



GOOD AGRICULTURAL PRACTICES

**for
Trainers and Processors**

**Prepared
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under

**PROCESSING
FOR COMMERCIAL
EXPLOTATION OF
SELECTED TREE
FRUITS AND
VEGETABLES IN
TANZANIA AND
RWANDA PROJECT**

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Preface

Fruits and vegetables are important crops in Eastern and Central Africa, just as they are the world over. They are a source of essential vitamins, minerals, antioxidants, fibres and carbohydrates which our bodies crucially need. These nutrients improve the quality the human diet and protect us from chronic diseases. Fruits and vegetables, however, are highly perishable leading to drastic nutritional and economic losses. Estimated post harvest losses for fruits and vegetable in developing countries is 40%. This means that during the off-season, households face shortage of fruits and vegetables due to lack of knowledge on how to preserve and process them for year-round consumption. The long term implication is that supplies of locally processed products are inadequate and do not meet the required quality standards for domestic and international markets. These challenges have spurred ASARECA to invest in research and development on fresh produce technology to add onto their value and increase incomes.

In response to this particular challenge, ASARECA initiated a project; “*Processing for commercial exploitation of selected tree-fruits and vegetables in Tanzania and Rwanda*” to validate the existing protocols for processing dried products and fruit juices on commercial but small scale basis. The project is focusing on ready-to-drink single or mixed fruit mango and passion fruits, and the vegetable *Amaranthus sp.* The project is implemented by scientists from Sokoine University of Agriculture, Tanzania; Institut des Sciences Agronomiques du Rwanda, Mikocheni Agricultural Research Institute, Tanzania, the Kigali Institute of Science and Technology, Rwanda, and the Community Food Processing and Training Centre, Morogoro Tanzania. It is managed by ASARECA’s High Value Non Staple Crops programme. The project has identified a number of key cost-effective technology packages for small scale fruits and vegetables processing to produce quality products that meet safety demands of target markets. It has fostered linkages amongst stakeholders along the fruit/vegetable value chain to promote best handling practices and standards, and sensitized consumers to appreciate the value of locally processed fruits and vegetable products. The project has also facilitated the training of farmers, transporters, processors and traders on suitable agronomic practices, quality assurance and appropriate technologies.

This training manual is therefore, prepared to present, Good Agricultural Practices (GAP). In preparing this manual, the author has taken into consideration recent advances in GAP, quality and safety issues.

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ESSENTIALS OF GOOD AGRICULTURAL PRACTICES

Introduction

People have the right to expect the food they eat to be safe and suitable for consumption. Foodborne illness and foodborne injury have many consequences:

- at best they are unpleasant; at worst, they are fatal.
- damage trade and tourism,
- lead to loss of earnings,
- unemployment and litigation.
- Food spoilage is wasteful, costly
- can adversely affect consumer confidence.

Why hygiene on foods?

- International food trade, and foreign travel, are increasing, bringing vital social and economic benefits to our countries. This makes the spread of illness around the world easier.
- Eating habits, have undergone major changes in many countries over the last two decades. In response to these changes food production, preparation and distribution techniques have also developed.
- The recent increase in reports of food borne illness associated with fresh fruits and vegetables has raised concerns from public health agencies and consumers about the safety of these products.

