LEARNER GUIDE

Food Safety

Level 4

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Title:		**Implement a Food Safety and Quality Management System in the Agricultural Supply Chain**					
Applied Title:		**Implement a Food Safety and Quality Management System in the Citrus Supply Chain**					
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Table of Contents

Directions

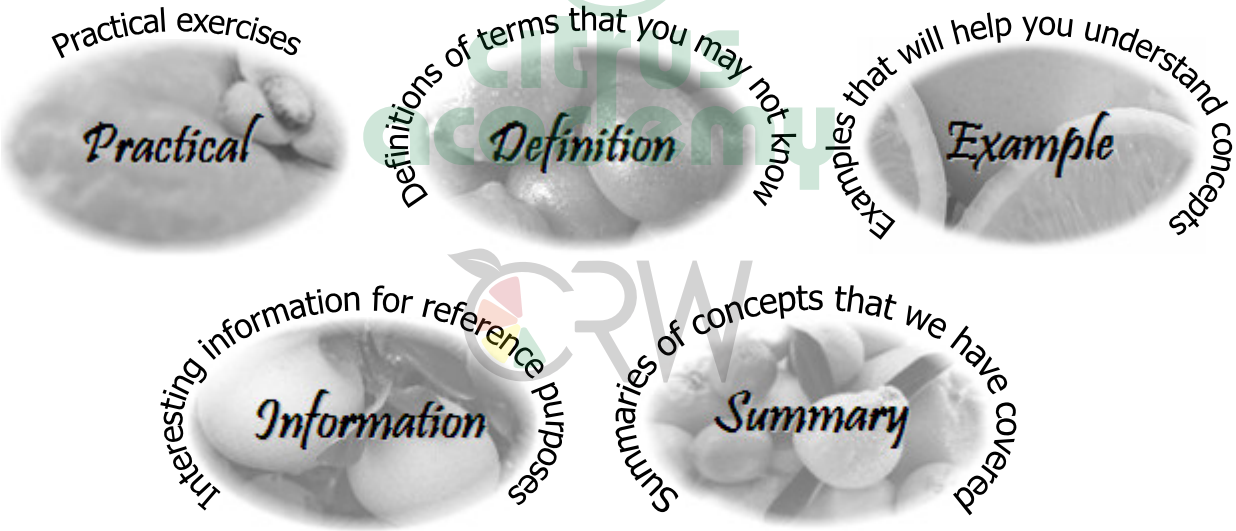
This learning material has been developed to assist the learner wishing to complete this unit standard. The guide contains all necessary learning to ensure that the learner will attain the competencies required by the unit standard.

The learner guide is accompanied by a Learner Assessment Guide. Please ensure that you have access to this guide as well.

The learner guide was designed to be used by a learner during the presentation of a skills program based on the unit standard, and to be kept afterwards by the learner for reference purposes. The learner assessment guide was designed to be completed during and after the presentation of the skills program, and forms part of the assessment process.

Although this learner guide contains all the information required for attaining competency in this unit standard, references to additional resources, both printed and electronic, are provided for further study by the learner.

Information in boxes is indicated by tags that show:



Introduction

1. Purpose

A learner achieving this unit standard will be able to implement a management system related to food safety, production practices, as well demonstrate environmental and social awareness within the agricultural supply chain. Learners will gain an understanding of sustainable agricultural practices as applied in orchard farming. This unit standard focuses on the application of food safety principles in primary agriculture.

Competent learners will be fully competent in food safety practices whereby providing the environment for the application of quality practices and thus strengthen agricultural practices in general. They will be able to participate in, undertake and plan farming practices with knowledge of their environment. This unit standard will instil a culture of maintenance and care for both the environment as well as towards farming infrastructure and operations.

2. Learning Assumed to Be in Place

It is assumed that the learner has successfully completed the unit standards listed below:

NQF Level	***Unit Standard Number***	***Unit Standard Description***
NQF3	Literacy and Numeracy	
2	116125	Apply crop protection effectively and responsibly
3	116240	Explain store inputs categories, labelling and storage methods
3	116271	Monitor and supervise a food safety and quality management system in the agricultural supply chain

Revision of Level 3

1. Health, Social and Environmental Issues in the Agricultural Environment

- Food safety is an essential public health obligation according to a resolution that was adopted by the World Health Organisation.
- Food-borne diseases are a major threat to public health and affect the social and economical well-being of societies.
- Global trends in food consumption mean that food is consumed far from where it is produced, and that food from a single source is consumed by a great number of people.
- The Codex Alimentarius Commission establishes international food standards to protect the health of consumers, and to ensure fair practices in the food trade, on which member countries base their national food safety legislation and regulations.
- In South Africa the Agricultural Products Act (APS Act) prescribes food safety standards, and the Agricultural Pests Act (Act 36 of 1983) regulates the use of plant protection products.
- Regulations for specific commodities are based on and empowered by the APS Act, and standards and requirement checklists are in turn based on the regulations.
- PPECB is an assignee of DAFF, and conducts, amongst others, quality assurance audits in terms of food safety regulations, and food safety audits.
- GlobalGAP prescribes a set of food safety requirements for certain agricultural products that are exported to regions where their buyers require GlobalGAP certification.
- Communicable diseases are of importance in plant production because is impacts on worker health and productivity.
- Workers that contract infectious diseases must be removed from the workplace until they no longer pose a danger to the health of other workers.
- The environmental impact and sustainability of citrus production is addressed on an industry level through the Citrus Improvement Program, Crop and Fruit Quality Management Research, Disease Management Research, and Integrated Pest Management Research.
- The most significant contribution that individual growers can make to sustainability and minimising environmental impact is by applying Integrated Crop Production (ICP) principles.
- Awareness amongst workers with regard to food safety issues are created through skills development, workshops and road shows by commodity organisations, awareness campaigns, incentives and disciplinary enforcement by employers, warning signs, and inspections.
- Checklists are handy guidelines for the information that should be disseminated to workers.
- Recordkeeping enables traceability, which should allow one to trace a fruit from where the consumer buys the fruit back to the orchard, with details of all the processes that it was subjected to in between.

2. Non-Conformance and Food Safety

- Everyone involved in the production process has a responsibility towards food safety and must be aware of what is required to ensure that food is safe for human consumption.
- Non-conformance must be reported immediately and the reporting must be escalated until appropriate action is taken.
- The seven principles of HACCP are a good general approach to food safety management.
- Periodic reports and checklists must be developed for each critical control point that is identified with the specific aim to detect non-compliance and non-conformance as soon as it occurs.
- Informal reporting relies on every person having a thorough understanding of the requirements and principles of food safety and on a tiered reporting system that normally follows the chain of command.
- The response in case of non-conformance must include steps to immediately correct the problem, to isolate the area in which the problem occurred, to determine the impact of the problem and take steps to rectify the situation, to determine the cause of the problem, and to ensure that the problem does not recur.

3. Traceability

- Traceability depends on the completeness of the recordkeeping systems throughout the supply chain.
- ISO develops voluntary international standards for products and services and defines traceability as the ability to trace the history, application, or location of that which is under consideration.
- The purpose of traceability is to allow one to determine the point at which deviations or non-conformance occurred if it is found that the safety of the product has been compromised.
- Traceability is a legislative requirement.
- The immediate penalty for non-compliance is that produce will not be accepted, shipped or sold if it does not comply with the minimum standards for traceability.

4. Recordkeeping

- Recordkeeping is essential to traceability.
- Checklists are available to ensure the correct records are kept.
- Quality management systems that are commonly used are ISO, GlobalGAP and HACCP.
- ISO reflects international consensus on the standards that are required by governments, business and society.
- GlobalGAP aims to develop widely accepted standards and procedures for the global certification of Good Agricultural Practices (GAP).
- HACCP is a commonsense approach designed to identify and control food safety hazards, and monitor the controls established.

5. Internal Audits

- Internal audits aim to monitor and probe the integrity of any quality management system continuously.

- There are no specific rules for internal audits, but it is closely related to the type of quality management system that is in place.
- Regardless of the size of the entity or the approach to internal audits, there are key elements that must be included in all internal audit systems.
- Conducting an internal audit mostly includes measuring and monitoring, evaluation, and reporting.

6. Implementing Food Safety and Quality Principles

- Observing sanitation standard operating procedures reduces the risk of food contamination.
- Maximum residue levels are prescribed by legislation, but also by importing country's standards.
- A document indicating maximum residue levels and pre-harvest intervals is developed by the Citrus Growers Association of Southern Africa and Citrus Research International.
- HACCP provides a handy tool for implementing food safety principles.
- Hazard analysis involves identifying all possible hazards to food safety at every point.
- Critical control points are identified as points at which control can be applied.
- Critical operational limits are established for each critical control point.
- Critical control points are monitored and operations are measured against operational limits.
- Procedures for corrective action are developed in case of a loss of control.
- Records are kept of all operations at critical control points.
- The soundness, effectiveness, and implementation of the system are verified.
- Recordkeeping is essential for traceability and effective management.
- The basic types of records that must be kept are prescribed by legislation and standards authorities.

Chapter 1

After completing this chapter, the learner will be able to:

Implement a record system on the farm.
Manage a traceability system demonstrating operational efficiency in the agricultural supply chain.

1. Introduction

Traceability is the ability to trace and follow a food product or any substance intended to be, or expected to be incorporated into, a food product through all stages of production, packing, processing, handling and distribution. Traceability refers to the availability and completeness of the information about every step in a process chain.

Traceability is one of the most important corner stones of food safety implementation. In this chapter, we will briefly revise certain concepts and checklists that were discussed in detail at previous levels, before looking at how traceability is implemented in the pre-harvest production environment and the recordkeeping systems that are essential for traceability.

2. The Purpose of Traceability

Consumer protection is an essential aspect of agricultural production. Traceability allows the grower to provide proof of the origin of all fresh produce, and therefore presents a measure of protection for the grower and the consumer.

