
<td></td>
</tr>
<tr>
<td>4. Training and technical support programmes</td>
<td></td>
</tr>
<tr>
<td>5. Governmental programmes and policies to address post harvest issues</td>
<td></td>
</tr>
<tr>
<td>6. Understanding by the actors of the importance of appropriate logistics and post harvest handling to assure quality and safety of fresh produce</td>
<td></td>
</tr>
</tbody>
</table>
Activity 2. Guidelines for action plans to maintain the quality of fresh fruits and vegetables

GUIDELINES FOR TRAINERS

The trainer stresses the importance of post-harvest handling and the objectives that appropriate programs and actions will accomplish.

Material 3.7 allows the trainer to make general remarks on implementing an action plan to maintain quality and improve the post-harvest handling of fruits and vegetables. Presentation 3.3 works through a case study with the assistance of appropriate material (Material 3.8).

Doubts and concepts are clarified in a plenary session, followed by conclusions by the trainer stressing the advantages of using methodologies based on hazard analysis to address quality maintenance of fresh fruits and vegetables and the need to use a holistic and multidisciplinary approach in these matters.

MATERIAL 3.7 REFERENCE READING. GUIDELINES FOR AN ACTION PLAN FOR QUALITY MAINTENANCE AND ENHANCEMENT AND FOR IMPROVING THE EFFICIENCY OF POST-HARVEST HANDLING SYSTEMS FOR FRESH FRUITS AND VEGETABLES

BACKGROUND INFORMATION

Quality assurance of horticultural produce allows customers access to products satisfying their expectations. Quality assurance and safety of horticultural produce starts at the very moment when varieties fulfilling the consumers expectations and those of other actors in the chain are selected according to taste, nutritional value, texture, post-harvest life, perishability rate, etc.

Quality and safety assurance programmes should be directed towards the market and not towards the product, and should answer questions such as:

What does the consumer want? How much is the consumer willing to pay for the product? Can the volumes required by the customer be delivered on time, with the required quality and at an adequate price?

Quality assurance and safety also involves, among other factors, a systematic planning incorporating people, product, production systems and procedures, the market and the post-harvest infrastructure available.

It is important to state that no post-harvest technologies can improve the quality of a harvested produce not fulfilling the requirements of a particular market. Post-harvest life, however, can be maintained and extended by optimized handling, with reduced damages, etc.

The adequate post-harvest handling of fresh fruits and vegetables must account for the cultural, economic, technological, environmental and administrative context of the target market. On the other hand, the objectives of efficient post-harvest processes and of quality improvement and safety programmes must conform to the needs of the actors along the product handling sequence. Any action plan must incorporate and direct this multiplicity of objectives in such a way that the requisites of all involved are considered.

Objectives of post-harvest technologies for products include:

- maintaining the quality and safety to fulfil the needs of the intended market;
- creating and capturing market opportunities;
- adding value and increasing income and profit;
- satisfying the customer;
- reducing costs and making processing more efficient.

These objectives can be addressed at a:

- country and governmental level;
- regional level;
- local level;
- company level (farm, trader, exporter, services, etc.).
As a result of these objectives, country and local projects and programs may result, and/or specific company directed action plans and projects for a product or a group of products.

Maintaining and enhancing quality of fresh fruits and vegetables entails:

- knowing the order of magnitude of problems likely to occur (losses in quality and quantity), their causes and opportunities to differentiate a product to comply with the requirements of a particular market;
- finding solutions to problems and available technologies to secure already identified market opportunities;
- assessing the impact of simple changes in product handling;
- training and involving the people responsible for these changes;
- identifying problems requiring more detailed research.

**GUIDELINES FOR ACTION PLANS TO MAINTAIN THE QUALITY OF FRESH FRUITS AND VEGETABLES**

Guidelines are given to maintain the quality and optimize post-harvest handling systems. These guidelines apply hazard analysis associated to product quality.

— *Preparing an Action Plan*

**Step 1. Assemble a team to develop the plan and assist in its implementation**

A multidisciplinary team is called for to attend to the complexities in products, processes and actors involved along the chain and to identify quality related problems and opportunities, as well as feasible and integrated solutions adapted to local conditions.

Some solutions to quality losses will require farmers and entrepreneurs, others transport agents and package manufacturers, still others the resources of research institutions with innovative solutions and suitable technologies. Therefore, the support of different players is required for the plan to succeed, even if leadership should fall in a small group of people.

The team will clearly define the objectives of the Action Plan:

a. **What is intended?** For example, one or several of the following objectives:

- improving process efficiency, optimizing steps;
- extending post-harvest life of the product;
- differentiating the product to attend the needs of a specific market;
- reducing quality and physical losses and maintaining the quality and safety of the product.

b. **For what product or products?** Fresh fruits and vegetables are perishable, some more than others, and show different physiological behavior during maturation and senescence rendering them more susceptible to adverse handling. Knowing this behavior allows choosing the technological alternatives to achieve the objectives of adequate post-harvest handling.

c. **Where?, at a company, in a region, nationally, etc.?**

d. **In what stages of the process are the improvements implemented, during harvest, while making the product suitable for packaging, etc.?**

It is essential to define the target market and the expectations resulting from quality (product standards, production standards and handling standards) to be met, since all quality maintenance and enhancement programs point to the customer satisfaction.

It is also necessary to have clear references on what hazards must be considered. That is, those quality hazards preventing conformance to a specific standard. This implies reference to legislation, consumer requirements, specific industry and market standards, a registry of claims and recalls pointing out the more relevant and frequent hazards.

For fresh fruits and vegetables, losses are in the first place related to biological, chemical, mechanical and physiological reasons. Secondary causes result, mainly, from inappropriate handling in post-harvest.

The team will also be involved in identifying the post-harvest technologies used, land tenure structure, farmers involved, etc., as a reference when approaching answers to problems and when dealing with strategies to secure identified opportunities.
**Step 2. Flow diagram and in situ confirmation**

Steps leading from harvest to final consumer must be adequately identified in order to know what improvements can be introduced. Additionally – whenever possible – players, times involved and activities developed to access the target market should also be identified. The flow diagram must furnish enough technical information to design the plan, following logical sequences and ensuring that all steps are included.

**Step 3. Identifying hazards resulting in quality losses and establishing control measures**

The following step is identifying hazards responsible (associated damages) for quality losses and nonconformance to standards or quality specifications for the target market, at each stage of the process.

The team developing the plan describes each step in the process, pointing out, according to their experience, the various strengths and weaknesses associated to quality maintenance and efficiency. Material 3.8, Table 1.

Each problem and hazard resulting directly in quality losses (i.e. mechanical damage) or indirectly (i.e. long delays during processing) is studied as shown in Material 3.8, Table 2.

While identifying hazards associated to process steps, the team should consider:

- taking into account the views of the players in the chain;
- review available information on, for example, records of exporting companies on qualities produced and traded, losses and percentage of recalls, to assist in identifying hazards and on appropriate control measures.

Once the problems (associated hazards) are identified, appropriate prevention/control measures need to be established.

Some measures will result from training workers, transport personnel, traders, etc., while others imply adopting available and proven technologies and techniques (see Presentation 3.1). Sometimes the resources of research institutions with suitable technologies and/or information will be required.

At critical stages, where it is necessary to enforce hazard prevention and control measures, consideration should be given to their implementation in the short, medium and long term, allowing for available technical and financial resources and technological responses. Recommendations to optimize technologies should be backed by analysis of costs and benefits, pointing out clearly the technologies to be adopted and to the resulting benefits.

**Step 4. Prioritizing control points**

Once agreement has been reached to define the problems and their likely solutions, priority must be given to those steps in the process where control measures to prevent, reduce or eliminate a hazard should be introduced.

In general, problems associated with inadequate post-harvest handling are accumulative and seldom one single control measure on a specific point of the process will help to control hazards (e.g. mechanical hazards). Nevertheless, it is important to identify steps where control methods will significantly influence the prevention, reduction or elimination of associated hazards.

The order of magnitude of the identified hazard is important when control points are being prioritized; for instance, estimates of quality losses, physical losses associated with mechanical spoilage and other physical and physiological damages. (see Case Study, Material 3.8).

**Step 5. Identifying acceptance levels**

For fresh fruits and vegetables acceptance levels apply for quality criteria and size, and according to the quality standard adopted by the target market, different levels of tolerance may be acceptable.

For defects in fruits (mechanical damages), tolerance levels depend on the established quality classes. For other hazards, e.g. pests or diseases, abnormal smells or tastes endangering the safety or the aptitude for use as a fresh produce (section on the standard dealing with minimum requirements, Material 3.4), tolerance zero applies and adequate measures should be enforced to prevent such hazards.

Levels of tolerance or of acceptability for nonconformance with some quality requirements are therefore associated to the expectations of the intended target market. If this is an export market, efforts should be channeled to produce export...
quality fruits and vegetables that enable maintaining this quality, with adequate handling, through harvesting and post-harvesting.

For the defined control points, levels of acceptance must be established to monitor the efficiency of the operation: for example an optimum range for refrigeration temperatures (to avoid damages resulting from excessive cold or freezing or from excessive heat on the post-harvest life) should temperatures run out of control.

Implementation follows, once these measures are defined in the short, medium and long term for the different stages:

- training plan for workers;
- plans for implementing selection and sorting in the fields;
- plan to optimize drying.

Available human and financial resources are evaluated (both entrepreneurial and institutional) and a responsible individual and time frame are agreed.

— Implementing the Action Plan

The following points should be considered in executing the Action Plan:

- Establish a system to follow up the actions envisaged in the Action Plan.
- Agree on the measures to be taken should the Action Plan not give the expected results (corrective measures) because of low efficiency of the control methods implemented.
- Agree on a verification process.
- Keep all documents and records.
- Agree on strategies to secure the commitment and involvement of all actors in applying the Plan.
- Adjust the Plan when necessary.

Step 6. Establish a follow-up system

To assess the effectiveness of control measures, a simple follow-up system, easy to use by the players, should be put in place. A responsible individual is needed for collecting data, overseeing collection frequency and take action in case the objectives of the Plan are not met.

Examples of follow up for product quality are: records describing qualities delivered, percentage of rejects, reasons for rejection, reviewing process temperatures, records of selection and grading equipment, records of training, drying times and temperatures.

Step 7. Establish a Corrective Plan

Corrective actions are required whenever the goals in the Plan are not met. To assure success, measures such as improved training for workers and transport personnel, reviewing temperature control systems, storage conditions, logistics of handling the product and waiting times are required throughout the implementation of the Plan.

Step 8. Documents and records

For proper evaluation of the Plan it is required that all records be kept. This is also a precondition for certification, should this be part of the plan.

Step 9. Evaluation and refocusing of the Plan

In the highly changing and dynamic horticultural sector the two-fold purpose of satisfying the customer and making profit should be met. Therefore, market opportunities and product differentiation through post-harvest technologies entail a continuous need to reroute quality assurance and safety plans and to redefine strategies along with the changing requirements of the markets.

The goal of quality assurance and safety is to satisfy the needs of the customers while making profits efficiently through adaptability, change and innovation.
REFERENCE DOCUMENTS


**Kadel, A. and Rolle, R.** (Sin publicar). The role of post-harvest management in assuring the quality and safety of horticultural crops. Documento Borrador. Organización de Las Naciones Unidas para La Agricultura y La Alimentación, FAO.


**Trejo, P.** 1997. Patrones Tecnológicos en la Hortifruticultura Chilena. UNCTDA, División de Desarrollo Productivo y Empresarial, Santiago de Chile, Chile.
— Preparing the Action Plan

Step 1. Team

- Team of post-harvest technologists.
- Technologist specialized in handling horticultural produce.

Support from producers, exporters, research and development institutes, academia, etc.

