

PHILIPPINE NATIONAL STANDARD

**PNS/BAFS 171:2015
ICS 67.080.20**

Good Agricultural Practices for Papaya



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

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FOREWORD

With the implementation of the Food Safety Act (FSA) of 2013, the role and contribution of standards in ensuring food safety from the farm level up to post-harvest stage of agricultural commodities has never been more relevant. Similar to melons, wherein the produce is sold either as a whole or in its fresh-cut form, there are several reported incidences of food recall due to *Salmonella* contamination of fresh papaya.

In this regard, food safety hazards at the farm level can be addressed by adherence to Code of Good Agricultural Practices (GAP) for Papaya Production. While food safety issues at the postharvest and/or minimal processing stage for fresh-cut papaya, the relevant provisions of Good Manufacturing Practices (GMP) can be considered applicable.

The Bureau of Agriculture and Fisheries Standards, in collaboration with the experts of the Technical Working Group (TWG), developed the Code of Good Agricultural Practices (GAP) for Papaya. The Special Order No. 189 series of 2014 authorized the creation and establishment of the TWG, which is tasked to draft the standard, facilitate public consultative meetings and finalize the Code of GAP. The members of the TWG include experts from the Bureau of Plant Industry (BPI) and academic institution particularly University of the Philippines Los Baños (UPLB).

This Code provides general recommendations to allow flexible and uniform adoption even when production practices and environmental conditions are diverse. Therefore, this Code is also applicable to micro, small and medium scale operations of the producers.

INTRODUCTION

In the Philippines, there are currently seven (7) commercial varieties of papaya sold for human consumption. These are Cavite Special, Morado, Solo, Sintá, Cariñosa, Red Lady and Red Royale. Papayas from these varieties are: sold fresh either in its whole or fresh-cut form for direct consumption; or sold to food industries for further processing. The fresh-cut form of papayas, however, are gaining popularity with consumers and can often be found in supermarkets and in food carts.

In order to gain perspective on the potential of the fresh-cut papaya industry in the Philippines, the same industry in the United States of America (USA) was used for reference. The fresh-cut sector in the USA registered an annual \$12 billion in sales in the past few years making it the fastest growing segment in the fresh agricultural commodity sector (USFDA, 2008).

During the same review of the industry in the USA, reports of foodborne illness outbreaks were encountered. From the period of 1996 to 2006, 72 reported illness outbreaks were associated with the consumption of fresh produce (USFDA, 2008). Of these produce related outbreaks; 25 percent implicated fresh-cut produce. It can be further deduced from the reports that processing fresh produce into fresh-cut products appears to increase the risk of bacterial growth and contamination since the natural exterior barrier of the produce is already removed. Other incidences further correlated the surface integrity of the fruit and pathogen growth. With these premises, proper sanitation procedures were implemented to significantly decrease the potential for pathogenic contamination (USFDA, 2008).

Considering the trade potential of fresh papaya, including its fresh-cut form, and the food safety issues linked with it, the drafting of the Philippine National Standard (PNS) Code of Good Agricultural Practice (GAP) for Papaya took into account existing international guidelines as basis or references. These include the *Codex Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53:2003) and its Annex (Annex I for Ready-to-eat Fresh Pre-cut Fruits and Vegetables), ASEAN Code of Good Agricultural Practices (GAP), and Philippine National Standard (PNS) Code of Good Agricultural Practices (GAP) for Fruits and Vegetables (PNS 49:2011).

In essence, this Code addresses the essential principles of food safety applicable to primary production, postharvest, transport operations, and minimal processing (i.e. fresh-cut) operations. It encompasses applicable provisions relevant to Good Hygienic Practices (GHP) and Good Manufacturing Practices (GMP) that will help minimize microbial, chemical and physical hazards associated with all stages of production to minimal processing of fresh papaya.

SECTION 1 - OBJECTIVE

This Code addresses Good Agricultural Practices (GAP) that will provide specific guidance on how to minimize microbial, chemical and physical hazards associated with all stages of the primary production, postharvest operations, and transportation of fresh papaya. The Standard further takes into account as far as practicable the relevant practices pertaining to Good Manufacturing Practices (GMP) associated with minimal processing operations.