Traceability facilitates and promotes:

- ***Security*** – It is a legal requirement that any defective product that presents a risk to the consumer must be able to be recalled immediately. Traceability enables this by ensuring that the origins of the product can be determined.

- ***Investigation*** – If a product is found to be defective, at least two things have gone wrong. Firstly, the product itself was not produced, handled or packed in the prescribed manner. Secondly, the quality management system failed to detect this defect. Traceability allows for the necessary investigation to determine where these deviations occurred.

- ***Production Management*** – Traceability information linked to various activities can lead to a greater understanding of the company's capabilities, making it possible to meet production targets in a shorter time or at a lower cost. Traceability can also be a starting point for the statistical methods of process control (SPC).

- ***Stimulus for Technical Progress*** – There is always a risk that a production unit that is profitable and meeting its objectives may become complacent. Implementing traceability systems forces management to assess the use of technology within the organisation and skills levels of employees.

- ***Consumer Information*** – Traceability systems may allow a producer to collect information about consumers and their spending habits, allowing him to better define and understand target markets.

3. Traceability in the Supply Chain

Supply chains exist in production, manufacturing and service organisations, and they are principally concerned with the flow of products and information between supply chain member organisations.

Supply chains are concerned with processes such as the procurement of products (sourcing), their transformation into finished product (production and packing), and distribution of that product to consumers.

The citrus supply chain is a series of distinct activities that take place in order to take the product from orchard to market. The demand chain is the supply chain in reverse, seen from the point of view of the consumer.

Tracking

Tracking is the ability to follow a path of a specified unit and / or batch of product through the supply chain as it moves between organisations towards the final point-of-process, point-of-sale or point-of-service. Tracking is also referred to as **forward traceability**.

Tracing

Tracing is the ability to identify the origin, movements and relevant associated information of a particular unit and / or batch of product located within the supply chain by reference to records held upstream. Tracking is also referred to as **backward traceability**.

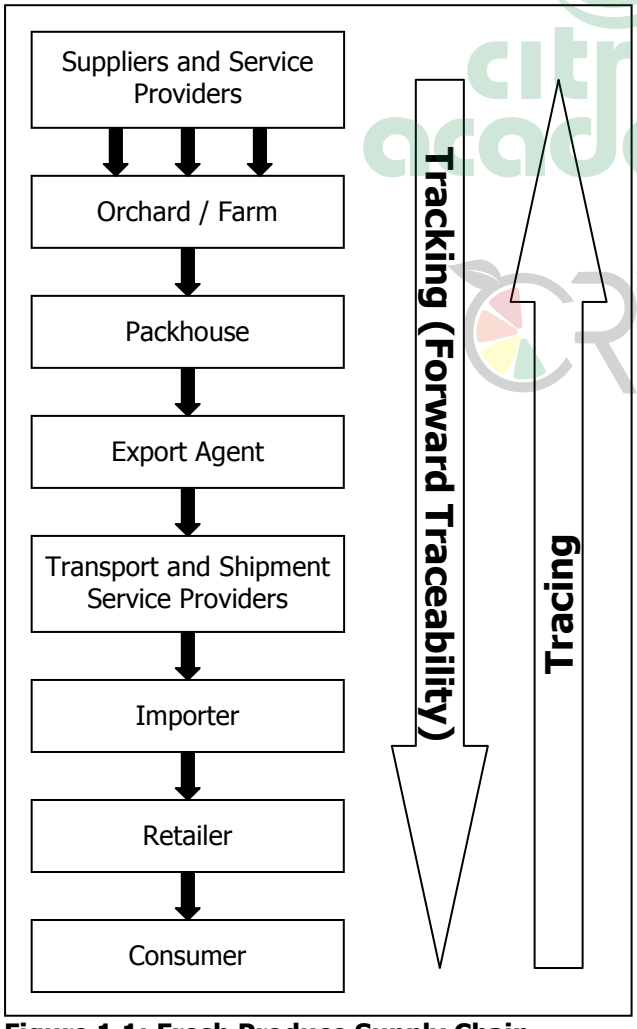


Figure 1.1: Fresh Produce Supply Chain

In order to meet consumer demands for consistent supply of top quality, safe and nutritious foods, the design and implementation of fully backward and forward traceable supply chains has become an important part of the overall food quality assurance system. Farmers, postharvest handling operators, marketers, researchers and policy makers need a sound understanding of the concepts and implications of supply chain traceability to assist in developing and implementing appropriate technological interventions to meet consumer demands for traceable agricultural supply chains.

4. Elements of Traceability

On previous levels we examined traceability in its obvious and simplistic form, but it is important to remember that traceability has many different elements. Traceability adds value to the overall quality management system by providing the communication linkage for identifying, verifying and isolating sources of non-compliance to agreed standards and customer expectations. Some of these elements are directly related to the Good Agricultural Practices (GAP) that are discussed in detail in Chapter 2 of this guide.

There are six elements of traceability, which in combination constitute an integrated agricultural and food supply chain traceability system, being:

- Product traceability
- Process traceability
- Genetic traceability
- Inputs traceability
- Disease and pest traceability
- Measurement traceability

4.1. Product Traceability

Product traceability means the identity and physical location of a product at any stage in the supply chain is known, and facilitates logistics and inventory management, product recall and dissemination of information to consumers and other stakeholders.

4.2. Process Traceability

Process traceability ascertains the type and sequence of activities that affect the product during every step in the supply chain. This means knowing what happened to it, and where and when this occurred. This includes interactions between the product and physical, mechanical, chemical, environmental and atmospheric factors, and the absence or presence of contaminants.

4.3. Genetic Traceability

Genetic traceability is the ability to determine the genetic constitution of the product. Where agricultural products have been genetically modified (GMOs) it is especially important to be able to trace the genetic source of that plant material.

Although there are no known GMOs in the Southern African citrus industry, the ability to verify whether or not two products have the same source material is valuable, for instance the ability to differentiate between Valencia oranges and Midknight valencias.

4.4. Inputs Traceability

Input traceability determines the type, quantity and supplier of inputs such as fertiliser, chemical sprays, irrigation water, and the presence of additives and chemicals used for the preservation of the product.

4.5. Disease and Pest Traceability

Disease and pest traceability traces the epidemiology of pests and biotic hazards such as bacteria, viruses and other pathogens that may contaminate food.

4.6. Measurement Traceability

To know for certain that a 1m ruler is actually one meter long, the ruler must be calibrated or compared to some other object which is known for certain to be one meter long.

Measurement traceability relates final individual measurements back to an acceptable reference standard. To achieve measurement traceability, all measuring and test equipment and measurement standards are calibrated utilising a reference standard whose calibration is certified as being traceable to a national or international standard.

The other aspect of measurement traceability relates to the property of the measurements, including data and calculations, generated throughout the supply chain and their relationship to the requirements for quality. By focusing on the quality of measurements, rather than on a property of an instrument, it is possible to assure that the measurements are indeed adequate for the intended use. To achieve this, each measured data must specify the environmental, operator, and geospatial and temporal factors, which are not related to the instrument but impact on the quality of the data.

5. Recordkeeping for Traceability

Recordkeeping is central to traceability. Without accurate records, it would be impossible to determine the origin of the product. An effective recordkeeping system does not only enable one to keep complete and accurate records, but is must also allow one to access information easily. The availability of records is as important as the records themselves.

As we have already seen, traceability is the ability to trace and follow a food product from the orchard to the basket, or back from the basket to the orchard. It is logical that effective recordkeeping is the cornerstone of traceability and the implementation of a traceability system.

We also already know that traceability and supporting records for fresh produce are essential components of all quality management systems (QMS).

Checklists and compliance criteria have been developed to be used as an aid and self-assessment tool for food business operators (FBOs) in implementing the food safety system. The same checklists are used by PPECB auditors to verify that systems are in place when they conduct official food safety audits.

The checklists and compliance criteria are listed in the table below. Note that these documents are updated on a regular basis. Where they are found on the Internet, a month and year is added to the name of the document to indicate when it was last updated.

Operation	***Checklists and Compliance Criteria***
On-Farm Packhouses	• SAGAP – On-Farm Packhouse – Checklist • SAGAP – On-Farm Packhouse – Compliance Criteria
Off-Farm Packhouses	• Off-Farm Packhouses – Checklist • Off-farm Packhouses – Compliance Criteria
Processing Plants	• Processing Plants – Checklist • Processing Plants – Compliance Criteria
SA GAP	• GAP – Compliance Criteria
Cold Stores	• Cold Storage – Checklist • Cold Storage – Compliance Criteria
Container Depots	• Container Depots – Checklist • Container Depots – Compliance Criteria

Operation	*Checklists and Compliance Criteria*
Transporters	• Road Transporters – Checklist • Road Transporters – Compliance Criteria

Table 1.1: Traceability Checklists and Compliance Criteria

Downloading Checklists and Compliance Criteria

Checklists and compliance criteria can be downloaded from the website of the PPECB at www.ppecb.com. Minimum export standards are available for download from the website of the Department of Agriculture, Forestry and Fisheries, at www.daff.gov.za.

Records may be kept manually (filling in checklists and forms by hand) or electronically (recording the information on a computer). Electronic systems have the added benefit of being able to process the data and additional information can be extracted from these programs as a result. For example, computer programs can generate graphs and comparisons about the progress of the producer in terms of the quality of his produce. Electronic data can often be used when comparisons are drawn over a period of time. Although manual data could supply the same information, it is more complicated to extract the information without the assistance of electronic equipment and software.

The decision between a manual or electronic recordkeeping system is based on the internal capacity of the organisation (do our workers have the capacity to operate an electronic system?), available resources (do we have the money to implement an electronic system?), and most importantly on the availability and accessibility of information (how easy will it be for us to retrieve the required records and information when it is required?).

The records that must be kept in accordance with the requirements of legislation and various food safety accreditation systems are evidence of compliance with traceability recommendations because specific information with dates and signatures of responsible parties are found on these documents when they are completed correctly.