Staff members from participating institutes meet to analyse results.

Defining the scope

a. Objective: Assure the quality of Physalis, throughout harvesting and post-harvesting, by improving the efficiency of the post-harvest handling systems, to meet the growing demand in international markets.

Hazards associated with quality losses were evaluated against Codex Alimentarius Standard 226-2001, establishing:

Minimum trade requirements

- Fruits must be whole (Shape).
- Fruits must have the characteristic spherical shape (Shape).
- Color of the fruits must be uniform, according to the maturity specified in the color tables (Uniformity).
- Fruits must be fresh in appearance and with a firm consistency, skin must be smooth and shiny (Appearance/Consistency).
- Fruits must be healthy, free from insects and/or diseases diminishing the internal quality (Pathological damage/insects).
- Fruits must be free from any abnormal external moisture resulting from mishandling in post-harvest (harvest, collection, sorting, grading, adaptation, packaging, storage and transport) (Appearance).
- Must be free from foreign matters (soil, dust, agrochemicals and others), visible in the product or package (Physical/chemical contamination).
- Length of the peduncle must be less than 25 mm (Avoid mechanical damages).

Classification: is traded with or without calyx (outside leaves protecting the fruit). Regardless of size and color, is classified in three classes:

- Extra Class: produce must conform to all general requirements and be free of defects affecting quality. The calyx may have defects in coloration resulting from moisture and/or fungi (absent). The whole of these defects must be below 5 percent of the total area of the fruit.

* Source of the data “Evaluation of post-harvest losses for physalis (Cape gooseberry)”. Agreement CIAL-SENA-CENICAFE, Colombia (2001-2002). The data were adapted by FAO to illustrate the application of a HACCP approach methodology to implement action plans to improve the quality of horticultural products.
• Class I: produce must conform to all general requirements and must be free of defects affecting quality, to be traded. The calyx may have defects in coloration resulting from moisture and/or fungi (absent). The whole of these defects must be below 10 percent of the total area of the fruit.
• Class II: any produce not qualifying for the other two categories, but complying with the general requirements for trading. Fruits with healed cracks over 5 percent of total area are not permissible. The calyx may have defects in coloration resulting from moisture and/or fungi (absent). The whole of these defects must be below 20 percent of the total area of the fruit.

b. Produce characteristics:

**Physiology:** from a physiological standpoint, Physalis shows an intermediate behavior, with increased respiration during ripening of climacteric fruits. Nevertheless, before its actual physiological nature is defined, ethylene production should be studied.

**Production periods:** Physalis is grown by small farmers, in surfaces not exceeding 2 ha, using quite conventional technologies. Even if harvest takes place all year long, peaks in harvesting occur in October-November.

**Handling the produce:** has a relatively low perishability, allowing for greater flexibility in harvesting. For export, Physalis comes with calyx, index of maturity at harvest time ranges between degree 3 and 5, adaptation processes are basically by hand (sorting and grading), packaging in dried cardboard boxes, transport to ports and loading. Most exports are by plane, although with growing demand, sea shipping is increasing.

c. Determining hazards associated to quality impairment

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Fruit</th>
<th>Calyx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological:</td>
<td>Heliothis (insect)</td>
<td>Diseases (fungi)</td>
</tr>
<tr>
<td></td>
<td>Diseased (Cercospora and other fungi)</td>
<td>Insect</td>
</tr>
<tr>
<td>Mechanical:</td>
<td>Bruised</td>
<td>Broken Loose</td>
</tr>
<tr>
<td>Physical:</td>
<td>Freeze damage</td>
<td>Transparent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spotted</td>
</tr>
<tr>
<td>Chemical:</td>
<td>Evidence of chemical residues</td>
<td>Evidence of chemical residues</td>
</tr>
<tr>
<td>Physiological:</td>
<td>Small</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td>Defective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Healed cracks</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Estudio- Evaluación de pérdidas poscosecha de Physalis. SENA - CIAL - CENICAFe (2002).*

**Step 2. Preparing a Process diagram:**

The process diagram summarizes the flows in post-harvest handling of produce to meet the export markets requirements.
**Step 3. Identifying hazards resulting in quality losses of produce during harvest and post-harvest and defining control measures**

The process diagram in Table 1 describes the process and operations, pointing to strengths and weaknesses that might result in hazards and quality losses in the end product.

The process diagram allows for the ready identification of significant process hazards, resulting in quality impairment and losses.

Answers to these hazards may be grouped into training (for workers, producers and other agents in the chain), technology (adoption, transfer and adaptation) and applied research (solutions not yet available). Table 2 shows results obtained.

Some answers may not be available (such as results from applied research) and a distinction should be made between preventive and control measures applicable in the short and medium term, and measures resulting from efforts made by institutions outside the enterprise concerned, enforceable only in the long term.

**Step 4. Prioritizing control points**

Both Tables 1 and 2 are rich in qualitative information. However, to prioritize those points along the process where control measures are necessary, quantitative information, assessing the actual magnitude of the hazard resulting in quality losses, is required.

Data on quality categories produced: Estimates show that at roadside collection, 60 percent of the fruit produced belongs to class extra and the remaining two 30.3 percent to classes I and II. However, after reclassification, 17 percent is downgraded from extra to I and II as a result of mechanical damage (bruises) and the amount of very small fruits.

Likewise, 5.8 percent of the fruit harvested remains out of the chain, discarded at the farm and resulting from:

- 45.6% have healed cracks
- 9.1% are split, bruised, etc. ( mishandled)
- 16.6% maturity index (green fruits)
- 19.6% biological damages (basically fungi: Cercospora sp.)

Why does fruit not meet the requirements for class extra?

Physiological damage: 10 percent fruit damages (split fruits) and 26 percent calyx damages.

Inadequate handling: 35 percent on fruits and 18 percent calyx. Inadequate maturity index: 20 percent green and over-ripe fruits.

Biological damages: particularly significant in the calyx up to 28 percent.

Some 8 percent of losses from inadequate handling result from a dirty calyx.

This reference data allow deciding the short-, medium- and long-term solutions to enforce and the proper follow-up actions to take.

The action plan could, for example, prioritize – in the first place – training to reduce losses associated with inadequate handling, while contemplating adding more costly and complex answers.

Table 2 shows that measures conducive to sorting out the following points are critical and should be prioritized to enhance the efficiency of the handling chain to meet the quality requirements of the target market:

- reduce mechanical damage optimizing the process diagram;
- reduce rejects not meeting the maturity requirements;
- reduce biological hazards (implementing post-harvest measures, Integrated Crop Management, ICM and Integrated Pest Management, IPM);
- reduce cracked fruits.
Step 5. Acceptance levels

According to Codex Alimentarius Standard 226-2001 regarding tolerances for size and classes.

Implementing the Action Plan: Some measures of the action plan shown on Table 2 concern training to optimize produce handling. Presentation 3.3 exemplifies a post-harvest training program for workers.

- Likewise, in order to implement hazard reducing actions, public and private support will be required to:
  - assess the climacteric nature of the fruit;
  - assess the relation, under different temperatures, between maturity and post-harvest life;
  - assess post-harvest factors bearing on split fruits;
  - standardize packaging and harvest containers;
  - assess potential zones for different crops (seasonality);
  - research into integrated handling systems to reduce phytosanitary problems.

Step 6. Follow-up and verification

Records should become available in the field and in packaging with enough data to verify the efficiency of the control measures in place. Presentation 3.6 illustrates this.

Step 7. Corrective actions

Strengthened relations are to be expected, in the short term, among the players along the chain resulting in continuous feedback between producers, exporters and support institutions. This will allow for timely corrective actions when the quality improvement targets are not being met for produce selected for export markets. Corrective actions may be: revise data gathering, strengthen training, increase technology transfers, etc.

Step 8. Evaluation and refocusing of the plan

The entrepreneurs will continually evaluate that the objectives of the action plan are met (monitoring records and customer complaints and using other validation procedures) and introduce any required adjustment responding to the market’s signals and opportunities. For example, quarentenary treatments are currently studied to place products into potential markets now closed. This will surely result in adjusting post-harvest processes and redirecting marketing strategies.
FLOW DIAGRAM: PHYSALIS/GOOSEBERRY

Section III

Improving the quality and safety of fresh fruits and vegetables: a practical approach manual for trainers

3 - 27
SECTION IV
Applying food safety principles to the fresh fruits and vegetables chain
Applying food safety principles to the fresh fruits and vegetables chain

Objectives

- Provide a clear understanding of the safety concept as applied to production and trade of fresh fruits and vegetables
- Provide practical guidance to assure safety of fresh fruits and vegetables throughout the chain

Contents

- Part I. Introduction.
  The concepts of quality and safety in production methods and post-harvest handling methods for fresh fruits and vegetables.
  Standards and other food safety documents
- Part II. Programs for safety assurance of fresh fruits and vegetables. Prerequisite programs: concepts, application (GAP, GMP, GHP, etc.).
  The concept of HACCP as applied to the production and post-harvest chain of fresh fruits and vegetables

Activities

- Part I
  Activity 1. Importance of safety in horticulture: implications for demand and trade
  Activity 2. Codex Food Safety Standards
- Part II
  Activity 1. Hazard analysis in production and post-harvest handling of fresh fruits and vegetables
  Activity 2. Hazard identification and control measures. Field visit
SECTION IV. Applying food safety principles to the fresh fruits and vegetables chain

GENERAL INFORMATION

OBJECTIVES

• Provide a clear understanding of the safety concept as applied to production and trade of fresh fruits and vegetables.
• Provide practical guidance to assure safety of fresh fruits and vegetables throughout the production and post-harvest chain.

CONTENTS

This section covers:

• concept and importance of safety in horticulture;
• chemical, physical and biological hazard identification;
• legislation in food safety;
• prerequisite programs: concepts, examples (GAP, GMP, GHP, etc.);
• the HACCP approach applied to the production and post-harvest handling chain of fresh fruits and vegetables.

TIME FRAME

20 hours

METHODOLOGY

The trainer conducts workshops, team work and field visits.

PLAN

Section IV has two parts. The first is introductory, the trainer defining the relevance of the concept of safety, illustrating with cases of chemical and, mainly, microbiological contamination in horticulture. A case study shows the consequences on demand and trade of problems resulting from food contamination. Codex standards (codes of practice and other documents) concerning safety assurance for fresh fruits and vegetables are also studied.

Part II gives guidelines to implement safety assurance programs for fresh fruits and vegetables. The trainer points out the relevance of implementing safety assurance programs, including prerequisite programs and the HACCP system. With practical exercises, the trainer demonstrates the HACCP approach for safety assurance, applied to horticulture produce, followed by a case study and field visits.

EXPECTED RESULTS

Participants will:

• have a clear understanding of the concept and relevance of safety in horticulture and the risks for produce safety throughout the production and post-harvest chain;
• identify the relevance of applying the general principles of food hygiene, Codex standards of practice and other relevant documents relating to safety of fresh fruits and vegetables;
• have clear guidelines to apply safety assurance programs in horticulture.

TRAINING MATERIAL

Material 4.1 Case study. Importance of safety in horticulture: implications for demand and trade.
Material 4.2 Reference reading. Importance of food safety in horticulture.
Material 4.3 Worksheet. Codex Food Safety Standards.
Material 4.4 Worksheet. Supplementary standards.
Material 4.5 Reference reading. Programs for safety assurance of fresh fruits and vegetables.
Material 4.6 Hazard analysis in production and post-harvest handling of fresh fruits and vegetables.
Material 4.7 Case study. Action plan to assure safety of Physalis (Cape gooseberry) as fresh produce for export markets.
Material 4.8 Reference reading. Guidelines for action plans to assure safety of fresh fruits and vegetables.
Material 4.9 Hazard identification and control measures. Field visit.
Part I. Introduction

Activity 1. Importance of safety in horticulture: implications for demand and trade

GUIDELINES FOR TRAINERS

The trainer introduces the concept of safety, the impact of contamination in fresh fruits and vegetables (with examples) and the implications on the overall demand and produce trade (Presentation 4.1). Participants should become involved in the brainstorming and in the questions/answers approach.