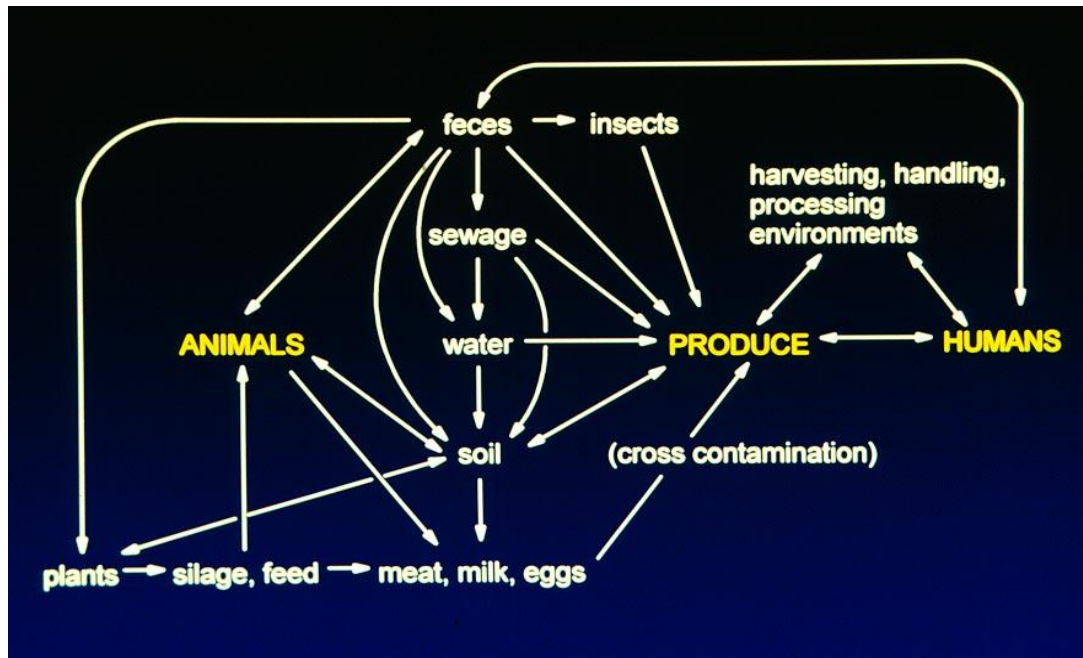
Current Foodborne Illness Outbreaks

- In the past, most outbreaks were associated with improper food processing, preparation or storage. Recently, outbreaks have been associated with contamination at the source
- In September of 2006, several individuals in Georgia and Florida came down with foodborne botulism from un-refrigerated carrot juice
 - Juice not heat-processed
 - Has low acidity (pH~6)
 - Low salt
- Conditions listed above coupled with warm temperatures allowed bacteria to grow and produce botulism toxin.

Foodborne Illness – statistics

- Most foodborne illnesses are undiagnosed and unreported
- CDC estimates that every year about 76 million people in the US become ill from pathogens in food.
- Of these, about 5,000 die
 - 6 – 81 million illnesses
 - 325,000 hospitalized
 - Costs : \$6.5 - \$34.9 billion annually
- Effective hygiene control, therefore, is vital to avoid the adverse human health and economic consequences of foodborne illness, foodborne injury, and food spoilage.

Sources of Pathogenic Microorganisms



Sources of Pathogenic Microorganisms on Fresh Produce

- human and animal feces
- contaminated water
- unsanitary farm environment
- unsanitary facilities
- improperly treated animal manure or biosolid wastes
- poor worker hygiene and sanitation practices during production, harvesting, sorting, packing, and transport
- cross-contamination during transport of fresh produce from farm to market

Objectives of Good Agricultural Practices (GAPs)

GAPs in fruits and vegetables are the basic environmental and operational conditions that are necessary for the production of safe, wholesome fruits and vegetables. GAPs can enhance food safety and help prevent and reduce the risk of foodborne illness

PRIMARY PRODUCTION

Main concern

- Primary production of fruits and vegetables should:
 - be well managed to ensure that these products are safe and suitable for their intended use
 - avoid the use of areas where the environment poses a threat to the safety of these products during production and during and after harvest
 - adopt practices and measures to ensure these products are produced under appropriately hygienic conditions.

- Procedures associated with primary production of fresh fruits and vegetables should:
 - be conducted under good hygienic conditions
 - minimize potential hazards to health due to the contamination

ENVIRONMENTAL HYGIENE

- potential sources of contamination from the environment should be identified.
- The access of farm and wild animals to the site and to water sources should be evaluated
- previous uses of the sites as well as adjoining sites should be evaluated. The evaluation process may include the following;
 - Crops grown, feed lot, animal production, hazardous waste site, sewage treatment site, mining extraction site
- leaking, leaching or overflowing manure storage sites and flooding from polluted surface waters should be evaluated

Water in primary production

- Growers should identify the sources of water used on the farm (municipality, re-used irrigation water, well, open canal, reservoir, rivers, lakes, farm ponds etc.).
- They should assess its microbial and chemical quality (through testing), and its suitability for intended use, and identify corrective actions to prevent or minimize contamination (e.g. from livestock, sewage treatment, human habitation).
- The frequency of testing will depend on the water source and the risks of environmental contamination **Flowing Water (rivers, streams) 4 times per year, Impounded Water (ponds, lakes) 3 times per year before season begins**