All workers that are responsible for traceability records must therefore be trained in:

- How to complete the forms and checklists correctly
- How, where, when and for how long, to file forms and checklists
- The legal accountability and responsibility of traceability as it applies to completion, or failure to complete, these forms and checklists

Records must be kept for a specified period in a central, accessible place, under the care of a person appointed for this task. The records must meet standard criteria of tracking and tracing, in order words it should be kept in a systematic and chronological way, by date, batch number, geographical reference point, and delivery or dispatch reference.

6. Implementing a Recordkeeping Traceability System

Traceability systems are implemented in most cases as part of the food safety and quality management system. Traceability is in fact a major requirement for such a system.

HACCP requires that risks, or hazards, are assessed prior to implementation of a quality control system, and on an ongoing basis. The risk that applies in this case is the break in the traceability of a product.

ISO 22000 is a commercial food safety management system that makes use of the HACCP principles and methodology to develop a HACCP plan. A HACCP plan describes how an organisation manages and controls its food safety hazards, and contains at least the following information:

- Hazard analysis
- Identification of critical control points
- Establishing critical limits
- Monitoring critical control points
- Establishing procedures for corrective action
- Recordkeeping
- Verification

HACCP requires that risks, or hazards, are assessed prior to implementation of a quality control system, and the ongoing management of identified risks. The risk that applies in this case is the break in the traceability of a product. ISO 22000 is a commercial food safety management system that makes use of the HACCP principles and methodology to develop a HACCP plan. A HACCP plan is a document that describes how an organisation plans to manage and control its food safety hazards, and contains at least the following information:

- Identified critical control points (CCPs)
- Hazards that must be controlled at each CCP
- Control measures for each CCP
- Critical limits to be applied at each CCP
- Procedures for monitoring CCPs
- Procedures for remedial action when limits are exceeded

ISO 22000 provides for combining the HACCP plan with **prerequisite programs** (PRPs) and **operational prerequisite programs** (OPRPs) into a single integrated food safety management strategy.

Prerequisite and Operational Prerequisite Programmes

Prerequisite programmes (PRPs) prescribe the conditions that must be established throughout the production chain, and the activities and practices required for a hygienic environment, suitable for the production of food that is safe for human consumption. PRPs are closely related to Good Practices, which is discussed in detail in Chapter 2. Operational prerequisite programmes (OPRPs) are PRPs that are related to specific identified hazards or risks in a specific food production environment. They are therefore essential for that production unit.

Chapter 1

- Traceability allows the grower to provide proof of the origin of all their fresh produce.
- The citrus supply chain is a series of distinct activities that take place in order to move the product from orchard to market.
- Tracking is the ability to follow a product forward as it moves through the supply chain towards its final destination, while traceability is the ability to trace the product backward to its origins.
- The six elements of traceability are product traceability, process traceability, genetic traceability, inputs traceability, disease and pest traceability, and measurement traceability.

- Recordkeeping is central to traceability and the availability of records is as important as the records themselves.
- Checklists and compliance criteria have been developed to be used as an aid and self-assessment tool, and are also used during internal and external food safety audits.
- Records can be kept manually or electronically with information accessibility, internal capacity, and prevailing resources forming the basis for deciding on the type of system.
- All workers must be trained in recordkeeping, including how documents must be completed, how and for how long records must be stored, and the recordkeeping requirements of traceability.
- HACCP principles can be used for the implementation of a traceability and recordkeeping system.

Complete activities 1, 2 and 3 in the **Learner Workbook**.

Chapter 2

After completing this chapter, the learner will be able to:

Manage and maintain good agricultural practices (GAP) associated with good manufacturing practices (GMP), good health practices (GHP), good social practices (GSP) and good environmental practices (GEP).

1. Introduction

'Good practices' is a term that has come into use in recent years to describe the "right way" to get things done. Guidelines for Good Practices have been developed for almost every type of activity in every field, from Good Trading Practices to Good Marketing Practices to Good Fundraising Practices.

Good Practice guidelines aim to improve the manner in which businesses conduct themselves, by integrating for instance Good Social Practices with Good Agricultural Practices (GAP). This chapter considers good practices that are linked to agriculture, and which are therefore generally termed GAP.

2. Good Practices in the Agricultural Supply Chain

In agriculture, Good Practice guidelines have been developed for the entire supply chain, and they include:

- Good Agricultural Practices (GAP)
- Good Manufacturing Practices (GMP)
- Good Distribution Practices (GDP)
- Good Health Practices (GHP)
- Good Social Practices (GSP)
- Good Environmental Practices (GEP)

Good Practice guidelines are interactive and integrated, meaning that the requirements of Good Social Practices, Good Health Practices and Good Environmental Practices are included and integrated with Good Agricultural Practices and Good Manufacturing Practices. Good Practices that are implemented in the fresh produce supply chain are collectively referred to as GAP, even though some of these practices actually may be GHP, GSP or GEP. GAP however does have a specific meaning as well, as discussed below.

2.1. Good Agricultural Practices (GAP)

Good Agricultural Practices are a collection of principles and basic environmental and operational conditions that are necessary for the production of safe, wholesome fruit and vegetables. The term includes practices used in growing, harvesting, sorting, packing and storage operations. GAP principles also aim to ensure the sustainability of agricultural production, including the appropriate management of pests and diseases.

GAP can be applied to a wide range of farming systems and farming operations that range widely in size. GAP is applied through sustainable agricultural methods, such as integrated pest and fertilisation management, integrated and conservation. They rely on four principles, being:

- Economically and efficiently producing sufficient, safe and nutritious food
- Sustaining and enhancing natural resources
- Maintaining viable farming enterprises and contributing to sustainable livelihoods
- Meeting the cultural and social demands of society

2.2. Good Manufacturing Practices (GMP)

Good Manufacturing Practices are guidelines for manufacturers to ensure the quality, consistency and safety of products and processes. GMP is often used simultaneously with GAP and includes practices used in sorting, packing, storage and transportation operations.

2.3. Good Distribution Practices (GDP)

Good Distribution Practices applies to the handling, transport and distribution of fresh produce. GDP is relevant to services providers in the supply chain that transport and ship products, and to handling facilities, such as the Fresh Produce Terminals.

2.4. Good Health Practices (GHP)

Good Health Practices help reduce the risk of being implicated in the spread of food-borne illnesses through poor personnel hygiene. The scope of these practices is relevant to staff and worker health and hygiene.

2.5. Good Social Practices (GSP)

Good Social Practices address a wide range of socio-environmental issues and are not only applicable to agriculture. These issues include:

- ***Economically Disadvantaged Producers*** – Good Social Practices prescribe a strategy for poverty alleviation and sustainable development. Its purpose is to create opportunities for producers who have been economically disadvantaged or marginalised by the conventional trading system.
- ***Transparency and Accountability*** – Good Social Practices encourages transparent management and commercial relations to deal fairly and respectfully with trading partners.
- ***Capacity Building*** – Good Social Practices is a means to develop producers' independence. Fair trade relationships provide continuity, and a stable trading environment, which enables producers and their marketing organisations to improve their management skills and their access to these markets.
- ***Payment of a Fair Price*** – A fair price in the regional or local context is one that has been agreed through dialogue and participation. It covers not only the costs of production but enables production which is socially just and environmentally sound. Fair price means fair compensation to the producers and takes into account the principle of equal pay for equal work by women and men.
- ***Gender Equality*** – Good Social Practices means that women's work is equally valued and rewarded. Women are paid for their contribution to the production process and are empowered in their organisations.
- ***Working Conditions*** – Good Social Practices means a safe and healthy working environment for producers and workers. The participation of children, if any, does not adversely affect their well-being, security, educational requirements and need for play, and conforms to the UN Convention on the Rights of the Child as well as the laws and norms in the local context.

2.6. Good Environmental Practices (GEP)

Good environmental practices address the following aspects:

- The environmental hazard posed by the agricultural product, its production, its use, and its ultimate disposal

- Substitution by less polluting activities or substances
- The scale of land use and the need to guard against for instance over-grazing
- The potential environmental benefit or penalty of substitute materials or activities
- Advances and changes in scientific knowledge and understanding
- Time limits for implementation of plans that guard against environmental degradation
- Social and economic implications of land use and environmental degradation
- The precautionary principle, i.e. taking preventive measures when there is reason to assume that substances or energy introduced, directly or indirectly, into the natural environment may create hazards to human health, harm living resources and ecosystems, damage amenities or interfere with other legitimate uses of nature even when there is no conclusive evidence of a causal relationship between inputs and their effects.

3. Managing of Good Agricultural Practices

3.1. Land Use and Soil

Agricultural land and land that has been used for activities other than agriculture can be contaminated with pathogenic organisms or toxic chemical substances.

Obtaining a history of the prior use of the land is important because it helps identify these potential hazards. In addition, the failure of prior users to follow Good Agricultural Practices can pose risks of contamination to produce grown on the soil.

It is important to obtain information about the previous use of the land where agricultural production is taking place. This can be done through interviews with prior owners, a review of municipal permits, or from other sources. This background information can help in the identification of situations that can increase the risk for fresh produce contamination.

3.1.1. Cultivated Land Information

Information that should be obtained about the history of the land includes where land is currently used or has been used for:

- Animal feeding or domestic animal production
- Barns or other housing of farm animals
- Garbage or toxic waste disposal, sanitary waste management
- Mining activities, or oil or gas extraction

Other information that should be obtained includes:

- If the land has experienced any serious flooding
- If the land has been treated in an uncontrolled manner with organic or inorganic fertilisers and / or pesticides.

Prior use of land for animal feeding or domestic animal production can greatly increase the risk of contamination of fruit and vegetables with pathogens commonly found in the intestinal tract of animals. The potential for contamination from this source is related to the time that has passed since the land was used for animal feeding or production. The risk of contamination will also be influenced by conditions such as atmospheric temperature, sunlight and relative humidity.