Material 4.1, relating to fresh produce contamination, concludes the section assessing impact on consumers, exporting countries and trade in general.

Material 4.2, assists the trainer in developing the item.

MATERIAL 4.1 CASE STUDY CYCLOSPORA CONTAMINATION OF GUATEMALAN RASPBERRIES EXPORTED TO UNITED STATES AND CANADIAN MARKETS

— Background information:

In 1995/1996, Guatemala was the major supplier of raspberries to the United States, with sustained growth in production for this market. In 1996, contamination with Cyclospora, affecting 1,465 people in the USA and Canada was reported (Herwaldt and Ackers, 1997). Californian raspberries were initially blamed, resulting in US$20 million to US$40 million sales losses. Subsequently, Guatemalan raspberries were identified as responsible by the US Center for Disease Control and Prevention. After a new outbreak in 1997, exports from Guatemala to the USA market were preventively stopped and the USA government published in 1998 an alert on these raspberries. Canada, another significant market, followed a ban on imports after an outbreak on 305 people in Toronto in 1990.

— Response of Guatemala:

Guatemala’s Exporters Association, with government support, began evaluating, together with the US Food and Drug Administration, possible answers. All producing farms were surveyed for possible contamination risks and an Excellence Model Plan was enforced to assure safety from the producing area to the importing country port of entrance. This plan was backed up by the importing countries’ food surveillance agencies, the government, supermarkets, exporters, producers, etc. The plan provides for training inspecting personnel, strengthening inspection and farm qualification systems, analytical procedures (clinical and microbiological laboratories), traceability plans and good agricultural and manufacturing practices.

— Consequences:

— For the importing country:

In 1999, the USA again allowed imports of raspberries from Guatemala as a result of the approval of the safety assurance program implemented. Estimated losses of some US$10 million for producers and exporters resulted from closed markets. Current demand is only one-third of that before the outbreaks (Calvin et al., 2000) with the Canadian market still closed. Calvin et al., 2000 also report a significant reduction in the number of producers, following the crisis.
— **For competing countries:**

Mexico, in particular, benefited from the situation, becoming the leading exporter, while the safety assurance plan was enforced and exports were closed for Guatemala.

— **For demand:**

With the outbreak, demand for all berries, and raspberries in particular, diminished. Once Guatemalan berries were identified as causing the outbreak, demand for other Guatemalan produce also decreased. raspberries, no matter its origin showed a slowdown. Even if the situation has now been overcome, consumer’s confidence in Guatemalan raspberries and other produce is yet to be restored and even if evolving slowly, some buyers are adamant. (Calvin et al., 2000).

**Source:**


**QUESTIONS TO PARTICIPANTS**

1. What lessons can be learned on demand and trade in general from the case study presented?

**Answers**

- Consumers’ perceptions on the potential contamination risks of imported produce were enhanced as a consequence of the outbreak.
- Consumers’ perceptions on produce contamination risks changed their tastes and preferences. Besides the quality attributes of raspberries, consumers now associate raspberries to high risk of contamination potential, and consequently a health damaging capacity. Changes in taste and preferences dictate what the country wants (Cyclospora free blackberries) and what imported produce the country will accept (for example: produce from Cyclospora free areas).
- Consumers’ and buyers’ confidence in importing markets that an exporting country will produce healthy products in general and raspberries in particular, recovers only slowly, leaving a lasting impact on demand and trade in general.
- Industries involved in these situations (either by rumor, association or directly) may become economically vulnerable. Countries may respond to risks differently (i.e. the responses of the USA and Canada), while consumption and trade may find substitute produce or alternative supplying countries.
- The need for safety assurance programs, not addressing the contamination situation after it happens, but reducing as much as possible the risk of contaminated produce by prevention and control, becomes evident.

**MATERIAL 4.2 REFERENCE READING FOR TRAINER. “IMPORTANCE OF FOOD SAFETY IN HORTICULTURE”**

— **The concept:**

Food safety may be defined as the assurance that food will not cause harm to the consumer when it is prepared or eaten according to its intended use. (FAO/WHO, 1997). This guarantee means reducing risks that may result from the production and handling of produce.

Public concern about food safety has increased dramatically in the last years as a result of food-borne diseases. The World Health Organization (WHO, 1999) estimates in the hundreds of millions the number of people suffering from diseases resulting from contaminated food or water. Even if reporting this data is difficult, statistics show that both in developed and developing countries, food-borne diseases are rising (resulting from more trustable reporting of data and occurrence). In developed countries, more than 30 percent of the population suffers every year from food-borne diseases, with 70 percent of worldwide diarrhea resulting from biological contamination of foods. Contaminated food is also responsible for cholera, which together with various types of diarrhea, contributes significantly to malnutrition problems. Incidence of food borne diseases can be 300 to 350 times higher than that actually reported worldwide. Not all diseases resulting from contaminated food become evident as intestinal difficulties, *Clostridium botulinum* causes severe cerebral paralysis, usually terminal. Effects of *Listeria monocytogenes* range from influenza to meningitis and meningo-encephalytis. This micro-
organism is particularly relevant to pregnant women, with infections leading to abortion, intrauterine death or premature births; while infections for individuals with immunodeficiency may result in severe diseases and even death (WHO, 1999).

Risks associated to chemical contaminated foods, such as pesticide residues, although less dramatic and immediate in their outcome, are a permanent concern for customers. With enhanced awareness of the presence of pesticides in fresh fruits and vegetables resulting in occasional intoxications, their long-term effect is important. Agrochemical intoxication of workers and infants is a risk associated with their use, with scientific evidence pointing to other direct and indirect risks. Pesticides residues, throughout the food chain, resulted in reduced pelican and eagle populations. Toxicological research shows pesticides to be responsible for cancer and birth defects and for damaging the interphase between the nervous, endocrine, reproductive and immunological system in mammals.

--- Diseases caused by fresh fruits and vegetables:

Even if the figures for diseases resulting from fresh produce are low (in 1996 only 6 out of some 200 UK reports on diseases were associated to consumption of fruits and vegetables), increased consumption results in rising incidence. For example, for the USA (Guzewich and Salisbury, 2000) report 2 percent (from 1973 to 1979) and 6 percent (from 1990 to 1997) of outbreaks associated to fresh agricultural produce. Some outbreaks concern imported produce. Nevertheless, food-borne diseases from imports are not larger than those resulting from local crops in the importing countries.

In developing countries, diseases resulting from contaminated fruits and vegetables can be higher in some areas and result in a higher percentage of affected population.

However, many outbreaks are not officially reported and only 2 percent are related to fruits and vegetables in Latin America.

--- Implications:

- Consumers health: outbreaks have a direct effect on consumers health, with vomits, gastroenteritis, diarrhoea, non-intestinal diseases (pathological, premature births and intrauterine deaths, among others) and indirect consequences (lack of confidence resulting in a constantly increasing demand for quality).

- Economical: Economic consequences affect not only individuals but their families, the community, industries and countries. Direct costs result from assistance to the diseased person, while indirect costs impact on absenteeism (both work and school), displacements to receive medical attention, finances, etc. Exporting countries suffer significant losses from contaminated fruits and vegetables. In April 1999, 85 rejects resulting from inspections by the FDA meant important losses for countries in Central America.

- Society: reduced productivity, costs associated to research into the causes of outbreaks, control of outbreaks, wasting of time and legal procedures, costs of public services for chronic sufferers and environmental costs.

Activity 2. Codex Food Safety Standards

GUIDELINES FOR TRAINDERS

The trainer distributes Document 1 and Document 2 to different teams.


Each team reviews these documents, to understand: 1. What is a Code of Practice?

2. What are the main objectives of the Codes of Practice? 3. What is the scope of these codes?
4. How do they complement with other Codex standards and documents?
5. What is the structure of the code?
6. What points should be considered to apply the codes and meet their requirements?

Each team answers the questions in 30 minutes for later discussion in plenary. Trainer uses Material 4.3 (to be handed out later) to conduct the discussion and to clarify doubts. Backed by Material

Answers:

Question 1. What is a Code of Practice?

Voluntary documents, providing general recommendations on practices, operations or specific agricultural products and for hygiene codes of practice, to reduce to a minimum the contamination risks of foods.

Questions 2, 3, 4 and 5

Material 4.3 answers these questions, showing objectives, scope, components, etc.
Material 4.4 explains Codex documentation (shown in red) on food safety issues such pesticide contamination and general recommendations for packaging and transport of fresh fruits and vegetables.

Question 6. What points should be taken into account to apply the codes and meet their requirements?

Considering the diversity of activities and risks associated to food production and in particular for fruits and vegetables to be consumed fresh, codes of practice are flexible enough to encompass different contamination control and prevention systems for diverse products and production procedures. The scope must basically define what is necessary and appropriate both for food safety and for aptitude for consumption. To decide on the appropriateness or necessity of a requirement, a hazard assessment based on the HACCP approach is recommended.

Chapter 2 from Food Quality and Safety Systems: Training Manual on Food Hygiene and HACCP (FAO, 2002) and Presentation 4.2 should be used by trainers to conduct the teams, lead their discussions and elaborate on answers produced.
Section IV

Improving the quality and safety of fresh fruits and vegetables: a practical approach manual for trainers

<table>
<thead>
<tr>
<th>MATERIAL 4.3. CODEX FOOD SAFETY STANDARDS</th>
<th>PRELIMINARY PROJECT: CODE OF PRACTICES FOR THE HYGIENE OF FRESH FRUITS AND VEGETABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OBJECTIVE</strong></td>
<td></td>
</tr>
<tr>
<td>Identify the essential principles of food hygiene throughout the food chain, to achieve the goal of ensuring that food is safe and suitable for human consumption.</td>
<td>Mainly identifies the general principles of hygiene specific for primary production and packaging of fresh fruits and vegetables, resulting in safe products, suitable for human consumption.</td>
</tr>
<tr>
<td>Provide a guidance for specific codes which may be needed for sectors of the food chain.</td>
<td>Provide guidelines to prepare specific codes for specific products and for a country agricultural sector.</td>
</tr>
<tr>
<td>Recommended a HACCP-based approach.</td>
<td>Covers Good Agricultural Practices and Good Manufacturing Practices that will assist controlling the microbiological, chemical and physical hazards associated with production and packaging, emphasizing microbiological hazards.</td>
</tr>
<tr>
<td>Baseline structure for country standards for food processing.</td>
<td>Provides a general framework of recommendations to be implemented uniformly in the sector.</td>
</tr>
<tr>
<td><strong>SCOPE</strong></td>
<td></td>
</tr>
<tr>
<td>The food chain, from primary production to the end consumer, including government, producers, processors, traders, (Annex, Guidelines for the Application of Hazard Analysis and Critical Control Point System (HACCP) to in Appendix I).</td>
<td>Primary production and packaging of fresh fruits and vegetables (Annex preserved fruits or processed seeds),</td>
</tr>
</tbody>
</table>

| PRIMARY PRODUCTION                         |                                                                                   |
| Environment                                |                                                                                   |
| Hygienic production of food sources (inputs) |                                                                                   |
| Handling, storage and transport            |                                                                                   |
| Cleaning, maintenance and personal hygiene |                                                                                   |
| **ESTABLISHING: DESIGN AND FACILITIES**    |                                                                                   |
| Location, premises and rooms, equipment and facilities | Adequate facilities to enable hazards to be effectively controlled.          |
| General recommendations on Good Practices | General recommendations on Good Practices.                                      |
| **CONTROL OF OPERATIONS**                  |                                                                                   |
| Control of food hazards                    |                                                                                   |
| Key topics in hygiene control systems      |                                                                                   |
| Incoming materials requirements            |                                                                                   |
| Packaging                                  |                                                                                   |
| Water management                          |                                                                                   |
| Management and supervision                 |                                                                                   |
| Documentation and records                  |                                                                                   |
| Retail procedures                          |                                                                                   |
| **ESTABLISHMENT: MAINTENANCE AND SANITATION** |                                                                                   |
| Maintenance and cleaning                   |                                                                                   |
| Cleaning programs                          |                                                                                   |
| Pest control systems                       |                                                                                   |
| Waste management                          |                                                                                   |
| Monitoring effectiveness                   |                                                                                   |
| **ESTABLISHMENT: PERSONAL HYGIENE**        |                                                                                   |
| Health status, illness and injury, personal cleanliness, behavior, visitors | To reduce the risk of contamination associated to personal hygiene or diseases in operational personnel. |
| Personal cleanliness                       |                                                                                   |
| **TRANSPORT**                              |                                                                                   |
| General requirements, use and maintenance  |                                                                                   |
| **PRODUCT INFORMATION AND CONSUMER AWARENESS** |                                                                                   |
| Identification, information to consumers   |                                                                                   |
| **TRAINING**                               |                                                                                   |
| Awareness and responsibilities, training programs, instruction and supervision, refreshment training | Increase knowledge of all personnel responsible for production and adaptation on the risks to product safety. |
| Training                                   |                                                                                   |
### Code of Practice for Transport and Packaging of Fresh Fruits and Vegetables