SECTION 2 - SCOPE, USE AND DEFINITIONS

2.1 Scope

This Standard covers general practices for the production and primary processing of papaya cultivated for human consumption, particularly those that will be consumed fresh whether in its whole or fresh-cut form; or those that will be further processed. Specifically, this Code is applicable to papaya that is field-grown. It concentrates on microbial and chemical hazards and addresses physical hazards only in which can be related to GAP and GMP during primary production and minimal processing of the commodity.

This Code does not provide recommendations on handling practices to maintain the safety of papaya at wholesale, retail, and food services or in the home.

2.2 Use

This Code and its Annex follows the format of the *Codex Code of Hygienic Practice for Fresh Fruits and Vegetables (CAC/RCP 53-2003)* and the *Annex for Ready-to-Eat Fresh Pre-Cut Fruits and Vegetables*. It also takes into consideration the relevant practices in the Philippine National Standard (PNS) Code of Good Agricultural Practices for Fresh Fruits and Vegetables (PNS/BAFS 49:2011) and the *Codex Recommended International Code of Practice-General Principles of Food Hygiene (CAC/RCP 1-1969, Rev 4:2003)* and other applicable codes. As such, it should be read in conjunction with these standards.

It also covers general practices that are relevant to the primary production, packing and transportation of fresh papaya; including specific guidance on how to minimize hazards during primary and minimal processing of papaya for fresh-cut market.

2.3 Definitions

For the purpose of this Code, the following terms are defined:

Agricultural worker

Any person that undertakes one or more of the following activities: cultivation, harvesting and packing of fresh fruits and vegetables

Biological control

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

Cleaning

The removal of soil, dirt, grease or other foreign matter through washing or treatment with disinfecting agents

Composting

A managed process where organic materials are subjected to moisture, heat and microorganisms for a specific period to produce a product known as compost

Cultivation

Any agricultural action or practice of growers to improve the growing conditions of fresh fruits or vegetables grown in the field or in protected facilities (hydroponic systems, greenhouses)

Contamination

Food safety context:

The introduction or transfer of a food safety hazard to produce or to the inputs that contact produce, such as soil, water, chemicals, equipment and people

Environmental context:

The introduction or occurrence of a hazard into the environment

Farm

Any premise or establishment in which fresh fruits and/or vegetables are grown and harvested and the surroundings under the control of the same management

Fertilizer

Includes any substance – solid or liquid – or any nutrient element– organic or inorganic – singly or in combination with other materials, which may be applied directly to the soil or foliar for the purpose of promoting plant growth, increasing crop yield or improving their quality.

Field packing

Farm operation that involves placing the produce on fiberboard boxes, plastic crates or wooden crates immediately after harvesting; some produce is wrapped prior to this bulk packaging.

Fresh-cut produce

Fruit and/or vegetables that have been trimmed and/or peeled and/or cut into 100% usable product that is bagged or pre-packaged to offer consumers convenience while maintaining its freshness. This is used interchangeably with 'pre-cut fruit or vegetable'

Food safety hazard

Any chemical, biological or physical substance or property that can cause fruit and vegetables to become an unacceptable health risk to consumers

Grower

The person responsible for the growing and management of the primary production of fresh fruits and vegetables

Hazard

A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health and environmental effect/s

Manure

Animal excrement which may be mixed with litter or other material, which may be fermented or otherwise, treated

Packer

Person responsible for overseeing the packing operations of fresh fruits and vegetables

Packing

The action of putting fresh fruits and vegetables in a package. This may take place in a field or in the establishment such as packinghouse or collection center

Packing establishment

Any indoor establishment in which fresh fruit and vegetable receive postharvest treatment and are then packaged

Pest

Any species, strain or biotype of plant, animal or pathogenic agent, injurious to plants or plant products

Pesticide

Any substance or product, or mixture thereof, including active ingredients, adjuvants and pesticide formulations, intended to control, prevent, destroy, repel or mitigate directly or indirectly, any pest. The term shall be understood to include insecticide, fungicide, bactericide, nematocide, herbicide, molluscicide, avicide, rodenticide, plant growth regulator, defoliant, desiccant and the like.

Potable water

Water that meets the quality standards of drinking water suitable for human consumption as approved by World Health Organization (WHO) or equivalent regulations

Primary production

Those steps involved in the growing and harvesting of papaya for example planting, irrigation, application of fertilizers, application of agricultural chemicals.