The presence of barns or farm animals a short distance from a cultivation site increases the risk of product contamination. An assessment of the location of the animals and their

facilities and an evaluation of drainage systems and water currents flowing near these areas will help determine the potential for contamination. In some instances it may be necessary to create physical barriers or channels to divert water carrying animal contaminants away from production sites.

When the land has been used for garbage disposal or as a waste management site, it may contain decomposing organic matter and faecal material. Depending on the garbage contents, soil microbial loads can be extremely high and the soil may also contain harmful chemicals or toxic contaminants.

Land that has been used for mining or petroleum extractions can be contaminated with heavy metals or hydrocarbons. Even if the contamination is located on a small portion of the land, factors such as rainfall and subterranean water flow should be evaluated. Analysis of toxic substances in the soil and a review of the environmental compliance of the extraction operation are recommended when the ground history indicates a high risk for chemical hazards.

Heavy flooding can increase the sources of contamination. Water runoff can introduce pathogens and chemical contaminants from remote areas. Dead animals and standing water that remains after the floodwater has receded can lead to significant bacterial hazards. Individual assessment of each flooding situation is necessary, along with a review of the time that has passed since the flood and other conditions that can mitigate or reduce the risks. When there is concern about the safety of the site, microbiological analyses after the flooding has occurred may assist in identifying contamination.

Even if the investigation of the prior use of the land indicates that it has been used solely for agricultural production, prior production practices should be reviewed. Improper use of organic fertilisers may result in microbiological contamination of the soil, while inorganic fertiliser and / or pesticides used improperly can cause serious chemical hazards. Chemical compounds should have been used according to label recommendations and the products should be registered for use on the specific crop.

3.1.2. Current or Prior Use of Adjacent Land

The land owner or operator should research both the present and prior use of adjacent lands to identify potential sources of contamination and precautions that need to be taken to prevent contamination of fresh produce in the orchards. Contamination from areas away from the actual growing area can reach produce through a variety of means including water, wind, workers, vehicles, or equipment moving from one area to another.

3.2. Water Sources and Irrigation Practices

During agricultural production of fruits and vegetables, water is used for numerous activities, including pesticide and fertiliser applications and irrigation. Other water uses during produce handling include cooling, washing, waxing and the movement of fruit. In addition to activities where water comes in direct contact with produce, field and packhouse workers use water for drinking and hand-washing.

Water used in agricultural activities can be contaminated with pathogenic bacteria that may cause severe health problems to consumers. It can be a source of and vehicle for a number of biological hazards. Such micro-organisms are associated with gastrointestinal diseases that, in severe cases, can cause death.

Poor quality water may be a direct source of contamination and also an important vehicle for spreading micro-organisms in field production. The severity of the hazard resulting from poor quality water will depend on the type and number of micro-organisms in the water and their capacity to survive on the produce.

Other factors that can increase the risk of contamination of produce by water include the stage of development and type of crop, the time between the contact of the produce with the water and harvest, and water and produce handling practices. Fruits and vegetables with large surface areas, such as leafy vegetables, or those where the surface structure allows pathogens to adhere easily, are at a greater risk of contamination from water.

This risk can be further increased when the contact with contaminated water takes place near harvest time or during postharvest handling.

3.2.1. Potential Contamination Associated with Water Sources

Among the most common sources of agricultural water are surface rivers, streams, and open canals. Other sources include reservoirs such as swamps, lakes, tanks, ground water from boreholes and, occasionally, public water systems.

Surface and reservoir sources vary considerably in their microbial content. Microbial loads of surface water range from several thousand organisms per millilitre after a rainfall to a relatively low number after auto-purification, a natural process in undisturbed waters.

Surface water can be exposed to temporary or intermittent contamination. This contamination can come from raw human and animal wastes, sewage water discharges, and water coming from adjacent areas dedicated to animal production or other contamination. Surface water generally flows some distances before it reaches the crop. It is important to identify upstream sources of contamination to this flow. Elimination of this contamination may involve modification of the water route or the introduction of intervention methods, such as filters.

Water destined for agricultural production can easily become contaminated with human and / or animal faeces. It is important to keep animals and children out of the orchards and to provide field workers with properly constructed and maintained restrooms or mobile sanitary units. Water contamination with human faecal material can occur if wells and water systems are not properly developed, if septic systems fail or have deficiencies in their design, and from discharges that come from sewage treatment plants.

Wildlife, including insects, rodents, reptiles, and birds, can carry diseases. Since these are found even in the most pristine environments, absolute protection of water is difficult and minimisation of potential contamination by wildlife should be the goal.

It is generally believed that ground water is less likely than surface water to be contaminated with pathogens since ground water generally loses much of its bacterial and organic content after filtration though rock and clay layers. The bacterial content of ground water may vary from a few to a few hundred organisms per millilitre. However, under certain conditions, such as with shallow, old, or improperly constructed wells, the potential for contamination of ground water by surface water is a great risk.

3.2.2. Hazards Introduced by Irrigation Practices

Irrigation is the controlled application of water to the land or field with the purpose of providing the moisture required for the appropriate development of the plant. Irrigation plays a major role in achieving cultivable lands, especially in arid and semi-arid regions.

The hazards associated with irrigation practices are influenced by:

- Water source and quality
- Amount of water applied
- Irrigation program
- Irrigation method
- Soil drainage properties
- Pre-harvest interval

The closer to harvest irrigation occurs, the greater the chance for survival of pathogens and for the presence of residual chemicals on the produce. Irrigation methods, such as drip irrigation, where the contact between water and plant is minimised, are generally less likely to lead to fresh produce contamination, however, the use of good quality water is still important.

3.2.3. Chemigation

Chemigation refers to the application of chemicals, such as fertilisers or pesticides, through the irrigation system. In citrus production, fertilisers are often applied in this way, and this is referred to as **fertigation**.

When chemigation systems are not properly designed, they can result in serious ground water contamination, increasing the risk of chemical contamination of fresh produce. Safety equipment is available that can prevent back-flow and subsequent groundwater contamination. This equipment is relatively inexpensive and can prevent serious hazards.

In the case of fertilisers, it important to know the plant toxicity of the specific fertiliser and to pay close attention to calculated and recommended dosage rates and schedules of application.

Additional safeguards against contamination during chemigation include training and certification of applicators and water analysis at the source and at locations near the water source. In addition, it is important to identify the runoff direction if runoff takes place.

3.2.4. Agricultural Water Microbiological Testing Procedures

Microbiological analyses are generally performed as indicators of contamination, especially for the verification of cleaning programs for tanks, wells, or when contamination from a specific source or event is suspected. They are time-consuming and are used to track trends rather than for daily monitoring activities, and are generally used to verify that the appropriate preventive measures are effective.

Proper records of water microbiological quality are an important good agricultural practice. It is important to document the frequency and results of each water test since changes in results may identify problems.

Testing for specific pathogenic bacteria in water may be inappropriate. They could be present in very small amounts and thus not detected. Furthermore, microbiological characteristics of water can vary considerably depending on such factors as the water source, season, and sampling time. Since waterborne disease is usually the result of faecal contamination of water supplies, it is more efficient to determine if faecal contamination is present than to actually look for the presence of pathogens.

3.3. Implementation of Soil and Water Conservation Principles – Organic Fertilisers

Good agricultural practices prescribe the use of soil and water conservation practices, such as channel construction, drain control structures, diversion tanks, vegetative barriers and so on, which act as physical barriers in the event of a contaminated water runoff.

A very important aspect of soil and water conservation is the management of fertilisers that are applied to the soil.

Animal manure and solid biological waste may provide safe, effective fertiliser when properly treated. If the treatment is inadequate, or if no treatment is used, the risk of contamination of fruit and vegetables with pathogenic micro-organisms is extremely high. The rate of survival of contaminants in manure and their transfer to crops depends on a number of factors. These include soil type, manure application rate, soil pH, composting method, and time of application.

Raw materials commonly used for the production of organic fertilisers include:

- Animal manure
- Postharvest material
- Organic waste
- Bio-solids / sludge (human waste)

3.4. Implementation of Soil and Water Conservation Principles – Inorganic Fertilisers

Inorganic fertilisers are produced through commercial chemical processes. Although the products themselves are generally not a source of microbial contamination, care should be taken to assure that contamination is not introduced through the use of contaminated water to mix the products or unclean equipment used in their application.

Many inorganic fertilisers may cause residues which are unacceptable for export requirements of certain markets. It is therefore very important to keep accurate fertilisation records in order to complete the cycle of traceability as well as to implement the relevant good agricultural practices.

3.5. Animal Exclusion from Production Areas

All animals including mammals, birds, reptiles and insects can be vehicles for contamination with pathogenic organisms. A large number of micro-organisms can be found on the surface of animals' hair, feathers, hide, and skins, and in their respiratory and gastrointestinal systems.

In addition to food-borne pathogens, animals can carry many spoilage micro-organisms, which can greatly reduce the quality and shelf-life of fresh produce. Quality deterioration can be accelerated by physical damage to the surface of the fruit caused by animals, birds and insects. In addition to lowering quality the wounded surfaces become an open door to organisms that cause disease and decay, greatly increasing the risk of contamination of the internal parts of the produce.

3.5.1. Methods for Keeping Animals Out of Production Areas

Maintain domestic and farm animals away from the fruit orchards and establish physical barriers or vegetation to prevent entry of wild animals. These precautions are especially important near harvest time. Field workers should not be allowed to bring dogs, cats or other domestic animals into the field, packaging areas or storage facilities.

Dead or trapped animals such as birds, insects, and rats, should be disposed of promptly to avoid attracting other animals. Proper disposal procedures are to bury or incinerate the animal.

3.5.2. Cleaning Surrounding Areas

It is important to keep areas around the orchards clean and neat to further protect the plants and fruit. The following general guidelines should be adhered to:

- Keep the grass short to avoid the presence of rats, reptiles and other pests
- Keep all areas free of garbage
- Remove all old and broken equipment – it provides protection for rats and insects
- Remove nests from fields and buildings

3.5.3. Animals and Water

Since animals are attracted by water, the presence of water in the orchards and in the fruit packing or storage area should be limited to what is needed for specific uses. In the packhouse, surfaces and floors should be kept clean and as dry as possible to avoid water that may promote bacterial and pest growth. Water tanks and storage containers should be capped to prevent access to water sources.