<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>Recommendations to maintain product quality in packaging and transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE</td>
<td>The code recommends transport and packaging procedures for fresh fruits and vegetables to maintain quality throughout transport and marketing</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>Not exclusively a code of hygienic practices, it covers other production topics and its recommendations can be grouped in three categories</td>
</tr>
<tr>
<td></td>
<td>1. Design, conditions and loading methods for transport</td>
</tr>
<tr>
<td></td>
<td>2. Adequate packaging to maintain quality throughout transport and marketing</td>
</tr>
<tr>
<td></td>
<td>3. Prerfrigeration practices</td>
</tr>
</tbody>
</table>

### Code of Conduct for Distribution and Use of Pesticides (CCDUP)

<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>Starting point for developing country programs for pesticide control and to promote the safe and efficient use of pesticides, to minimize their possible effects on people and the environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE</td>
<td>Using CCDUP, farmers and others in primary production commit to comply with practices to protect human health and the environment above any other commercial or economic concerns</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>Emphasizes the responsibilities of governments, manufacturers and users of pesticides to preserve human health and the environment; recommends scientific research to assess residual effects from pesticide use; assess continuously the toxicity of pesticides; produce standards for preparation and use; propose safe measures for handling, storage, transport and distribution; standards for use and preparation; instructions in case of intoxication or accident, coupled with a strong training and extension service to producers in use of pesticides, including danger of death signs on labels, honest publicity restricted to areas where this information is required and unbiased, exchange information between experts, in particular from developed to less developed countries.</td>
</tr>
</tbody>
</table>

### Other Information

- [http://apps.fao.org/cgi-bin/nph-db.pl?subset=FoodQuality](http://apps.fao.org/cgi-bin/nph-db.pl?subset=FoodQuality)
Part II. Programs for safety assurance of fresh fruits and vegetables

Activity 1. Hazard analysis in production and post-harvest handling of fresh fruits and vegetables

GUIDELINES FOR TRAINERS

a. Introduction

Trainers stress the importance of implementing safety assurance programs addressed both to the internal and export markets.

A detailed explanation will follow on the component parts and on the application of fresh fruits and vegetables safety assurance programs, including:

- Prerequisite programs: Good Agricultural Practices, Good Manufacturing Practices, Good Hygiene Practices, and supporting programs such as Standard Operating Procedure and training programs.
- The Hazard Analysis and Critical Control Points system.

Reference reading Material 4.5 and Presentations 4.3, 4.4, 4.5, 4.6 and 4.7 will assist trainers to develop the theoretical foundations.

b. Practical considerations

Participants assemble in teams of no more than 5 persons each, to have enough time to complete the practical exercises.

PART 1. PLANNING ACTIVITIES

1. The trainer invites each group to choose a particular crop in which the group is experienced, both in production and post-harvest handling.
2. Each team goes through steps 1 to 5 of the HACCP system. Time permitting, each group includes field and packaging procedures. If not, some teams cover production and others post-harvest operations. (Worksheets Material 4.6).
3. Each team makes a brief presentation, in less than 5 minutes, of the results of item 2 (above).

PART 2. HAZARD ANALYSIS AND IDENTIFYING CONTROL POINTS

Teams will:
1. Identify hazards associated to activities described in the flow diagram.
2. Identify methods of control for each hazard (including hazard prevention, reduction and elimination methods should the hazard be present).
3. Establish critical control points (if any) or control points relevant for prevention. Prioritize, for each control point, control methods to be implemented.
4. Establish for each control point or for each critical control point, levels of acceptance.
5. Establish corrective measures.
6. Each team presents their results.

The trainer concludes, pointing out the importance of the HACCP approach for safety assurance programs of fresh fruits and vegetables, using the case study handed out: Presentation 4.8 and Material 4.7 to assist participants. Reference Material 4.8 helps trainers in developing the case study.

Questions allow the trainers to evaluate understanding of Part 2.

Required materials

- overheads and dry pens
- worksheets
- data show
- overhead projector

Expected result

Strengthened aptitudes for hazard analysis and for identifying control measures for hazards detected.
Material 4.5 Reference Reading for Trainer. Programs for Safety Assurance of Fresh Fruits and Vegetables

Background Information

No matter where food is produced, consumers expect it to be wholesome. Very few people are responsible for foods produced by themselves and consumers must, therefore, put their trust in producers, distributors, processors and regulators for the safety of foods consumed.

Expected increases in trade of foods in a globalized world as a result of higher incomes, improvements in transport and distribution systems and a growing population demanding nutritious and safe foods, imply:

- new risks of introducing contaminated foods;
- reintroducing previously controlled risks or hazards;
- contaminated foods may result in the spread of diseases worldwide.

Each country has its own health priorities and concerns. Consumer’s perception on food safety risks changes and is influenced by previous experiences with diseases resulting from contaminated products, information on hazards and other related topics. Some societies would regard diarrhoea-causing diseases as normal and naturally occurring and resulting from new teeth in children, eating very spicy foods, indigestion and even superstition, instead of as symptoms of food-borne diseases resulting from the food or its handling. (Buzby, 2001).

Strategies to assure quality and safety rely on guaranteeing and certifying, with processing and production standards, the attributes produce must conform to. This entails verifying that the standards’ provisions are met and conformance made apparent through marks, labels or certifications.

Public and private strategies addressing risk of contamination and their controls may differ from country to country. Public strategies usually direct institutional efforts and regulations to both locally produced and imported foods. For fruits and vegetables, National Codex Committees strive to align national regulations with Codex recommended codes of practice. These codes rely on implementing GAPs, GHPs and GMPs to prevent and control contamination hazards in primary production and post-harvest handling by using the hazard analysis approach.

The objectives of safety assurance programs are to:

- protect local consumers assuring the safety of fruits and vegetables produced and traded;
- enhance confidence of foreign markets on safety of locally produced products;
- assure the acceptance in target markets of the exporters’ national programs and/or protocols;
- increase the offer of safe foods;
- differentiate between private companies assuring safety of their offers.

These objectives apply nationally, regionally, locally, for a group of producers/exporters or at the company level (farm, trading company, service company, etc.) and result in programs, national/local projects, action plans and projects that meet specific company needs for a product or group of products. Implementing quality assurance programs means:

- knowing the hazards, and their causes, associated to production and post-harvest handling of produce;
- understanding that safety assurance is a shared responsibility under the chain approach.

Safety hazards for fresh fruits and vegetables

The production chain for fresh fruits and vegetables has several links: production, harvesting, post-harvest treatments, packaging, transport and storage, each with its own contamination hazards and, depending on size of operations, of production and of processing systems in use. Safety assurance programs identify these hazards throughout the entire produce production and handling chain.

Three different types of hazards can be associated to product safety: biological, chemical and physical (Presentation 4.3). For further information on hazards associated to fresh fruits and vegetables visit: Improving safety and quality of fresh fruits and vegetables: a training manual for trainers. University of Maryland (2002) at the following link http://www.jifsan.umd.edu/gaps.html, or see the complete document listed on the references to this Manual.
Different methods or practices allow for the dissemination of hazards in the production and handling stages.

**Primary production and harvest**

- The environment as contaminant.
- Agricultural inputs (water, soil, organic and chemical fertilizers, etc.).
- Inadequate handling of agrosupplements (mixtures, storage, dosage, etc.).
- People and animals.
- Inappropriate facilities.
- Contaminated tools.
- Production methods, crop-seed quality protection methods, planting distances, fertilizing, irrigation, pests and disease controls, shrub management, etc.

**Post-harvest handling**

- Inadequate facilities.
- Unsuitable packaging.
- Inadequate/contaminated equipment (storage rooms, grading equipment, etc.).
- People and animals.
- Inputs for post-harvesting (washing water, waxes, etc.).

**Programs for quality assurance of fresh fruits and vegetables**

Programs for quality assurance of fresh fruits and vegetables concentrate in identifying hazards, prioritizing their importance according to the risks represented for produce safety and identifying appropriate prevention and control practices.

1. **Prerequisite programs**

Include Good Agricultural Practices, Good Manufacturing Practices and Good Hygienic Practices. These are the backbone for quality assurance and safety programs.

**Good Agricultural Practices**

Include practices improving conventional production and produce handling methods - starting from the selection of the soil to be cultivated - and activities related to production and handling of produce in the field, always stressing SAFETY. Practices also aim at reducing negative impacts of production systems on the environment, fauna, flora and workers’ health. GAP in primary production, relies on hazard identification and detection of appropriate prevention and control practices. Specifically for a farm or a production system, Best Practices should be identified within the Good Practice options as those more suitable for production conditions and the environment in the area and in the farm (Presentation 4.4).

Applying GAP supposes identifying different production hazards, selection of recommended practices avoiding produce contamination, protecting the environment and workers health. Applying GAP relies on the previous implementation of Integrated Crop Management (ICM) and Integrated Pest Management (IPM) programs, pointing to practices producing economically and viable foods, not affecting natural resources (NRI, 2003). Main components for these systems are:

- applying soil conservation and minimum tillage techniques;
- using self-fixing Nitrogen plants, green fertilizers and soil agroforestry conservation techniques;
- integrated pests and diseases control methods (involving cultural, physical, chemical and biological controls);
- crop rotation;
- productive use of plants and animals waste;
- preserving biodiversity;
- minimum use of external inputs and non-renewable energy resources.

To enforce ICM and IPM programs, practical research on pests and diseases biological cycles, infestation levels, propagation ways, economic damage thresholds, most appropriate and effective control practices, etc., is required.

Further information on GAP may be found at: Improving safety and quality of fresh fruits and vegetables: manual for training the trainers. FAO/University of Maryland.
Good Manufacturing Practices

Include practices preventing and controlling post-harvest hazards affecting produce safety and having minimum effect on workers and the environment (Presentation 4.5).

From the chain standpoint, hazard prevention and control in stages previous to production and harvest of produce using GAP are essential to assure success of implementing Good Manufacturing Practices programs. The objective is to ensure that safe raw materials go into the packaging plants with assured safety resulting from using Best Practices in post-harvest handling. Enforcing GMP programs supposes identifying associated hazards in post-harvest handling and suitable preventive and control practices.