Primary Processing

Those steps involved from receiving of raw materials to preparation for post-production activities that includes handling and preparation of papaya e.g., cleaning to make it suitable for direct human consumption or further processing

Processor

Person responsible for the management of activities associated with production of ready-to-eat fresh -cut papaya

Risk

A function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard in food

Production Area

Site where the crops is grown

Traceability

The ability to follow the movement of produce through the specified stages of production and distribution

SECTION 3 - PRIMARY PRODUCTION

In each primary production area, it is necessary to consider particular agricultural practices that will ensure safe production of papaya that will be eaten fresh either in its whole or fresh-cut form. Various conditions are taken into consideration like those that are specific to a production area and/or production system. Procedures associated with primary production should be conducted under good hygienic conditions to minimize potential hazards to health due to the contamination of papaya.

3.1 Planting material

Planting materials or seedlings should be reasonably free of visible signs of pests and diseases and of good health status. Only disease-tolerant, high yielding and good quality planting materials should be distributed or released by nurseries/propagation centers to the farmers. Other factors that will contribute in reducing occurrence and impact of pests to selected planting material and its growing conditions should be considered.

Farmers may opt to obtain their planting materials from outside sources. Outside sourcing of planting materials is usually decided on due to numerous factors that include: unavailability of on-farm sources, unavailability of stable cultivar and size of the area to be planted. For hybrid varieties, NSIC registered varieties / seeds are recommended. In cases where domestic transport of plants / plant products and/or planting materials are necessary, movement of planting materials should comply with existing regulations of the Bureau of Plant Industry – Plant Quarantine Service (BPI-PQS) to prevent the proliferation of infection and infestation.

Papaya is not a direct-seeded crop. Nursery-grown seedlings are transplanted in the field to have a uniform stand; and usually, germination of papaya seeds takes two (2) weeks.

To guide construction of nurseries, the following factors should be considered: separation of nurseries from storage facilities of chemicals and fertilizers; distance from housing and packaging facilities; and enclosure and barrier to prevent the entry of stray animals which may transfer pest/diseases.

3.2 Environmental Hygiene

One of the key features of sustainable farming is continuous integration of site-specific knowledge and practical experiences into future management planning and practices. This section is intended to ensure that the land, buildings, water, soil and other facilities, which constitute the fabric of the farm, are properly managed to ensure safe production of papaya and protection of the environment.

3.2.1 Location of Production Site

Wherever possible, potential sources of contamination from the environment should be identified. In particular, primary production should not be carried out in areas where the presence of potentially harmful substances would lead to an unacceptable level of such substances in or on papaya after harvest. Furthermore, areas, which show signs of soil borne diseases for papaya, should be avoided.

In evaluating the production site for potential sources of contamination, the following are to be considered:

- Previous land use;
- Level of nutrient;
- Slope and potential for run-off from nearby fields;
- Proximity to high risk production sites (animal production facilities, hazardous waste sites, cemeteries, and mining areas); potential microbial hazards including faecal contamination and contamination by organic waste and potential environmental hazards that could be carried to the growing site;
- The access of farm and wild animals to the site and to water sources used for primary production is a potential source of contamination. Efforts should be made to protect papaya-growing areas from animals. As far as possible, domestic and wild animals should be excluded from the production area in compliance with the local and national environmental and animal protection regulations.
- Likewise, feeding of papaya by wild animals does not only injure the fruit but may also serve as entry of microbial contamination. Thus, intrusion of wild animals especially birds and bats should be prevented by site harvesting the papaya at color break stage or Philippine Color Index (PCI) No. 2.

If previous land use cannot be identified, or the examination of the growing or adjoining sites leads to the conclusion that potential hazards exist; the sites should be analyzed for contaminants of concern. If the contaminants are beyond the allowable levels and corrective or preventative actions have not been taken to minimize potential hazards, the sites should not be used until corrective/control measures are implemented.

Other considerations which may affect the cultural management practices include the following soil and climatic requirements:

- Papaya should be planted in open areas. Although it may be planted in areas with partial shading, it generally prefers open areas;
- Rainfall – well distributed throughout the year or 2.54 cm per week;
- Time of planting – onset of rainy season or when water is available;
- Orientation of planting - preferably east west;