3.6. Pest Control

3.6.1. Pest Control in Fresh Produce Operations

In fresh produce operations, the term pest applies to all organisms that can damage or contaminate fruit and vegetables during field production, packaging, storage and distribution. Insects, micro-organisms, wild animals and weeds, which can also harbour insects, vermin, etc., should all be considered in a pest control program. This program should also extend to the packhouse, storage facilities and vehicles used for transport.

3.6.2. Common Pest Control Procedures

Pests can be controlled through a variety of methods. When selecting a pest control method, choose one that is approved for local, regional and national level use and apply it appropriately. Table 2.1 describes the pest control methods that are commonly used.

Method	***Description***
Biological Control	Biological control uses living organisms for pest control. Biological pesticides fall into three major classes, which are: • Microbial pesticides that contain micro-organisms, such as bacteria, fungi, or viruses, that attacks a specific pest. • Plant pesticides that are substances that plants produce from genetic material that has been added to the plant. • Biochemical pesticides that are naturally-occurring substances that control pests by non-toxic mechanisms, for example pheromones. Some plant growth regulators are naturally-occurring bio pesticides. Biological control also includes the release of parasitic and predaceous insects to control insect pests or weed species.
Plant Resistance	Plants are bred to produce varieties that resist insects and other pests, and they are genetically altered to allow them to withstand herbicides so that only weeds are killed when treated.
Cultural Control	Cultural methods include crop rotation, soil tillage, the use of trap crops, changing planting or harvesting time, intercropping with other crops or with varieties that repel pests.
Mechanical and Physical Control	Mechanical and physical methods refer to techniques such as collecting pests with traps, suction devices or by hand, or such as using fire, heat, cold, sound, or physical barriers or screens.
Chemical Control	Chemical control methods make use of conventional pesticides, which are synthetic chemicals that are intended to prevent, destroy, repel or mitigate any pest.
Integrated Pest Management (IPM)	IPM is a pest management approach that uses all available pest control methods, including the judicious use of pesticides, to optimise the ability of a crop to resist the pest with the least hazard to humans and the environment. Integrated pest management supports the control of pests through methods that are less dependent on chemicals. In recent years, consumers of fresh produce are becoming more aware of the chemicals that are applied to fresh produce and the demand is therefore for a more integrated pest control strategy.

Table 2.1: Common Pest Control Methods

Pest control programs should include a series of scheduled inspections to identify situations that can encourage the introduction of pests, identify the presence of pests and quantify their number.

3.6.3. Pesticides

Pesticides are toxic chemicals that are used to protect crops, to control household pests and nuisance insects, and to eliminate vectors of human and animal diseases. Vectors are organisms that carry pathogens from one host to another.

Classes of pesticides are commonly named after the pests that they help to control, for instance insecticides control insects, herbicides control weeds, fungicides control fungi, and rodenticides control rodents.

Since pesticides can be extremely harmful, they should be applied, handled and stored in accordance with the instructions given on the label or on the manufacturer's safety data sheet for the product. Because of the potential health hazards associated with pesticides, application rates should be controlled to limit the amount of residues on produce and only pesticides approved for use on a specific product or in food processing facilities should be used.

Registration of a pesticide is a scientific, legal and administrative process to enable authorities to control quality, use levels, labelling, packaging and advertising. Data required for registration of a product include its chemical and physical properties, effectiveness, toxicity for assessment of human health hazards and a prediction of the environmental effects that it may have.

Pesticides should be used only when needed and only in the amounts that will adequately control pests. Minimising the amount of pesticide used reduces costs and helps to protect the environment. The pesticide label is the ultimate source of information for determining the proper application rates for a specific pesticide.

It is recommended that growers document and verify that the pesticides used come from certified distributors, and that competent authorities approved their usage.

3.6.4. Pesticide Handling

Pesticide handling should be controlled through every phase, from acquisition through storage to use in the fields. It is very important that the persons in charge of handling these products are aware of the possible danger that they hold, and follow the instructions printed on the label or on the information page that usually accompanies the product.

3.6.5. Pesticide Application

The instructions for application of a particular pesticide should be read carefully before using the product. Information such as restrictions for its use, application rates, approved doses, number of applications and minimal intervals between applications should be carefully considered.

Pesticides are supplied in liquid, solid, or gaseous forms. It is important to follow label instructions for the mixing, loading and handling of the specific pesticide being used and the actual conditions of use. The amount of pesticide concentrate needed to treat a specific site should be carefully calculated. The water used to prepare pesticides should be free of pathogenic organisms.

Special attention should be paid to spray equipment, pumps and nozzles used to apply pesticides. To minimise the potential for over or under treatment, accidents and spills, they should be calibrated for accuracy and checked frequently for malfunctions. Spray equipment should be regularly washed to prevent possible contamination of fruits or vegetables with compounds not authorised for that commodity and to avoid accidental overdosing.

Warning signs should be posted on fields that have recently been treated with pesticides to prevent workers or visitors from inadvertently coming in contact with treatment chemicals. Such signs should only be removed after the established re-entry period into the field has passed so that residual levels are at an acceptable level.

3.6.6. Pesticide Storage

The amount of pesticide on hand should be kept to a minimum by buying only what is needed for the season or for the specific application. The pesticide storage facility should:

- Be properly identified and signposted
- Be away from animal shelters, human habitations and all water sources
- Have a concrete floor to facilitate clean up in the event of a spill or leak

3.6.7. Pesticide Residues

High levels of pesticide residues on crops may be a hazard to humans who eat the produce. To regulate pesticide residues, a legal limit known as the maximum residue limit (MRL) is developed for each pesticide. The MRL is the maximum level of residue of a chemical substance that is legally permitted to remain in or on a crop when sold. This limit is used to provide reasonable assurance that the consumer will suffer no adverse effects from consuming the product, even over a lifetime of exposure.

The Citrus Growers' Association of Southern Africa publishes and updates a document called **The Recommended Usage Restrictions for Plant Protection Products**. This document indicates the MRL for all plant protection products that are registered for use on citrus in South Africa, and the withholding period for each product. The withholding period is the length of time between application of a plant protection product and harvest to ensure that the residue levels will be within the acceptable range at the time of harvesting.

If the guidelines contained in this document are strictly adhered to and the pesticides are applied in the correct dosages, the risk of exceeding an MRL is extremely low.

3.6.8. Pesticide Disposal

Instructions and restrictions on pesticide disposal are available from the product's manufacturer and may also be prescribed by local environmental regulations.

Empty pesticide containers should be washed multiple times and taken to an appropriate place for disposal. Empty, properly rinsed containers can be disposed of at most sanitary landfills. In view of the persistent, volatile nature of many pesticides, disposal by burning or burying on the farm is discouraged. Never dispose of pesticides or pesticide containers in unused wells or near water sources.

Excess spray and rinse water from cleaning of equipment can be sprayed on sites or crops listed on the label.

3.6.9. Training and Documentation

Records of training for the proper handling and application of pesticides should include:

- Employee's name
- Experience or employment date
- Position or job performed by the employee
- Date of training
- Training topics
- The institution responsible for training and instruction records or certificates

- Signature of trainer

Pesticide records must contain information on:

- Crop data (variety, planting date, etc.)
- Name of pesticides used
- Place of application
- Dosage
- Application dates
- Time period before harvest
- Name of the person responsible for the application
- Date of last equipment calibration

3.7. Worker Health and Safety

3.7.1. Relationship between Worker Health and Hygiene

Assuring worker health both increases worker productivity and aids in preventing potential microbial contamination of crops. An infected employee, whether he / she is showing symptoms or not, can easily contaminate fresh produce if they do not practice good hygiene, such as washing their hands after sneezing, touching hair or other body parts, or using the bathroom.

General symptoms that flag an employee with the potential for causing microbial contamination of produce include:

- Diarrhoea
- Vomiting
- Dizziness
- Abdominal cramps
- Exposed or open wounds
- Hepatitis or jaundice (yellow colour of the skin)

Employees with gastrointestinal distress or open wounds can contaminate fresh fruits and vegetables through handling. Persons that do not show any symptoms of disease can unknowingly transmit microbial pathogens. Many micro-organisms can be "guests" in the human body without evidence of disease and can be spread to others by human hosts.

Workers should be trained to report any disease symptoms to supervisors. Sick employees should not participate in activities that involve direct contact with the fresh produce or with packaging material until they have clearance from a licensed healthcare provider.

3.7.2. Health Programs

Ideally, agricultural workers should have access to a health care system that is accessible to them in their workplace. Workers have been shown to be more willing to report symptoms of illness or disease if they have access to healthcare professionals.

Information on and contact details of medical service providers that should be contacted in case of emergency must be prominently displayed.

Any worker with exposed wounds that can directly contaminate fresh produce should have these wounds properly disinfected and covered before participating in production and handling activities. A first aid kit with supplies for treating worker injuries should be readily available at the worksite.

3.7.3. Worker Hygiene Training Program

It is also important for employers to provide fruit and vegetable handlers with a training program on good food handling and hygiene practices. The possibility of produce contamination is directly related to the quality of the worker training program.

Proper hygiene procedures should be established and included in hygiene and health training programs. All employees including supervisors, temporary personnel, part-time and full-time workers should participate in these activities. The level of knowledge required should be set according to the type of operation, responsibilities and type of activities in which the employee participates.

Training should be reinforced constantly. Demonstrations of procedures are usually more effective than simple verbal instructions. Training should be in the language and dialect of the employees to ensure comprehension and trainers should consider cultural aversions and ingrained practices when planning training.

3.7.4. Drinking Water

Water for human consumption should be potable, which means that it should be free of micro-organisms and chemical substances that can jeopardise the health of the person consuming it. Ensuring the availability of potable drinking water for field workers can minimise the risk of them developing disease and consequently contaminating fresh produce.