Further information can be found at: Improving safety and quality of fresh fruits and vegetables: manual for training the trainers. FAO/University of Maryland.

Good Hygienic Practices

Include all those measures and conditions required to prevent and control produce contamination hazards, mainly biological. In practical terms, the implementation of GAP and GMP (at primary and post-harvest stages) already include all recommendations regarding hygiene practices to produce and handle safe products. (Reference reading: Code of Hygienic Practices for Fresh Fruits and Vegetables).

Good Practices as programs for safety assurance of fresh fruits and vegetables

- Good Practices, as seen from safety assurance programs for fresh fruits and vegetables imply:
- knowing the product’s potential contamination hazards in production and handling;
- prioritizing these dangers (define risk);
- determining prevention and control procedures for each operation (implementing GAP and GMP), for identified and prioritized hazards;
- applying support procedures, standardized sanitary operating procedures (SSOP) and product recall procedures;
- traceability: consumers tracking and information procedures;
- continuous training to different chain players;
- keeping a record and documentation system.

Standard operating procedures (SOPs)

A written, detailed and accessible description for use by personnel explains how each operation in the flow diagram is performed, including cleaning and maintenance procedures. All are known as SOPs.

Operating programs for sanitation and maintenance are put in place to assure that maintenance and sanitation (cleaning) of facilities, tools and equipment, as well as pests’ control and waste handling, are efficiently and appropriately done (Presentation 4.6). These programs include:

a) Procedures and methods for cleaning and disinfection: Cleaning, hygiene and disinfection programs, should be designed considering existing facilities where product production and adaptation is completed, as well as sanitation facilities, offices, equipment, tools, etc., are available. Cleaning programs must include name of responsible person, working schedules, chemicals and concentrations used for cleaning (equipment and facilities), temperature requirements, cleaning and sanitizing procedures, etc.

Non-contaminating products and chemically and microbiologically acceptable water, properly used, must be employed.

b) Pests’ control: Pests are a serious threat affecting safety and life of foods and result in quality losses and increasing chances of food-borne diseases. Programs precluding access, infestation and monitoring for their appearance and eradication are necessary preventive measures.

c) Waste handling or management: Appropriate measures should be taken to remove and store waste and trash produced; these should be absent from areas where fruits and vegetables are handled and stored or from working zones and outlying areas.

d) Monitoring: Procedures checking the efficiency of the maintenance sanitizing systems should be applied and sampling of outlying areas; areas in contact with produce should be implemented and examined regularly to reflect possible
changing conditions. For further information on these procedures see: Recommended International Code of Practice - General Principles of Food Hygiene: *(CAC/RCP 1-1969, Rev.3 1997)*. For practical examples, see *SOP Manual for Melons*.

**e) Recall procedures:** Efficient procedures should be used, allowing for the complete and fast recall from the market of fruits and vegetables showing safety hazards. Until a decision is taken, recalled products should be kept under surveillance to be either destroyed, not used for human consumption or declared safe. See: Recommended International Code of Practice - General Principles of Foods Hygiene: *(CAC/RCP 1 - 1969, Rev.3 1997)*

**f) Training:** To assure the proper implementation of preventive and control measures for identified hazards, the commitment of personnel involved in the process is required as they are responsible for compliance. Success highly depends on the understanding by each of the players in the chain of specifics of food safety and their role in its maintenance. Therefore, training programs aimed at enhancing awareness of the proper application of practices along the processes, are essential and should encompass all actors playing a direct role in production (producers, packing and transport personnel, etc.) and those supporting the chain (technicians, extension workers, researchers, etc.).

Training programs must be periodically updated to ensure that all players are aware of all procedures to maintain safety of fresh fruits and vegetables. It is therefore necessary to articulate efforts between research institutions and the private sector (producers, packing and transport personnel, etc.) to ensure that all are aware of advances in product safety. See: Recommended International Code of Practice - General Principles of Food Hygiene: *(CAC/RCP 1 -1969, Rev.3 1997)*

**Traceability: consumers’ tracking and information procedures**

Traceability is the capacity to identify a product origin: where it was produced, inputs received, tracking post-harvest handling, and through appropriate records, following it along the supply chain. These records must be kept for some time (two years) as proof of its history. In quality and safety assurance programs, traceability allows proving conformance to specific standards.

Traceability, more than just being a label identifying production, origin and price, is a system promoting customer confidence and useful to settle quality and safety disputes (Opara, L. U. Mazaud, F. 2001).

To allow for efficiency, traceability schemes rely on an adequate coordination of the many actors in the production and post-harvest handling chain. Proper information must flow easily from link to link, enabling the adoption of actions resulting in safe handling and storage. Consumers should also have this information available to ensure maintaining the required hygienic and use aptitudes.

**Personnel hygiene**

This is covered by Recommended International Code of Practice - General Principles of Foods Hygiene *(CAC/RCP 1-1969, Rev.3 1997)* and in the Code of Hygiene for Fresh Fruits and Vegetables. Personnel may become a safety risk for fresh fruits and vegetables if they have inadequate personal cleanliness, if they suffer from or carry diseases or have an inadequate personal behavior. Training programs and other measures to avoid contact between produce and personnel representing a safety risk must be enforced. Strategies to improve personal cleanliness (protective clothing, hand washing) and practices promoting adequate behavior at work forbidding eating, smoking or spitting should also be adopted to safeguard safety. These strategies and procedures are usually covered in the general hygiene protocols available in the company/ plant (See: *SOP Manual for Melons*).

**2. Hazards Analysis and Critical Control Points System (HACCP)**

**What is it?** Is a control and systematic recording methodology, originating at the USA food processing company Pillsbury and in the North American Space Administration (NASA) to prevent food contamination in space flights and to avoid the effects of astronauts suffering food poisoning in a space mission. With time, the system evolved into a useful tool for the food processing industry, substituting the old-fashioned quality control systems relying on end product inspection and testing and destroying defective products; for quality assurance procedures where processing and production is adjusted along the way to avoid defective products by anticipation and adoption of prevention and control measures. HACCP performs a detailed analysis of the whole production system to identify physical, chemical and biological hazards and those points where control measures should be applied to minimize or reduce risks to acceptable levels. Steps taken to minimize risks should be properly registered and kept as proof of actions adopted.

**Advantages.** HACCP is applied to food safety management and uses a methodology to identify and control critical
points in food handling, to prevent safety problems. It is science-based and applies a systematic approach, identifying specific hazards and measures for their control to ensure food safety.

**Foundations of HACCP.** HACCP is based on hazard analysis, a series of logical steps to identify and provide answers to potential problems. Hazard analysis is the process of data gathering and evaluation on hazards associated to a particular food and of deciding which are significant and should be approached with a safety assurance program. HACCP consists of:

- analysis of potential hazards in production and post-harvest handling;
- identification of the points where the hazard can take place;
- establishment of the critical points for product safety;
- establishment of effective controls to minimize hazards;
- establishment of a system to monitor critical points;
- review of hazards, hazard analysis, critical points and follow-up records.

Hazard analysis can be simple or very complex depending on the safety assurance program enforced. Sometimes safety programs in primary production and post-harvest result in voluminous records supporting the HACCP system. However, these programs, depending on the scale of primary operations and the producers' resources, must concentrate in applying good practices backed up only by essential records.

**Establishing a HACCP system**

The General Code of Hygiene for Foods. Supplement to Volume 1B–1997, has as an annex document Hazard Analysis and Critical Control Point system (HACCP), guidelines for its application. The document specifies that before applying the HACCP system to any sector of the food chain, it should be working according to the Codex General Principles of Hygiene, relevant Codex Codes of Practice and to legislation relating to food safety. Prior to applying the HACCP system, prerequisite programs (GAP, GMP, GHP, training programs, traceability, standardized sanitary programs, etc.) should be in place.

Establishing a HACCP program relies on the application of the seven HACCP principles:

- Identify the hazards.
- Establish the critical control points (CCPs).
- Establish critical limits (CL) for each CCP.
- Establish a system to monitor control of the CCP.
- Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.
- Establish procedures for verification to confirm the HACCP system is working effectively.
- Establish documentation concerning all procedures and records appropriate to these principles and their application.

Applying these seven principles requires the following 12 steps:

Step 1. Assemble the HACCP team.
Step 2. Product description.
Step 3. Identify intended use of product.
Step 4. Establish a flow diagram.
Step 5. On-site confirmation of flow diagram.
Step 6. List all potential hazards, conduct a hazard analysis and consider any measures to control identified hazards.
Step 7. Establish CCP.
Step 8. Establish critical limits for each CCP.
Step 9. Establish a monitoring system for each CCP.
Step 10. Establish corrective actions.
Step 11. Establish verification procedures.
Step 12. Establish documentation and record keeping.

Steps 1 to 5 are preliminary to the plan, steps 6 to 8 apply the 7 principles and define the plan and steps 9 to 12 support the implementation.

A detailed description of each step can be found in A training manual on food hygiene and the Hazard Analysis and Critical Control Point (HACCP) system, FAO, 2002.

Difficulties defining critical control points and critical limits make HACCP not mandatory for the primary sector.
A critical control point as defined in the HACCP system is a phase in the process where an essential control may be applied to prevent or eliminate a hazard or to reduce this hazard to acceptable levels.

In primary production, for instance, it is not possible to establish just one control ensuring hazard elimination. Internationally, mechanisms establishing barriers along the chain to prevent and control were attempted. These controls, or good practices, together with proactive control and record keeping strive to keep out of the food chain hazards such as physical, chemical and biological contaminants.

For fresh fruits and vegetables, it is also difficult to establish an acceptable level for biological contaminants and efforts are directed to have pathogen free fresh foods. Relatively few steps during processing are addressed at reducing or eliminating biological contamination in already contaminated foods; measures aim at preventing hazards as a result of GAP, GMP and GHP in place.

In post-harvesting, some handling procedures may reduce the occurrence of pathogens: cooling temperatures, thermal processing, irradiation and water sanitizing procedures. But, except for irradiation, there is no guarantee of hazard reduction to acceptable levels, or elimination. New technologies, difficult to access for small producers, are currently being tried.

These constraints should be considered by producers contemplating adoption of a HACCP system. They should always remember that hazard reducing actions (biological in particular) are more preventive than established CCPs.

In any case the systematic approach involved in HACCP (steps in logical sequence, hazard analysis and control points) is valuable to apply safety assurance programs for fresh fruits and vegetables. (Presentation 4.7).

**MATERIAL 4.8 REFERENCE READING FOR TRAINERS. GUIDELINES FOR ACTION PLANS TO ASSURE SAFETY OF FRESH FRUITS AND VEGETABLES**

**Step 1. Assemble the team**

**Remarks**

Diversity in scales of production for fruits and vegetables, regional and local handling practices, the environment, specifics of soils and many other production factors with their various interactions, dictate a multidisciplinary approach to safety assurance.

When considering assembling the HACCP team for a product, candidates conversant with the following should be included:

- determining contamination hazards in primary production systems and available control methods for chemical, physical and biological contaminants;
- knowledge on production and post-harvest systems (local, national and regional);
- experience in implementation of ICM and IPM;
- experience with (principles and practice) of HACCP and GAP, GMP and GHP;
- knowledge of the target market demands on safety;
- experience in technology transfer to producers and others in the chain.

Small teams supported by specific external consultants when required (academia, private consultants, producers, exporters, etc.) must be favoured. The team will produce the plan (collect and evaluate technical data, determine hazards and control points) and conduct its implementation and verification.

A team leader coordinates, suggests changes and makes sure that objectives are accomplished. Sometimes training, in food hygiene in general and for fresh fruits and vegetables in particular, to ensure a common language among all the members of the team may prove very useful.