- Wind – Papaya cannot stand strong winds; moderate wind speed is ideal to keep the plants dry and prevent fungal infection. In case of strong wind, windbreaks or props are necessary. In cases where the farmers opt to plant windbreaks, rows may be planted at an interval distance, which is 20 times the height of the tree. It is preferable that windbreaks are planted prior to planting papayas. If this is not feasible, it is recommended to plant papaya in areas where there are established windbreaks;
- Soil drainage – well drained. Papaya plants are sensitive to water logging. To prevent water logging, hilling up should be practiced or drainage between rows should be provided;
- pH – optimum pH is at 5.5 to 6.5;
- Temperature – optimum temperature range is from 21°C to 33°C;
- Elevation – low to mid-level elevation in open to partially shaded areas. Optimum elevation is not higher than 500 meter above sea level (MASL);
- Topography – flat to moderate rolling;
- Water availability – near sources of irrigation water;
- Soil type – silty loam to clay loam, well drained and rich in organic matter;
- Depth of soil – 1 meter; and
- Production area – preferably accessible for transportation

3.2.2 Production Site Preparation

During land preparation, potential sources of microbial and/or chemical contaminations brought about by conduct of various operations should be identified. In particular, farm machineries should be checked for possible leakage.

For open field planting, the land is usually plowed and harrowed twice to ensure that the soil is well pulverized. At this particular stage, canals may be constructed to provide drainage and remove excess water. Furthermore, organic fertilizers and/or manure when used as basal application must be fully decomposed, spread and incorporated in the soil during land preparation.

After land preparation and in the course of planting, a planting distance of 2.5m x 1.6m to 3.0m x 2.0m is recommended. This may be increased depending whether papaya is to be inter-cropped with coconut and other crops. Regardless of the previous considerations and in order to ensure proper fruit production, the following practices are recommended:

- Farmers growing hybrid varieties – One plant per hill is planted; and
- For open-pollinated varieties (OPV) – There should be three (3) plants per hill. In flowering stage, one (1) vigorous female or hermaphrodite plant per hill is retained and the rest are removed.

When deciding to plant intercrops between papaya plants, care should be taken to ensure that these intercrops will not be an alternate source of pests and diseases.

3.2.3 Field Sanitation

Growers and agricultural workers should carry out field sanitation activities especially in the production area. Fields should be regularly cleaned to minimize the spread of pests and diseases. Diseased, senescent and dried leaves should be frequently removed, buried or burned as these may harbor pests and diseases.

3.3 Hygienic Production of Papaya

3.3.1 Agricultural input requirements

Agricultural inputs (water, fertilizer, agricultural chemicals, and the like) should not contain microbial or chemical contaminants as defined under the *General Principles of Food Hygiene (CAC/RCP 1-1969)* and at levels that may adversely affect the safety of papaya.

3.3.1.1 Water for primary production

Growers should identify the primary and secondary sources of water used in the farm; and assess its risk for microbial and chemical contamination and suitability for intended use. Once assessment is conducted, growers should be able to identify corrective actions to prevent or minimize contamination (e.g., from livestock, sewage treatment, human habitation, activities of neighboring farms).

For purposes of irrigation, the frequency of delivery will depend on the temperature and climate of the area, in order to maintain fruit quality and reduce flower drop, or fruit drop. Weekly irrigation is recommended especially during dry months. However, excessive irrigation should be avoided to reduce the occurrence of fungal infection.

To conserve soil moisture and control weeds, mulching using plastic or rice straw may be practiced.

3.3.1.1.1 Water for fertilizers, pest control and other agricultural chemicals

Water used for the application of water-soluble fertilizers and agricultural chemicals in the field and those used during postharvest operations should not contain microbial contaminants at levels that may adversely affect safety of papaya. Special attention to water quality should be considered when using agricultural chemical delivery techniques (e.g. sprayers) that expose the edible portion of papaya directly to water.

3.3.1.2 Manure, biosolids and other natural fertilizers

The use of manure and other natural fertilizers or commercial organic fertilizers in papaya production should be managed to limit the potential for microbial and chemical contamination. If the inputs to be used are contaminated with heavy metals or other chemicals at levels that may affect safety, these should not be used.

Growers and agricultural workers should not use untreated solid nor liquid manure because foodborne pathogens can persist in soils for long periods of time. In cases

when the farm produces its own organic inputs, proper treatment procedures should be followed to reduce or eliminate the pathogens present in the raw material and to minimize the probability of contaminating the produce. A record of treatment procedures, including the raw materials used should be kept. The location of the composting site should also consider the slope and proximity to production areas so as to prevent cross-contamination from runoff or leaching.