Precautions that should be taken for the handling of drinking water in the fields and packing areas include:

- Water supply systems should be in good condition and operating properly
- Water should be stored in clean, sanitised containers and tanks
- Water containers should be washed and sanitised on a daily basis
- Water storage containers should be closed at all times
- Containers should be kept out of the sun and away from excessive heat
- Disposable cups should be provided and each person should use a different cup

Frequent microbiological and physical evaluation should be performed on drinking water when the water is being stored or treated on site. Simple evaluations of the colour, odour and taste of water should be performed as part of the daily monitoring procedures.

If any of the water quality tests indicate the quality is not adequate, the water should be replaced to reduce the chances of infection and the proper authorities should be notified of the problem.

3.7.5. Worker Hygiene Practices and Sanitation Facilities

The responsibility for reducing or avoiding contamination during primary production falls heavily on agricultural workers. Employers can provide training and other resources to educate workers, but the effectiveness of the program, in the end, relies on the worker's understanding and implementation of personal hygiene and safety practices.

Therefore, management should provide workers with information about acceptable hygiene practices, that sends a clear signal to workers about the importance of these practices, and ensure that it is understood.

Hand washing is required:

- At the beginning of the work day
- After going to the restroom
- After smoking or eating

- After breaks
- After sneezing, coughing or touching the nose
- After touching or scratching the skin or wounds
- After touching dirty equipment and utensils
- After touching trash on the floor or after handling waste material
- After touching or handling fertilisers, pesticides, chemicals or cleaning materials

3.7.6. Sanitary Field Stations

The basic requirements for sanitary field stations are:

- Toilets should be connected to an evacuation or sewage system adequately constructed to avoid contamination of fields, water sources or product.
- Sanitary stations should be in good, clean and sanitary, and should have adequate clean water, soap and paper towels.
- There should be an adequate number of toilets for the number of employees working. There should be at least one toilet for every 20 persons of the same gender.
- Toilets should be accessible for the personnel, close to their working area, at a maximum distance of 400 meters or a 5 minute walk.
- Toilet facilities should be separated by at least 400 meters from the water sources.
- Water stations with drinking water for should be in place during the harvest season.

3.8. Safety Hazards Associated with Harvesting

Most fresh fruits and vegetables are extremely perishable. The safety and quality of the produce when it reaches the retail market is strongly influenced by the safety and quality of the produce at harvest. Additional factors that affect safety and quality of fresh produce at market include handling, storage temperature, transportation conditions, and the time period between harvest and consumption.

Maintaining safe, high quality produce with an adequate shelf-life depends on both the pre-harvest factors discussed earlier and the control measures taken throughout the distribution chain. This chain begins with harvesting the produce.

The choice of harvesting method depends on the produce characteristics. Mechanical harvesting is recommended for produce that can withstand physical handling. For commodities destined for the fresh market, integrity and appearance are important, and manual harvesting is therefore widely used. Citrus is almost exclusively harvested manually.

With manual harvest, worker hygiene is especially important since there is a great deal of hand contact with the product that could lead to contamination. Proper sanitation of harvest tools is also critical to product safety.

3.8.1. Physical Damage

Physical damage caused during harvesting may lead to:

- Water loss
- Increased respiration rate
- Initiation of ethylene synthesis
- Fruit discolouration
- Penetration of micro-organisms

3.8.2. In-Field Packaging Operations

The following is recommended for products packed in the production field:

- All workers involved in field packing operations must follow good hygiene and sanitation practices.
- Avoid the direct contact of packages, containers or products with the soil.
- All containers, baskets or empty boxes should be clean and free from visible signs of dirt, oil, grease and chemical contaminants.
- Packing containers should be stored in a clean dry place away from the field and should be transported and handled with the same sanitary considerations

3.9. Postharvest Treatments

3.9.1. Postharvest Water Quality

Water is used in a number of postharvest operations. It is used to reduce physical injury in dump tanks as bins or picking trailers are emptied onto a packing line. It may be used for rinsing at any point on a packing line. It is needed for mixing solutions of waxes and fungicides. Hot water treatment is also used as a quarantine measure for pest control.

Water quality is important in reducing contamination during postharvest cooling, washing and sanitising operations. The water used for postharvest operations should be potable and free of disease-causing organisms. Water taken and used directly from rivers or holding ponds should not be used for postharvest washing or cooling.

Practices that are used to reduce the risk of contamination of produce by postharvest processing water are as follows:

- Perform periodic water sampling and microbial testing
- Follow appropriate guidelines for packhouse water sanitation
- Change water as necessary to maintain sanitary conditions
- Clean and sanitise water contact surfaces, such as dump tanks and wash tanks
- Install backflow devices and legal air gaps to prevent contamination of clean water with potentially contaminated water
- Routinely inspect and maintain equipment designed to assist in maintaining water quality, such as chlorine injectors, filtration systems, and backflow devices

3.9.2. Cooling

Immediately after harvest the temperature of the fresh produce is high. To extend the shelf-life and quality of fresh fruits and vegetables, products are generally cooled within 24 hours after harvesting. Heat elimination is commonly applied to highly perishable commodities such as fruits.

There are many different types of cooling systems available. Methods that are commonly used to cool fresh produce include:

- Room cooling
- Forced air cooling
- Hydro-cooling

- Package icing
- Vacuum cooling

Of the commonly used commercial cooling methods, the ones using air and vacuum present the lowest risk for contamination. However, the air introduced in the cooling systems can represent a potential microbial hazard. Micro-organisms found in dust and tiny water droplets can be introduced onto product using these cooling systems. Such micro-organisms can come from outside dust, soil, equipment, and waste products. These micro-organisms cannot develop in the air, but air can serve as the vehicle through which they can reach the product.

Cooling methods using water and ice as the cooling mediums have the greatest potential for contamination of fruits and vegetables. Water used in hydro-cooling systems and for ice making should be potable and ice should be made and held under sanitary conditions.

Chapter 2

- Good Practice guidelines aim to improve the manner in which a variety of businesses conduct themselves.
- In agriculture, Good Practice guidelines have been developed for the entire supply chain, and they include Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Good Distribution Practices (GDP), Good Health Practices (GHP), Good Social Practices (GSP), and Good Environmental Practices (GEP).
- Good Practices that are implemented in crop production are collectively referred to as GAP, even though some of these practices actually may be GHP, GSP or GEP.
- More specifically, GAP is a collection of principles and basic environmental and operational conditions that are necessary for the sustainable production of safe, wholesome fruit and vegetables.
- GMP are guidelines for manufacturers to ensure the quality, consistency and safety of products and processes.
- GDP applies to the handling, transport and distribution of fresh produce.
- GHP focuses on personnel health and hygiene.
- GSP addresses issues such as economically disadvantaged producers, transparency and accountability, capacity building, payment of a fair price, gender equality, and working conditions.
- GEP promotes the management of farming operations to promote minimum impact on the natural environment and sustainable land use.
- GAP principles have been developed for the following areas:
  - **Land Use and Soil**
    - Cultivated land information
    - Current or prior use of adjacent land
  - **Water Sources and Irrigation Practices**
    - Potential contamination associated with water sources
    - Hazards introduced by irrigation practices
    - Chemigation
    - Agricultural water microbiological testing procedures
  - **Implementation of Soil and Water Conservation Principles – Organic Fertilisers**
    - Management of organic fertilisers
    - Hazards associated with animal manure and treatments to reduce the risks
    - Hazards associated with manure treatment and storage location
    - Precautions for the application of organic fertilisers
    - Keeping complete records of organic fertiliser preparation and use
  - **Implementation of Soil and Water Conservation Principles – Inorganic Fertilisers**

- Keeping complete records of inorganic fertilisation programs
- Appropriate storage of inorganic fertilisers

- **Animal Exclusion from Production Areas**
  - Methods for keeping animals out of production areas
  - Cleaning surrounding areas
  - Preventing cross-contamination between animals and water
- **Pest Control**
  - Pest Control in fresh produce operations
  - Common pest control procedures
  - Pesticides
  - Pesticide handling
  - Pesticide application
  - Pesticide storage
  - Pesticide residues
  - Pesticide disposal
  - Training and documentation
- **Worker Health and Safety**
  - Relationship between worker health and hygiene
  - Health programs
  - Worker hygiene training program
  - Drinking water
  - Worker hygiene practices and sanitation facilities
  - Hand washing and hand-washing facilities
  - Basic requirements for and placement of sanitary field stations
- **Safety Hazards Associated with Harvesting**
  - Physical damage caused by mechanical and / or manual harvesting methods
  - In-field packing operations
- **Safety Hazards Associated with Postharvest Treatments and Handling**
  - Postharvest water quality
  - Cooling considerations

Complete activities 4 and 5 in the **Learner Workbook**.

Chapter 3

After completing this chapter, the learner will be able to:

Take decisions on reported non-conformances in respect of food safety, production, environmental, and social practices and implement corrective action in the agricultural environment.

1. Introduction

Now that we have examined traceability through effective recordkeeping, and considerations regarding the management and maintenance of Good Agricultural Practices, it is important to examine the implications of non-conformance and explore possibilities for corrective actions.

In the context of food safety management systems, "non-conformance" is firstly used to describe products that are potentially unsafe because they deviate from a set standard, and secondly to describe the deviation from the prescribed processes and procedures that caused the deviation in the product.

A food safety management system is designed to consistently turn out final products that adhere to specific quality and safety standards. The system should be such that as long as all prescribed policies and procedures are adhered to the final product is virtually guaranteed to be safe and of good quality. It follows that only non-conformances or non-compliances to the prescribed policies and procedures can lead to a product that does not conform to quality and safety standards. For example: the product was handled or manufactured during a period when prescribed critical limits were violated or exceeded, or when an organisation lost control of a prerequisite program (PRP) or an operational prerequisite program (OPRP).