**Responsibilities of the team.**

The purpose and scope of the safety assurance program is point number one for the team to consider:

- **The product(s) and specific process to be studied:** For example, in a program at the national level, directed first at ensuring export products safety, all activities must apply to products for this market. Safety programs should
cover groups of products, with specific production and post-harvest handling characteristics, and establish general recommendations for those points regarded as critical for safety in production and post-harvesting. Specific products should be covered, if possible, by specific recommended practice guidelines, i.e.: good practice guidelines for leafy vegetables and for deciduous fruit trees. Producers in their farms will select the Best, out of the good recommended practices, to take into account particular characteristics of the crop, the region, etc.

- **Establish which links in the food chain will be evaluated:** It is essential to determine if the program will cover only production, or only adaptation processes in packaging or both. It should be remembered that contamination in a previous processing step will affect safety in the following steps. For example, an exporter willing to assure safety in packing, must make sure that the raw materials from the field are safe and of high quality and support suppliers in implementing practices to achieve the highest quality and safety standards.

- **Establish which hazards will be evaluated:** Horticulture produce can suffer in production and post-harvest handling from microbiological (food-borne pathogens), chemical (chemical pesticide traces) and physical risks (hairs, sticks, filth, etc.), as mentioned earlier. It is therefore, necessary to have clear references on the safety hazards to be covered by the program:

  a) hazards not permitting product conformance with standards of target market (i.e. safety regulations in the importing country, certification requirements for fresh produce importers in some markets);

  b) hazards in the internal market.

**Establish principles and essential areas covered:** adopt measures to ensure food safety throughout, protect the health and welfare of personnel in production and post-harvest handling, and implement practices assuring sustainability for production systems, while protecting the environment.

In the first place, safety assurance programs should be planned according to financial resources available (a private company) or assigned (a country). The team should be concerned with hazards significant for safety of fresh fruits and vegetables. Excessive resources could be wasted if unnecessary hazards were selected, bearing only marginally on production or on final product safety, and in particular when small producers are concerned. The working team should always take into consideration what is appropriate and what is necessary to assure safety of fresh fruits and vegetables in the context of market requirements.

**Steps 2 and 3. Product description and use**

The team must produce a clear description of produce in a safety assurance program. The description will include composition, packaging, transport conditions, distribution requirements, handling instructions and instructions for use.

Handling requirements for maintaining product quality, such as storage temperature, are of value for players involved in distribution and retail sales. Consumers that may be prone to particular biological hazards should be properly identified: children, pregnant women, senior citizens, etc.

Use of produce is also important to identify hazards, for example, fresh produce whose periderm is consumed, represent higher risks for the consumers than if the product had not been properly produced and handled.

**Steps 4 and 5. Establish a Flow Diagram and in situ confirmation**

Steps and operations involved from production in the farm to shipping to the target market need to be identified to assess the risks involved in production and post-harvest. Besides characterizing each activity, a responsible individual and times of operation should be identified as key information to establish the standard operating procedures supporting personnel job descriptions and training.

The Flow Diagram must be logical and include all steps. It must be verified in situ to ensure that key steps were not left out.

If the same product is produced in different areas with different production systems, the working team will carefully identify key steps and operations to maintain safety. The Flow Diagram must reflect production areas and any specific operations taking place in particular areas. As part of the process flow, in situ verification is important to identify water resources, storage areas for agrochemicals, places for composting, facilities at the farm and for post-harvesting. This will assist in identifying product hazards.
**Step 6. List all potential hazards, conduct a hazard analysis and consider measures to control identified hazards**

This step identifies product safety hazards for each stage in the process and possible measures that could be implemented to prevent, control or reduce them.

It is suggested that the Code of hygiene practices for fresh fruits and vegetables, is followed, identifying hazards in:

- **Primary production activities**
  - environment
  - agricultural inputs
  - associated crops facilities
  - equipment, machinery and tools
  - growing practices
  - possible contamination associated with personnel health and hygiene

- **Post-harvest handling activities**
  - inputs
  - facilities
  - equipment, machinery and tools
  - packaging, storage, handling and post-harvest treatments or possible contamination associated with personnel health and hygiene, visitors included
  - possible contamination associated to animals (rodents, etc.)

Once possible hazards associated to each activity are identified, preventive, reducing or controlling measures are established. These appear in the GAP, GMP, GHP, or in support programs such as SOPs.

**Step 7. Prioritize critical process steps for maintaining safety of fresh fruits and vegetables. Establish control points**

In those steps, where established hazards would have a significant impact on product safety, there is a need for prevention and control measures. These points are known, in codes of practice for primary production, as “Control Points”.

The following should be considered:

- **Involve the different players.**

- **Collect data on microbiological analysis of water and product, on pesticides residues resulting from tests run by companies acquiring pesticides in the same production area, review data on pesticides more commonly used, review data on weed killers, records on diseases occurring in personnel, etc.** This data will be of relevance when prioritizing control points and control measures to be enforced in the short, medium and long term.

- **Consider cultural, social and economic concerns that will or will not facilitate implementing preventive and control measures by producers, and especially small producers.**

- **Establish the requirements for the target market.** For example, some certifying protocols consider major, minor and recommended control measures. Major measures should always be complied with, minor measures should show some tolerance, while recommended measures are future requirements or recommendations going one step ahead of minor measures. For Chilean exports the protocol for orchards has 32 major items, 143 minor items and 43 recommended, while the packaging protocol considers 35 major items, 180 minor and 63 recommended.

**Step 8. Establish critical limits**

Even if one of the difficulties in applying the HACCP approach to primary production is establishing critical limits, it is important in methodologies similar to HACCP to define acceptance levels for hazards associated to each control point, for example: number of qualified people, preharvest intervals, maintenance of equipment routines and calibrating equipment routines. These parameters, even if they will not specify the hazards for fruit and vegetables contamination, once contamination takes place are basic for the acceptance of the prevention and control measures implemented, as well as for implementing corrective measures.
Implement the plan

When implementing the action plan it is important to have:

- monitoring procedures and corrective actions;
- verification procedures;
- records and follow-up actions;
- involvement and commitment of all players.

This last point, ensures or not, the success of the plan.

**Step 9. Establish a monitoring system for each control point**

A simple and easily applied monitoring system must be established to define the efficiency of the control or the preventive measures for each control point. The system should consider data to be collected and collection frequency, a responsible individual and actions to be taken should the objectives of the established program not be met.

Keeping records for implemented actions is essential, for example, to support future certification processes, to evaluate the plan and to adjust processes as required. Record keeping is equally important for traceability plans, allowing tracking a product back to its origin, should safety problems appear.

Records should be kept for training personnel, pesticide applications, cleaning and disinfecting facilities, fruit collection, cold rooms’ temperatures, drying temperatures, gas concentration in modified atmospheres, microbiological tests, etc.

**Step 10. Establish corrective actions**

The company must have a self-evaluation program, allowing through a continuous review of records for each control point, an assessment that the control measures are being met or not, and implementing actions for their compliance. Some corrective measures are: more specific records, the strengthening of training programs, establishing strict personnel hygienic measures and strategies to commit personnel in applying measures.

**Step 11. Establish verification procedures**

This consists in auditing all records and verification procedures, microbiological, chemical and physical analysis to verify if the safety assurance program is performing satisfactorily. Following audits, a period of time for correcting nonconformities applies. For proper verification, adequate indicators and appropriate verification means are required.

Indicators: allow for quantitative measurements to determine if criteria are met. For example, laboratory analysis and water analysis. These results are compared with the levels set for total coliforms and fecal coliforms in water, pesticide residues in products, etc., in conformance with national standards, target market requirements or Codex standards.

Verification procedures: information obtained through observation that can be used to demonstrate that a control measure is being effectively implemented, for example, field visits or reviewing records. Good verification procedures must be included in the follow up system, must be relevant, accepted by all actors, be practical and possibly integrative.

Results of the verification process must be recorded through analytical results, record keeping, frequency of verification and clear sampling procedures.

**Step 12. Establish documentation and record keeping**

Safety assurance programs, being regulatory, require complete record keeping. These records permit external audits, traceability and certification. Field and packaging registers kept electronically or in a notebook are valid records. Documents supporting hazard analysis, records of verification procedures and planned corrective actions are also program documents.
Activity 2. Hazard identification and control measures. Field visit

GUIDELINES FOR TRAINERS

The trainer, together with the organizers of the workshop, identifies fields and packaging plants, in areas where safety assurance programs are implemented for fresh fruits and vegetables.

Each team will visit production and post-harvest activities in packaging plants. Funding and logistics permitting, each team will visit different places to feed back on the final discussion of results.

Each participant will receive a guideline format, Material 4.9, to be completed after the field visits. The teams share experiences and discuss results, all resulting in a single report detailing hazards found and prioritized with recommendations on applying control methods. Each group will present its own results and in the discussions somebody responsible for implementing safety assurance programs will also participate to enrich the analysis both ways.

EXPECTED RESULTS

Participants will develop skills to identify hazards in primary production and to implement possible preventive and control measures, applicable according to technological, economic, cultural and social aspects of production.

REQUIRED MATERIALS

- overheads and dry pens
- worksheets
- overhead projector
REFERENCE DOCUMENTS


http://www.hort.cornell.edu/extension/commercial/vegetables/issues/foodsafe.html

http://www.eanbelgium.be/traceability.htm

http://www.jifsan.umd.edu/gaps.html

http://www.fao.org/Regional/LAmerica/prior/comagric/codex/rla0065/cronograma.htm

http://www.fao.org/Regional/LAmerica/prior/comagric/codex/rla0065/cronograma.htm


**MATERIAL 4.7 CASE STUDY. ACTION PLAN TO ASSURE SAFETY OF PHYSALIS AS FRESH PRODUCE FOR EXPORT MARKETS**

*The case study from Section III of this manual is continued in this section emphasizing hazards associated to produce safety*

**Step 1. Assemble the team**

Developing the plan requires:

- a team leader, experienced in horticulture and recognized for his leadership and management capacity;
- 3 agronomists from exporting companies;
- 1 specialist in post-harvest processes;
- an advisor in safety assurance systems in horticulture.

Specific support from:

- institutions with IPM and ICM programs;
- institutions responsible for legislatively food safety, regulations and sale of pesticides;
- institutions with the required analytical testing;
- training institutions with extension programs to producers and other actors on the chain;
- producers and exporters associations.

**a. Objectives:**

- Promote confidence of foreign markets in the safety of export of Physalis complying with the importers requirements.
- Increase availability of locally produced safe produce.

Microbiological, chemical and physical hazards will be considered in this case study. Hazards will be assessed along the chain up to shipment to the target market. The principles set forth in the Code of Hygiene Practices for Fresh Fruits and Vegetables will be used throughout the case study as well as the protocols required by the target market.

**Steps 2, 3, 4 and 5. Product description, intended use and flow diagram with in situ confirmation**

**Product description**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product name</td>
<td>Physalis in 100 g baskets</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Physalis as fresh fruit</td>
</tr>
<tr>
<td>Use</td>
<td>Direct consumption</td>
</tr>
<tr>
<td>Packaging</td>
<td>Plastic baskets covered with a pre-labelled plastic cover or paper</td>
</tr>
<tr>
<td>Packaging instructions</td>
<td>Lot, origin, day packaged</td>
</tr>
<tr>
<td>Post-harvest life</td>
<td>45 – 60 days</td>
</tr>
<tr>
<td>Instructions for distribution</td>
<td>Inventory rotation (first in first out), first to come, first to sell. Keep in well ventilated rooms, temperature 10°C</td>
</tr>
<tr>
<td>Selling points</td>
<td>Retail stores</td>
</tr>
<tr>
<td>Instruction for retailers</td>
<td>No refrigeration required, keep in ventilated places</td>
</tr>
</tbody>
</table>

**Remarks**

Fruits are marketed with calyx on (leaves covering the fruit) at international markets. Production is done in small farms, often as an associated crop (semester crops, with Physalis as the main crop).