Water Quality and Safety concern for primary production

- Be aware of potential sources of pathogens from your water sources
- Maintain wells in good condition
- Be aware of current & historical use of land
- Consider practices to protect water quality (e.g. **casing, cap, age, type, depth, back siphoning**)
- Consider irrigation water quality & use
- Microbial testing of water (e.g. **Test 1-2 times/year**)

Maintaining Water Safety

- Municipal or public water systems - best source and lowest risk of water for any use.
- Surface water (lakes, ponds or streams) more likely to have microbial contaminants
- Private wells from ground water - safe if tested annually
- Use only clean, potable/drinkable water to water or wash produce close to or at harvest and during post-harvest handling.

Manure, biosolids and other natural fertilizers

- The use of manure, biosolids and other natural fertilizers in the production of fresh fruits and vegetables should be managed to limit the potential for contamination.
- If contaminated with heavy metals or other chemicals at levels that may affect the safety of fresh fruits and vegetables should not be used.

Manure, biosolids and other natural fertilizers

It is important:

- To adopt proper treatment procedures (e.g. composting, pasteurization, heat drying, UV irradiation, alkali digestion, sun drying or combinations of these)
- Manure, biosolids and other natural fertilizers which are untreated or partially treated may be used provided that maximum time between application and harvest of produce is employed
- To minimize direct contact with produce, especially close to harvest.

Soils

- Soils should be evaluated for hazards.
- If the evaluation concludes that such hazards are at levels that may compromise the safety of crops, control measures should be implemented to reduce hazards to acceptable levels.
- If this cannot be achieved by available control measures, growers should not use these soils for primary production.

Agricultural chemicals

- Growers should use only authorized agricultural chemicals for the cultivation of fruits or vegetables and should use them according to the manufacturer's instructions for the intended purpose.
- To minimize and contain the emergence of microbial resistance:
 - antimicrobial agents significant to human and animal therapy should be avoided.
 - workers should be trained in proper application procedures.

- Chemicals should be kept in their original containers, labelled with the name of the chemical and the instructions for application.

Personnel health, hygiene and sanitary facilities

- Hygiene and health requirements should be followed at all the times
- Visitors should, adhere to the other personal hygiene provisions.
- Hygienic and sanitary facilities should be:
 - located in close proximity and be sufficient in number
 - Be maintained under sanitary conditions and good repair.

Health status, Personal cleanliness and behaviour

- Ill people should not be allowed to touch produces or enter any food handling area, illness or symptoms of illness should be immediately reported to the management.
- Personnel should wash their hands regularly
- Cuts and wounds should be covered by suitable waterproof dressings when working
- No smoking, spitting, chewing gum or eating, or sneezing or coughing over unprotected fresh produces
- Jewelleries are not be allowed during production

Equipment associated with growing and harvesting

- All Containers should be specifically identifiable, e.g. for waste, by-products

- Where appropriate, such containers should be lockable to prevent malicious or accidental contamination
- Such containers should be segregated or otherwise identified to prevent their use as harvesting containers.

Handling, storage and transport: Prevention of cross-contamination

- Fresh fruits and vegetables unfit for human consumption should be segregated during harvesting.
- harvesting containers should not be used for carrying other materials (e.g. lunches, tools, fuel, etc.)
- Equipment and containers previously used for potentially hazardous materials (e.g. garbage, manure, etc.) should not be used for holding fresh produce

Storage and transport to packing facility

- Fresh produces should be stored and transported under conditions which will minimize potential contamination.
 - Storage facilities and vehicles should minimize damage and deny access to pests.
 - non-toxic materials that permit easy and thorough cleaning.
 - workers should remove as much soil as possible from fresh fruits and vegetables before they are stored or transported.

CLEANING, MAINTENANCE AND SANITATION

- Premises and harvesting equipment should be kept in an appropriate state of repair and condition to facilitate cleaning and disinfection.

- Cleaning materials and hazardous substances should be specifically identifiable and kept or stored separately in secure storage facilities.
- Cleaning chemicals should be used according to manufacturer's instructions for their intended purpose.
- Cleaning and disinfection systems should be monitored for effectiveness

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