2. The Impact of Non-Conformance

Deviations from food safety procedures may compromise product quality by causing blemishing, contamination, accelerated decay, or exceeding of maximum residue levels, which would render it unsafe for human consumption or unsuitable for meeting specifications of export markets.

Many export or local contracts are based on the assurance provided by the implementation of and management according to a food safety management system and adherence to Good Agricultural Practices. The buyer of fresh produce would not be satisfied with a product that does not conform to the standards and specifications. Additionally, it would raise concerns for the buyer if they find repeated instances of non-conformance to the plan.

Fruit that does not conform to standards cannot be sold in that market. Regulations of importing countries may require such fruit to be quarantined, shipped back to the country of origin or destroyed.

3. The Role of Traceability and Recordkeeping in Identifying Non-Conformance

The purpose of traceability and associated recordkeeping was discussed in detail both in the level 3 guide and in Chapter 1 of this guide. As part of the food safety management system, data and records associated with traceability are analysed and interpreted to identify instances of non-conformance.

This is done both on an ongoing basis, where the records that relate specifically to identified risk areas, or critical control points, are monitored to ensure that critical limits are maintained. If critical limits are exceeded at any critical control point, the planned corrective action must be taken immediately to eliminate or control the non-conformance.

Records related to traceability are essential in determining the point at which non-conformance occurred. Because traceability records are designed to provide a complete picture of the process to which the fruit was subject, the point at which the critical limits were exceeded can be identified if non-conforming fruit is found.

Non-Conformance and Recordkeeping

In 2006, a consignment of fruit was found to exceed a maximum residue level on arrival in Japan. The consignment consisted of 4,000 pallets of fruit. The procedure in such a case prescribes that the entire consignment is rejected until it can be proven that not all the fruit was subjected to the same processes. Because the grower had sound traceability records, he could prove that most of the fruit were not subject to processes where the critical limits were exceeded. The non-conforming fruit was accurately identified and the remainder was released onto the market.

4. Validation and Verification

Validation is a process that is used to ensure that food safety control measures are capable of being effective. The validation process uses evidence to determine whether control measures are capable of controlling food safety hazards and ensuring that products are safe. Validation poses the question: "Is the control measure adequate and appropriate to control the particular food safety hazard?"

Control measures are implemented and managed using operational prerequisite programs (OPRPs) and HACCP plans, and must be validated before they are implemented.

Verification is a process that uses objective evidence to confirm that specified requirements have been met. In the context of most food safety standards, it must be verified that the food safety management system has been implemented. Verification poses the question: "How well is the control measure managing the risk?"

The following is the minimum requirements for verification:

- Verify that prerequisite programs (PRPs) have been implemented
- Verify that hazard analysis inputs are updated
- Verify that hazard levels are acceptable
- Verify that operational prerequisite programs (OPRPs) are implemented and effective
- Verify that the HACCP plan is implemented and effective
- Verify that procedures are implemented and effective

5. Corrective Actions

Corrective actions are steps that are taken to eliminate the causes of an existing non-conformance. The corrective action process includes causal analysis and is designed to prevent recurrence.

It is difficult to quantify or prescribe corrective actions, as the options would be related directly to the food safety management system and identified deviation or non-conformance. The scope of the corrective actions is also directly related to the class and grade of fruit to be produced and the market for which it is destined.

Planned corrective actions are described in the Quality Management Standard Operations Procedure Manual or in the Standard Operating Procedures manual for the food safety management system. The development of such prescribed corrective actions relates directly to HACCP step 5.

The following principles are applied in terms of taking corrective actions:

- Early identification of the problem through prescribed and regular analysis and interpretation reports
- Open and honest channels of communication regarding the occurrence of non-conformance to avoid health risks to the consumer and limit liability to the grower and its agents
- Rapid and coordinated response to the problem, for example quarantine any affected produce immediately or suspend procedures and activities that caused the problem
- Investigation and confirmation of non-conformance as measured against the critical control points identified in the food safety management system
- Confirmation and identification of source(s) of the non-conformance or non-conforming product(s) by measuring against critical limits
- Take decisive action to prevent future non-conformance instances or the production of similar non-conforming produce

Chapter 3

- "Non-conformance" describes, firstly, the identified product that is potentially unsafe because it deviates from set standards and, secondly, the deviation from the prescribed processes and procedures that were the cause of the deviation in the identified product.
- Deviations from food safety procedures may render the product unsafe for human consumption or unsuitable for meeting specifications of export markets.
- Data and records associated with traceability are analysed and interpreted to identify instances of non-conformance, and to determine the point at which the deviation occurred.
- Validation is a process that is used to ensure that food safety control measures are capable of being effective: "Is the control measure adequate and appropriate to control the particular food safety hazard?"
- Verification is a process that uses objective evidence to confirm that specified requirements have been met: "How well is the control measure managing the risk?"
- Corrective actions are steps that are taken to eliminate the causes of an existing non-conformance and are designed to prevent recurrence.
- Planned corrective actions are described in the Quality Management Standard Operations Procedure Manual or in the Standard Operating Procedures manual for the food safety management system.

Complete activities 6 and 7 in the **Learner Workbook**.

Chapter 4

After completing this chapter, the learner will be able to:

Conduct internal audits according to the specifications of the trade/market in the agricultural environment.

1. Introduction

The International Organisation for Standardisation (ISO) describes audits as follows:

> **A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.**

The food safety management system on a farm can be well written out, but if it is not implemented correctly and consistently, and if its prescriptions and procedures are not followed, it is of no real value.

Internal audits are used to continuously monitor and probe the integrity of the food safety management system and to thereby ensure that it is implemented as prescribed. The internal auditor conducts regulatory system audits. This auditor verifies that the establishment's food safety management system, such as the HACCP system and its prerequisite programs, HACCP plans and reassessment procedures, are implemented as described and are continuously effective.

2. Elements of Internal Audit Systems

An organisation's approach to internal audits consists of the policies and procedures that govern its internal audit functions, including auditing schedules.

There are no hard and fast rules that prescribe exactly how internal audit systems for food safety should be designed and executed and the approach to conducting an internal audit is often closely related to the quality management system.

There are certain common elements that occur in all internal audit systems, being:

- An audit charter
- Risk assessment process
- An audit plan
- An audit cycle
- Audit work programs
- Audit reports
- Requirements for audit documentation
- Follow-up procedures
- Professional development programs

2.1. Audit Charter

A mission statement or audit charter outlines the purpose, objectives, organisation, authorities, and responsibilities of the internal auditor, audit staff, audit management, and the audit committee.

2.2. Risk Assessment Process

A risk assessment process describes and analyses the risks inherent in a given line of business. The level of risk should be one of the most significant factors considered when determining the frequency of audits.

Auditors should update the risk assessment at least annually, or more frequently if necessary, to reflect changes to internal control or work processes, and to incorporate new lines of business.

2.3. Audit Cycle

An audit cycle identifies the frequency of audits. Auditors usually determine the frequency by performing a risk assessment of areas to be audited, as noted above.

While staff and time availability may influence the audit cycle, they should not be overriding factors in reducing the frequency of audits for high-risk areas.

2.4. Audit Plan

The audit plan details the internal audit budgeting and planning processes. The plan describes audit goals, schedules, staffing needs, and reporting.

The audit plan should cover at least 12 months and should be developed by combining the results of the risk assessment and the resources required to facilitate the timing and frequency of the planned audit cycle.

The audit committee should formally approve the audit plan annually, or review it annually in the case of multi-year audit plans. The internal auditors should report the status of planned versus actual audits, and any changes to the annual audit plan, to the audit committee for its approval on a periodic basis.

2.5. Audit Work Programs

Audit work programs set out the required scope and resources for each audit area, including the selection of audit procedures, the extent of testing, and the basis for conclusions.

Well-planned, properly structured audit programs are essential for effective risk management and to the development of comprehensive internal control systems.

2.6. Audit Reports and Requirements for Audit Documentation

Written audit reports inform the board and management of individual department or division compliance with policies and procedures. These reports should state whether operating processes and internal controls are effective, and describe deficiencies as well as suggested corrective actions.

The audit manager should consider implementing an audit rating system approved by the audit committee. The rating system facilitates conveying to the board a consistent and concise assessment of the net risk posed by the area or function audited.

The requirements for audit documentation (work papers) should be clearly described in the audit charter, including work paper retention policies. This ensures clear support for all audit findings and work performed.

2.7. Follow-Up Procedures

Follow-up processes require internal auditors to determine the disposition of any agreed-upon actions to correct significant deficiencies.

2.8. Professional Development Programs

Professional development programs must be in place for the institution's audit staff to maintain the necessary technical expertise.

3. Pre-Harvest Internal Audits

A pre-harvest internal audit on a citrus farm is normally conducted as a single audit, usually in the following sequence:

1. Chemical storage
2. Fertilisers
3. Water and irrigation
4. Waste disposal and pollution
5. Transport from orchard
6. Machinery and equipment maintenance
7. Personal hygiene
8. Training

On the following pages are examples of internal audit documents for each of these points. Please note that these are examples only and that the work papers used on specific farms will depend on the risk assessment and circumstances on that farm.