**Step 6. List potential hazards and control measures**

Tables 1 and 2 show the significant activities covered in the flow diagram, both for production and post-harvest, as well as possible contamination hazards for each step. Tables 3 and 4 reference good practices to prevent and control identified

* The information presented illustrates a methodology to implement safety assurance programmes (GAP, GMP, GHP, SOPs), but it does not represent specific recommendations for the sector, as these must be the result of the consensus among the different food chain actors.
hazards. Field visits allow in situ verification of the operative, informal meetings with farmers, visits to packaging plants and meetings with training organizations operating in the area and are the basic tools to define the hazards associated to production and post-harvest.

**Step 7. Establish control points**

As mentioned, control points are prioritized according to the requirements of the target market, product characteristics and production conditions (Physalis traded with calyx on reduces contamination risks to the surface of the fruit; washing the product increases the risks of contamination, should the water not meet requirements for this use). Physalis is not highly perishable, this rendering it less prone to losses in handling, transport, grading and packaging, as well as reducing microbiological risks. Chemical hazards are the more significant.

Tables 3 and 4 list prioritized control points as major, minor and recommended in consideration to the market, production and post-harvest. Major requirements are:

- assured traceability;
- reduced chemical contamination;
- use of water meeting minimum requirements (for irrigation, agrochemicals and personal use);
- avoid cross contamination, optimizing packaging plant design;
- enforce pest control program in packaging plants;
- enforce sanitation programs for facilities, equipment and tools;
- increased personnel hygiene.

The action plan should consider, first, major measures, followed by minor measures and adopting, last, recommended measures. Prioritized measures must involve all actors in the chain and their commitment to implement these measures. This last point is the real challenge.

Exporting companies, backed by other institutions, should support producers with adequate implementation strategies such as:

- Support programs to supply producers with pesticides to control major phytosanitary problems (i.e. crop specific).
- Support programs to recover used pesticide containers.
- Strengthen extension activities to help small producers decide on product application.
- Support specific maintenance programs for dosifiers and fumigation equipment.
- Support motivation programs for producers and their families, allowing for a new generation of producers, more literate and with greater understanding of business needs. This will assist in record keeping.
- Design adequate sanitary facilities using inexpensive materials and meeting export requirements.
- Involve producers’ families in safety assurance and training programs. Junior family members would be responsible for posting signs in storage areas and sanitary facilities.
- Training program for workers and producers in the safe use of pesticides, shears.

Programs will be successful only if all actors in the chain are actively involved. In particular, when reference is made to Tables 3 and 4, research institutions, testing laboratories and extension services have important roles to accomplish. **Presentation 4.8** includes an example of training in the safe use pesticides.

**Step 8. Establish acceptance levels**

For a successful program the following acceptance levels, among others, must be met:

- List of forbidden pesticides and chemicals.
- Maximum allowed pesticide residues.
- Drinking water requirements, according to national regulation or WHO definitions.
- Thresholds of economic damage for pesticide use.
- Drying conditions, temperature and time.
- Storage conditions, temperature and relative humidity.

**Step 9. Establish a monitoring system for each control point**

Tables 4 and 5 list records required to monitor the successful implementation of the program. **Presentation 4.8** gives information on the contents of records. At first, significant support will be required to ensure record keeping in the farm.
Records must be easily understood, even by producers with writing and reading problems, and several family members should be involved in record keeping after adequate training.

**Step 10. Establish corrective actions**

Corrective actions should result from the self-evaluation procedures contained in the plan (Presentation 4.8). Monitoring and corrective actions should have the technical support of local specialists or from exporting companies. However the producers directly must establish field records and appropriate corrective measures. For packaging plants, exporters will have a person responsible for monitoring the system and for the control measures.

**Step 11. Establish verification procedure**

Presentation 4.8 illustrates verifications based on criteria defined in Table 3 and includes indicators and verification procedures for the control point. Auditing in orchards is to be done by technical representatives from the exporters. A responsible individual should be nominated for auditing in exporting companies, assisted by a checklist accounting for all identified control points. The frequency of audits should be also specified.

**Step 12. Establish documentation and record keeping**

All information supporting actions implemented, monitoring and corrective actions, and audit findings should be properly filled. GAP records will be kept by producers in a notebook. Exporters may produce simple software for record keeping of the safety assurance system and for traceability of the product.
SECTION V
The importance of certifications and other quality schemes for the horticultural sector
GUIDELINES TO STUDY SECTION V

THE IMPORTANCE OF CERTIFICATIONS AND OTHER QUALITY SCHEMES FOR THE HORTICULTURAL SECTOR

- Promote a clear understanding for implementing Good Agricultural Practices, in the framework of integrated production with a food chain approach to assure safety of fresh fruits and vegetables
- Analyse the scope of private certifications to facilitate access of exports to high-value markets
- Examples of implementing country programs to meet the quality and safety requirements of import markets
- Identify opportunities and difficulties in the horticultural sector to meet the quality and safety requirements of import markets

- Safety and quality requirements by exporting countries for fresh fruits and vegetables: certification, challenges and opportunities for exporting countries
- A clear explanation of the contents of certifications

Importance of ethical and environmental concerns as part of product quality: implications for exporting countries

- Importance of implementing national programs, comments and recommendations for their application

Activity 1. Component parts of certifications
Activity 2. Implementing GAP in countries exporting fresh fruits and vegetables in response to market requirements
Activity 3. Country analysis of strengths and weaknesses to address certification and GAP as national priorities
Activity 4. Establishment of an action plan for the importance of certifications and other quality schemes for the horticultural sector
THE IMPORTANCE OF CERTIFICATIONS AND OTHER QUALITY SCHEMES FOR THE HORTICULTURAL SECTOR

GENERAL INFORMATION

OBJECTIVES

• Promote a clear understanding for implementing Good Agricultural Practices in the framework of integrated production with a food chain approach to assure quality and safety of fresh fruits and vegetables.

• Analyse the scope of private certifications to facilitate access of exports to high-value markets.

• Examples of implementing country programs to meet the quality and safety requirements of import markets.

• Identify opportunities and difficulties in the horticultural sector to meet the quality and safety requirements of import markets.

CONTENTS

Will cover:

• Safety and quality requirements by exporting countries for fresh fruits and vegetables: certification, challenges and opportunities for exporting countries.

• A clear explanation of the contents of certifications.

• Importance of ethical and environmental concerns as part of product quality: implications for exporting countries.

• Importance of implementing national programs, comments and recommendations for application.

TIME FRAME

8 hours

METHODOLOGY

Presentations by trainers, workshops and team discussion.

PLAN

The trainer presents the requirements of importing markets for product quality attributes (such as safety) and process attributes (such as environmental and ethical concerns) as components of private certifications. The trainer explains the documents supporting these certifications, detailing its components, structure, and implementation. (Presentation 5.1 - Slides 1-36). The teams analyse, as an example, the contents of several codes of practice/protocols (Activity 1).

Next, the responses given by exporting developing countries implementing national programs to importers requirements are studied. (Presentation 5.1 - Slides 37-53). Two case studies illustrate the background, objectives, code developing process, auditing, steps to certification and the role played by private and public parties in these programs. The difficulties and advantages resulting from the programs are listed and a question and answer discussion concludes the session. (Activity 2).

The trainer explains the scope of the certifications required by importing markets (Presentation 5.1 and Slides 35-61), followed by a discussion of the opportunities for implementing country programs, including changes in the quality and safety issues, to satisfy the needs of both export and local markets (Activity 3).

Study aids for this section are reference reading Material 5.1, internet links and the references given.

Activity 4, guides in preparing follow-up action plans for different participating countries.
EXPECTED RESULTS

The participants will:

- have a clear understanding of the scope of private certifications for fresh fruits and vegetables;
- become aware of the importance of national codes of practice harmonized to Codex standards and to market requirements;

TRAINING MATERIALS

Material 5.1 Reference reading. Implications of certification for the Latin American & Caribbean horticultural sector.
Material 5.2 Working documents. Codes of Practice.
Material 5.3 Worksheets. SWOT analysis.

PRESENTATIONS

Presentation 5.1 Importance of certifications and other quality assurance schemes for the horticultural sector.
Presentation 5.2 Case study. FDF Program, Chile.
Presentation 5.3 Case study. PIPAA Program, Guatemala.

Activity 1. Component parts of certifications

GUIDELINES FOR TRAINERS

The trainer distributes documents or protocols supporting private certification or the general requirements from markets importing fresh fruits and vegetables (Material 5.2 EUREPGAP Protocol and Harmonization Frame for Codes of Practice COLEACP). After briefly describing the structure and components of the codes, each team lists the difficulties that the producers would face to meet each requirement. As numerous items are included in each code, the teams will study code components independently according to its structure: in the COLEACP harmonized code, some teams will work on safety, others on crop protection and the environment and yet others on social issues. EUREPGAP is structured on process stages, and teams will tackle different steps but covering all items included in the code.

Teams present their results in the plenary session, and the trainer summarizes the difficulties and obstacles detected and concludes with the importance of establishing common strategies between private and public actors to address difficulties. Next, the case studies to be covered in Activity 2, are introduced.

EXPECTED RESULTS

Participants will be able to:

- identify the component parts of protocols and documents underlying private certification schemes;
- define some of the difficulties in meeting the requirements, taking into account the characteristics of horticulture for each country.

Activity 2. Implementing GAP in countries exporting fresh fruits and vegetables in response to market requirements

GUIDELINES FOR TRAINERS

Two case studies illustrate country programs answering to quality and safety requirements of importing markets:

- Background (How?, Why? and Who?).
- Objectives (quality attributes: safety, environmental protection, social welfare, GMOs, etc.).
- Program structure and standards (How are standards and documents produced?, Who worked on them?, How was work done?, etc.).
- Actors involved.
- Promoting the program (How to involve producers?).
- Training and consultancy.
Doubts and concepts are clarified in the plenary session once lectures are completed. The trainer emphasizes the basic points to assure the program success, with specifics for countries working on national programs.

EXPECTED RESULTS

Participants will identify the major points in successful and viable quality and safety assurance programs (both for export and local markets) for fresh fruits and vegetables.

Activity 3. Country analysis of strengths and weaknesses to address certification and GAP as national priorities

GUIDELINES FOR TRAINERS

Teams are assembled with participants from the same country. The trainer distributes copies of the completed preliminary questionnaire (see Manual Section II, Section C), Positive facts and difficulties for implementing quality and safety assurance programs in horticulture. The original difficulties detected will be adjusted to take into account the inputs from the workshop.

Teams are advised to consider the characteristics of the fresh fruits and vegetables sector from Manual Section II and the importance of post-harvest to maintain quality of produce (Manual Section III). Teams will analyse the difficulties and opportunities in horticulture and identify the strengths and weaknesses to meet the certification requirements of the importing countries. They will also identify the limitations/difficulties involved in implementing/strengthening country safety assurance initiatives.

Teams will produce strategies to overcome the detected difficulties/convert weaknesses into strengths and discuss their conclusions in a plenary session. (Material 5.3).

EXPECTED RESULTS

Abilities to identify difficulties and obstacles to implement safety and quality assurance programs and strategies likely to overcome these difficulties.

Activity 4. Establishment of an action plan

GUIDELINES FOR TRAINERS

Teams, assembled by countries, will answer to:

1. From an institutional standpoint, what items and strategies from Activity 3 can be addressed to support implementing GAP for internal and export markets?

2. What would the priorities be to achieve this? Teams are required to set objectives, activities, time frames and a responsible person for each prioritized strategy.

3. From answers to Items 1 and 2 teams define for each country a workshop multiplication plan, with:

   - beneficiaries;
   - responsibilities of team members;
   - date when the training plan will be sent to FAO (agenda, date, training materials, etc.);
   - specific backup from FAO, which is important to implement the defined strategies.

EXPECTED RESULTS

Participants are expected to prepare an action plan defining activities for each country.
As mentioned previously, changing patterns in consumption and increased incomes, in particular in developed countries, have increased trade of fresh produce in the last decade. Consumers request fresh, natural products, with good taste, safe, healthy and nutritious. Additionally, product process attributes are also increasingly requested (sustainable production, environmentally friendly, workers’ welfare and socially beneficial).

Private and public initiatives were implemented to meet these requirements. Public efforts have covered wide options (reorganizing the standards and regulatory framework, regulating for both locally produced and imported products). An example is a United Kingdom’s bill from 1990 to assure safety of foods, whereby all importers must take all necessary precautions and enforce due diligence to avoid any failures in developing, producing, distributing or selling the product to the consumer. The HACCP approach and quality systems are implied in these provisions. In the USA, HACCP is mandatory for fisheries, beef, juice manufacturing, etc.

The standards framework to assure food quality and safety under the Codex Alimentarius Commission umbrella centers on adoption of standards, guidelines and recommended codes of practice pertaining to the safety and quality issues detailed in Section IV of this manual. Codex documents are reference material for harmonizing national standards and codes. For food safety purposes, Codex documents direct Good Agricultural Practices to:

- prevent the misuse of pesticides, emphasizing the use of approved pesticides applied as to effectively control and prevent pests and diseases (Manual of Procedures of the Codex Alimentarius Commission, page 42), conforming to the approved MRLs [http://apps.fao.org/cgi-bin/nph-db.pl?subset=FoodQuality]. The International Code of Conduct for Distribution and Use of Pesticides requires all involved in primary production to comply with practices protecting human health and the environment above any economic concern (See Manual Section IV, Material 4.4).

- The recommended codes of hygiene for foods, and in particular the Code of hygiene for fresh fruits and vegetables (see Manual Section IV of the Manual), recommend using GAP, GMP and GHP to prevent and control food from contamination risks, in particular microbiological hazards.

FAO builds capacities in GAP, as mentioned in Section I of this Manual, as well as with initiatives to apply GAP for pesticide handling (Project TCP/IRA/0067 Handling and Control of Pesticides, Veterinary Drugs and Chemical Residues in Foods).

Private initiatives to assure quality and safety of fresh fruits and vegetables cover a wide variety of options: vertical integration through HACCP (for example, British Retail Consortium certifies HACCP for mechanized packaging plants) or self-certification according to codes of practice that are then certified by third parties.

Within this context, importers and retail distributors apply GAP, satisfying the consumer with profitable and sustainable production processes resulting in safe and high-quality fresh fruits and vegetables. An example of such a private initiative is the harmonization of MRLs undertaken by the EU for the African, Caribbean and Pacific (ACP) countries, [www.coleacp.org/en/pesticides/index.html](http://www.coleacp.org/en/pesticides/index.html). Other initiatives, such as the so-called ethical trade, require fulfilling workers’ welfare and environmental conditions.

What is ethical trade?

Ethical trade requires the adoption of socially and environmentally responsible strategies in the value chain, complying with and verifying these strategies and reporting their compliance by the players in the chain. It is generic and applies to different initiatives involving social and environmental values in production and marketing. Among these values are human rights, workers’ welfare, production methods, sustainability, animals’ welfare and biodiversity. [www.nri.org/NRET](http://www.nri.org/NRET).

There is a wide variety of policies and initiatives to address social and environmental impacts of enterprises, such as:

- The Ethical Trade Initiative (ETI), with the Base Code based on the nine principles resulting from the International Labour Organization (ILO) conventions [www.ethicaltrade.org](http://www.ethicaltrade.org);
- The Social Auditing Standard (SA 8000) promoting implementation of the ILO conventions and covering social justice and appropriate working conditions [www.cepaa.org](http://www.cepaa.org);
- The EU ECOLABEL addressed to environmental concerns [www.europa.eu.int/comm/environment/ecolabel](http://www.europa.eu.int/comm/environment/ecolabel);
The ISO 14000 series, a toolbox to implement environmental handling systems (follow-up, auditing, labels and life cycle of products) (www.iso.ch);


All these are voluntary, supported by a market choosing products beneficial to producers in developing countries, are quite recent and were proposed by individual companies, industries, NGOs, governments and from alliances of different sectors. The ETI, established in 1998 by the UK, is such an alliance of NGOs, companies and traders unions, aiming at improving working conditions in developing countries, verifying the value chain for workers’ welfare and human rights attitudes (www.ethicaltrade.org).

Third party certification

To guarantee quality and process attributes, producers, exporters, exporters’ associations, etc., are certified. These certifications are based on standards and reference materials such as codes of practice, checking lists, standards, etc. These private initiatives for safety and quality assurance of fresh fruits and vegetables include, among others, British Retails Consortium Standards (www.brc.org.uk) for mechanized packaging plants; United Fresh Fruit and Vegetable Association checking lists for orchards and packaging plants (www.uffva.org); Natural’s Choice protocol (www.tesco.com) and EUREPGAP Generic Code of Practices (www.eurep.org).

EUREPGAP was undertaken by European fresh fruits and vegetables retailing companies (EUREP) in 1997. This code covers consumers’ concerns for food safety, the environment and ethical matters. In 2000, the protocol was introduced in Barcelona and producers’ certifications started in 2001. EUREPGAP:

- defines consumers confidence as a responsibility shared by all players in the food production and distribution chain;
- establishes minimum standards satisfying European retailers and acceptable by other programs;
- promotes the implementation of hazard analysis in primary production;
- sets a baseline for implementing ICM systems.

Producers will have to demonstrate the continuing consumers’ confidence in food safety with reduced use of agrochemicals and increased efficiency in the use of natural resources, with minimum environmental impact, assuring a responsible attitude towards the health and safety of their personnel while complying with national and international labor laws. See www.eurep.org. EUREPGAP is used by individual producers and producers/exporters’ organizations. There is, also, an acceptance procedure for country programs, conducted by certifiers that have been making good profits selling their services to both sides: producers and importing supermarkets. Costs of certification are on the producers side with higher costs in the implementation phases of the certification programs. See case studies Presentations 5.2 and 5.3. Even, if as of now, supermarkets requiring certification are few their number is increasing.

Response of exporting countries to market requirements

Exporting countries have implemented national programs to meet the importers’ requirements. This has resulted in implementing codes of practice/national protocols, GAP guidelines, etc., addressing the importing markets main requirements. For ACP (AfricanCaribbean Pacific) countries, the multitude of codes, resulted in the COLEACP initiative (www.coleacp.org/en/cadre/index.html), harmonizing all codes in one protocol meeting all European requirements, emphasizing workers’ safety and welfare and the environment.

In Latin America, two examples to satisfy the target market requirements are the BPA program for horticultural exports from Chile (www.fdf.cl) and those under way in Guatemala (www.pipaa.com). USA supermarkets stress safety while European markets emphasize workers’ welfare and environmental protection. Chilean documents meet both markets’ requirements, while also complying with national regulations.

These documents require indicators and verification procedures to ensure compliance, in addition to clear objectives, principles and criteria. Other components and requirements are the involvement/compromise of all actors, the political will to grant these programs a national interest status, continuous training and consultancy, auditing and auditors training programs and reviewing procedures to adjust for technological advances and market changes. Further information on national codes of practice may be found at: www.nri.org/NRET and in Presentation 5.1.

Some GAP for melons, mango, vegetables, etc., are under way for the use of small, medium and large producers in Brazil (EMBRAPA assisted by FAO) and Colombia (SENA). In Uruguay (Ministry of Agriculture) is promoting the use of GAP.
in horticulture, both for export and local markets.

Governments, international cooperation agencies and NGOs promote IPM and ICM. Addressing environmental and social aspects in conventional practices, FAO leads the integrated production systems initiative, see http://www.fao.org/prods/, while Brazil has its own integrated program for food production, see http://www.agricultura.gov.br

**Advantages of country programs**

Some advantages resulting from the implementation of standards and codes of practice are:

- wider acceptance by producers and exporters;
- building local capacities for auditing and implementation;
- supplementing national regulations;
- providing a tool for national marketing processes;
- easier definition of priorities and needs both for local and export markets;

**Challenges**

The largest importers of fresh fruits and vegetables from Latin America are the USA and Europe. Is a highly concentrated business with supermarkets setting their own quality standards. Even if certifications requirements are few there is an increasing demand.

Major challenges are the acceptance of national programs by the importing markets, involvement/commitment of the actors, provisions for small, medium and large producers, significant expenses for implementation and accreditation and governmental commitments making the programs national priorities.

**Afterthoughts**

Today's reality is one of different standards: different standards for different buyers and for different markets. Some producers are compelled to invest in improvements, while their competitors may not have to do so.

The increasing number of initiatives to address GAP, coupled with the associated documents required, is confusing to governments, producers, exporters and entrepreneurs, on one hand, and to consumers on the other, who may become uncertain as to their requirements concerning production systems. A need for harmonization results apparent to avoid these programs being perceived as a threat, rather than as a contribution to the sustainability of horticulture and the environment.

A widely accepted reference frame on GAP principles with adequate control and verification procedures could be a useful guide to ensure producers, traders and consumers the benefits from applying GAP to production and post-harvest. This could support adoption of a wide variety of sustainable production methods for given ecosystems with specific environmental and socio-economic conditions applicable to various beneficiaries. This reference frame could enhance transparency of all players in the chain and harmonize approaches and indicators. One such approach is the European Initiative for Sustainable Development in Agriculture (EISA) (visit www.fao.org/prods/PP17501/EISA.htm).

FAO holds consultations for governments and other interested parties on GAP to understand and agree on their principles, to produce guidelines for production systems, clearly identifying roles for governments and beneficiaries.

This initiative seeks an understanding and an agreement on the principles and indicators for agricultural practices leading to strategies to produce Guidelines for Good Agricultural Practices for production systems, within a regulatory framework of public and private initiatives.

Following the internationally agreed objectives to reduce hunger and promote food security, four principles of good practice apply to all scales of production:

- Economic and efficient production of safe and high quality foods
- Sustaining and improving natural resources
- Maintaining sustainable and viable production systems
- Fulfilling society's demands

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FAO is working on approaches to good practices for assuring safety throughout the chain, including social and environmental sustainability indicators (see Documents Committee on Agriculture, 17th Session).

The strategy for this is to:

- develop, with the private and public sectors, general indicators/practices supporting good agricultural practices for production systems;
- develop approaches or effective guidelines as tools for policies;
- build a consensus based on existing codes of practice;
- apply the codes of practice to specific guidelines for crops and agro-ecosystems.

**Conclusions**

Good Practices applied within the integrated production methods and food chain approaches to ensure food quality and safety for fresh fruits and vegetables are expected to contribute to: increased food production, food safety, consumers’ protection, protecting natural resources conservation and the economic and social viability of production systems.

Technical cooperation programs addressed to applying GAP in an integrated and multidisciplinary approach for animal and agricultural production (horizontal and vertical market integration, environmental protection, social concerns, quality and safety, plant and animal health, etc.) become important.

Today, more than ever, the trend is towards a sustainable agriculture meeting the requirements of dynamic and differentiated markets. Worldwide and nationally integrated private and public efforts are basic to permit producers and exporters to gain and retain markets, as well as to protect the consumer in less developed ones.
REFERENCE DOCUMENTS


ETI. Ethical Trade Initiative. www.ethicaltrade.org