3.1. Chemical Storage

CITRUS
Internal Audit – Food Safety

Chemical Storage

Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Are there sufficient warning signs?		
2. Are there signs for no smoking, eating or drinking?		
3. Is the storage area always locked?		
4. Is there a safety gate to the storage facility?		
5. Are only authorised personnel allowed in the storage area?		
6. Are there hand-washing and showering facilities?		
7. Is clothing stored separately?		
8. Is the ventilation adequate?		
9. Is non-absorbent shelving used?		
10. Are the powders stacked above the liquids?		
11. Are the chemical stored in their original containers?		
12. Are there emergency procedures?		
13. Is there a pail with sand to clear up spillages?		
14. Are agrochemicals transported in a safe and secure manner?		
15. Is there a system in place for the disposal of wastewater?		
16. Is all documentation up to date?		
17. Are MRL lists and safety data sheets present and accessible?		
18. Is the yearly residue analysis available?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

3.2. Fertilisers

CITRUS
Internal Audit – Food Safety

Fertilisers

Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Are inorganic fertilisers stored at least 10m from ditches, water courses and other water sources?		
2. Are there retention walls where inorganic fertilisers are stored?		
3. Are all concentrated fertilisers stored under cover?		
4. Are all hazardous and risk areas sign-posted?		
5. Are the personnel trained in the handling of fertilisers?		
6. Are documentation, records, and safety data sheets up to date?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

3.3. Water and Irrigation

CITRUS
Internal Audit – Food Safety

Water and Irrigation

Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Has no untreated sewage water been used for irrigation?		
2. Have records been kept of the water volumes deposited during irrigation?		
3. Has routine water analysis been taken of water used from water sources where there is a potential pollution risk?		
4. Has an annual risk assessment for water pollution been completed?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

3.4. Waste Disposal and Pollution

CITRUS
Internal Audit – Food Safety

Waste Disposal and Pollution

Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Are there procedures and facilities in place for storage and disposal of hazardous materials?		
2. Is suitable provision made for the removal of waste?		
3. Is waste stored in suitable containers with lids in the orchard?		
4. Are there any indications that the production practices may cause pollution?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

3.5. Transport from Orchard

CITRUS Internal Audit – Food Safety			
Transport from Orchard			
Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Are the vehicles, trailers and crates cleaned regularly?		
2. Are drivers trained to operate vehicles and machinery?		
3. Are drivers instructed to drive at the proper speed through orchards to minimise dust?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

3.6. Machinery and Equipment Maintenance

CITRUS
Internal Audit – Food Safety

Machinery and Equipment Maintenance

Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Is all machinery in a good condition and cleaned regularly (spray machines, trailers, herbicides carts, etc.)?		
2. Is all equipment in a good condition and cleaned regularly (pruning sheers, saws, clippers, etc.)?		
3. Are all maintenance records and schedules in place and up to date?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

3.7. Personal Hygiene

CITRUS
Internal Audit – Food Safety

Personal Hygiene

Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Do all workers wash their hands before handling fruit and after using the toilet?		
2. Do all workers have clean protective clothing, head coverings and footwear?		
3. Is there no spitting, chewing, eating, smoking, drinking, sneezing, and coughing over fruit?		
4. Is hair clean, tidy and covered?		
5. Are no personal items taken into the orchard?		
6. Are all fingernails short and clean, with no nail varnish and no false fingernails?		
7. Is no jewellery allowed in the orchard?		
8. Are all cuts and open sores properly dressed with bandage or a plaster?		
9. Are all serious skin complaints reported to the health worker?		
10. Are no transferable or infectious disease carriers allowed to work with fruit? (please report)		
11. Are incidences of transferable or infectious disease carriers reported to the health worker?		
12. Are all field toilets equipped with soap, water and disposable towels?		
13. Are all the toilets kept clean and is there a cleaning schedule available?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

3.8. Training

CITRUS
Internal Audit – Food Safety

Training

Auditor		**Responsible Person**	
Signature		**Audit Date**	

Question	*Y/N*	*Defects*
1. Are all personnel operating machinery trained and do they have the necessary certificates?		
2. Are all personnel working with plant protection products trained and do they have the necessary certificates?		
3. Are all personnel trained in food hygiene and food safety and do they have the necessary certificates?		
4. Are all personnel trained in personal hygiene?		
5. Is there at least one person trained in First Aid?		
6. Is there at least one person trained in basic food handling hygiene in each harvesting team?		

Corrective Action	*Person*	*Target Date*	*Completion Date*	*Signature*	*Verify (Date and Signature)*

Chapter 4

- Internal audits are used to monitor and probe the integrity of the food safety management system continuously and to thereby ensure that it is implemented as prescribed.
- The common elements to all internal audit systems are an audit charter, risk assessment process, an audit plan, an audit cycle, audit work programs, audit reports, requirements for audit documentation, follow-up procedures, and professional development programs.
- A pre-harvest internal audit on a citrus farm is normally conducted as a single audit, usually in the sequence of chemical storage, fertilisers, water and irrigation, waste disposal and pollution, transport from orchard, machinery and equipment maintenance, personal hygiene, and lastly training.

Complete activity 8 in the **Learner Workbook**.

Chapter 5

After completing this chapter, the learner will be able to:

Maintain standard operational procedures with regard to agro-chemicals, food safety, quality, and production practices, as well as environmental and social awareness within the agricultural supply chain.

1. Introduction

Standard operating procedures (SOPs) are written documents that describe step-by-step and in detail how a procedure should be done. SOPs describe both technical and administrative operational elements of an organisation.

The standard operating procedure manual for food safety is to a large extent the documentation for a food safety management system. The SOPs contained in the manual is used during an internal audit to measure the actual procedures and processes that are employed. Although the SOPs for food safety are in many cases exactly the same as for instance HACCP documentation, there is a clear distinction: not every farming operation implements the HACCP system, but every operation needs food safety SOPs.

The development and use of SOPs is an integral part of a successful quality management system. It provides individuals with the information to perform a job properly and facilitates consistency in the quality and integrity of a product through consistent implementation of a process or procedure within the organisation.

SOPs can also be used as a part of personnel training programs, since they should provide detailed work instructions. When historical data is evaluated for current use, SOPs can be valuable for reconstructing project activities. In addition, SOPs are frequently used as checklists by inspectors when auditing procedures.

Ultimately, the benefits of a valid SOP are reduced work effort, along with improved data comparability, credibility, and legal defensibility.

2. Drafting Standard Operating Procedures

The following guidelines can be used when drafting SOPs:

- Standard operating procedures are often compiled into a standard operating procedures manual. The different standard operating procedures in a manual are typically related to managing one specific outcome or objective and are normally related to each other. The SOP manual related to food safety will for instance hold systematic and sequential procedures related to each of the steps that the organisation will follow in order to ensure food safety.

- It is important that each producer examines every aspect of the GAP list and associated HAACP plan and draft specific operating procedures that will ensure food safety principles are adhered to in line with his food safety management system.

- A SOP manual should be organised to ensure ease and efficiency of use and to be specific to the organisation that develops it. There is no one correct format – internal formatting varies with each organisation and with the type of SOP being written.

- A SOP should be written with sufficient detail so that someone with a basic understanding of the field can successfully reproduce the activity or procedure when unsupervised.

- SOPs should be written by individuals knowledgeable about the activity and with the organisation's internal structure in mind. These individuals are essentially subject-matter experts who actually perform the work or use the process. A team approach can also be followed, especially for multi-tasked processes where the experience of a number of individuals is critical.

- The organisation should have a procedure in place for determining what procedures or processes need to be documented. The first step in an SOP manual is to determine the policies of the organisation regarding:

    - Food Safety
    - Traceability
    - Good Agricultural and Production Practices
    - Quality and Quality Management
    - Environmental awareness and conservation
    - Social awareness

3. Validating Reviewing Standard Operating Procedures

SOPs should be reviewed and validated by one or more individuals with appropriate training and experience with the process. It is especially helpful if the draft SOPs are tested by an individual other than the original writer before the SOPs are finalised.

The finalised SOPs should be approved as described in the organisation's quality management plan. Generally, the immediate supervisor, such as a section or branch chief, and the organisation's quality assurance officer review and approve each SOP. Signature approval indicates that a SOP has been both reviewed and approved by management.

SOPs need to remain current. Therefore, whenever procedures are changed, SOPs should be updated and re-approved.

SOPs should be also systematically reviewed on a periodic basis to ensure that the policies and procedures remain current and appropriate, or to determine whether SOPs are even needed. The review date should be added to each SOP that has been reviewed. If a SOP describes a process that is no longer followed, it should be withdrawn from the current file and archived.

The review process should not be overly cumbersome or SOPs will never get reviewed. The frequency of review should be indicated by management in the organisation's quality management plan, which should also indicate the individual(s) responsible for ensuring that SOPs are current.

4. Checklists

Many activities use checklists to ensure that steps are followed in order. Checklists are also used to document completed actions. Any checklists or forms included as part of an activity should be referenced at the points in the SOP where they are to be used and attached to the SOP. Remember that the checklist is not the SOP, but a part of the SOP.

In some cases, detailed checklists are prepared specifically for a given activity. In those cases, the SOP should describe, at least generally, how the checklist is to be prepared, or on what it is to be based. Copies of specific checklists should be kept in the file with the activity results or with the SOP.

5. Standard Operating Procedure Document Control and Tracking

Each organisation should develop a numbering system to systematically identify and label their SOPs, and the document control should be described in its quality management plan.

Generally, each page of a SOP should have control documentation notation. A short title and identification (ID) number can serve as a reference designation. The revision number and date are very useful in identifying the SOP in use when reviewing historical data and is critical when the need for

evidentiary records is involved and when the activity is being reviewed. When the number of pages is indicated the user can quickly check if the SOP is complete. Generally, this type of document control notation is located in the upper right-hand corner of each document page following the title page.

The organisation should maintain a master list of all SOPs, and this file should minimally include the date of the current version. This list may be used when audits are being considered or when questions are raised as to practices being followed within the organisation.

Chapter 5

- Standard operating procedures (SOPs) are written documents that describe step-by-step and in detail how a procedure should be done.
- Food safety SOPs are the documentation for the food safety management system.
- SOPs are used during audits and for personnel training.
- Standard operating procedures are often compiled into a SOP manual.
- SOP manuals should be catalogued and detailed, and should be written by persons that have a good knowledge of food safety and a sound understanding of the organisation.
- SOPs should be reviewed and validated by one or more individuals with appropriate training and experience with the process.
- SOPs should be systematically reviewed on a periodic basis to ensure that the policies and procedures remain current and appropriate.
- Checklists or forms included as part of an activity should be referenced at the points in the SOP where they are to be used and attached to the SOP manual.
- Each organisation should develop a numbering system to systematically identify and label their SOPs, and the document control should be described in its quality management plan.

Complete activity 9 in the **Learner Workbook**.

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