The following factors may be useful in deciding the appropriate kind of fertilizer or the amount needed to be applied: crop demand and available nutrients from the soil, farm manure and other crop residues and soil analysis. In the absence of soil analysis, Table 1 below shows the recommended rate of fertilizer application depending on the age of papaya plant.

Table 1. Recommended fertilizer application for papaya

Age of Plant	Fertilizer rate	Fertilizer material
Transplanting	50g/plant	Ammonium sulfate (21-0-0)
2 nd to 6 th month	100g/plant	Complete fertilizer (14-14-14)
4 th month	20-40g /plant	Borax Every 2 months thereafter, apply Borax at 20g/plant
7 th month onwards	200g /plant	Complete fertilizer (14-14-14)
	100g/plant	Ammonium sulfate (21-0-0)

In order to prevent contamination of the produce, correct application and proper storage procedures of fertilizers should be followed.

Human manure and urine are not allowed.

3.3.1.3 Control of Pests and Diseases

3.3.1.3.1 Diseases

Diseases such as those due to bacterium, several species of fungi, nematodes, and a virus affect sustainable and profitable production of papaya. Generally, these diseases inflict damage at various stages that commence when papaya is still in seedbed, after it is transplanted, during flowering and fruiting stages, and even when it is already harvested.

In order to control known diseases, the following are recommended:

- Papaya ring spot virus (PRSV) - PRSV infected plants should be removed once symptoms are observed. Uprooting and burning or burying the entire plant disposes plant or plant parts. Tools that were used to cut infected plants (e.g., deleafing, cutting of old leaves, etc.) must be sanitized by dipping the tools in 10% chlorine solution (sodium hypochlorite) or 70% alcohol before using in other plants. One of the preventive measures is to avoid planting crops that serves as alternate hosts to aphids, which are vectors of PRSV.
- Bacterial crown rot (BCR) – Infected plant or plant parts are disposed by uprooting and burning or burying the entire plant.

- Phytophthora rot, damping off – Papaya are planted in well-drained soil to reduce or prevent infection.

3.3.1.3.2 Insect Pests

Eighteen (18) different species of insect and nine (9) mite species have been reported to infest papaya. However, only a few species maybe considered as major pests.

In order to control known major pests, the following are recommended:

- Mites – Upon early detection of damage due to mites, infested plants are removed and burnt thereafter.
- Fruit fly –Sanitation is practiced by disposing fallen fruits which serves as hosts to the larvae of fruit flies.

3.3.1.3.3 Agricultural chemicals

Growers should only use agricultural chemicals, which are approved and authorized by the Fertilizer and Pesticide Authority (FPA) and should use them according to manufacturer’s instructions and for its intended purpose. Residues should not exceed maximum residue level (MRL) as established by the Codex Alimentarius Commission, ASEAN or by the Philippine National Standard (PNS).

Growers should refer to the Section 4.6 (Crop Protection) of the PNS Code of Good Agricultural Practices for Fresh Fruits and Vegetables (PNS/BAFPS 49:2011) for practices pertaining to pesticide management.

3.3.1.3.2 Biological control

Environmental and consumer safety should be considered when using competing biological organisms and/or their metabolites to control of pests, mites, plant pathogens and spoilage organisms in papaya production. Growers should only use biological control agents, which are authorized for the cultivation of papaya and should use them for its intended purpose and according to the manufacturer’s instructions.

Registration of biological control agents is based on existing regional and national standards on the Regulation, Use and Trade of Biological Control Agents (BCA).

3.3.2 Personnel Health, Hygiene and Sanitary Facilities

All agricultural workers including contractors or visitors should act in accordance with the appropriate sections of the *Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1 – 1969)* to maintain an appropriate degree of personal cleanliness; operation operate in an appropriate manner and to ensure that those who come directly in contact with fresh papaya during or after harvesting are not likely to contaminate the product/produce.

In particular, attention should be given to availability of hand-washing facilities with provisions of soap and clean running water during harvesting and postharvest handling

operations. When gloves are used in the operation, there should be a proper and documented procedure especially on regular cleaning and sanitation. If disposable gloves are used, these should be discarded when torn, soiled, or otherwise contaminated.

Training should be conducted annually and according to hygiene instructions. Evidence on the conduct of training should be kept. Moreover, the farm should keep track of evidence that hygiene instructions are followed.

Regular environmental and personnel hygiene assessment as well as sanitary inspection of facilities should be conducted to serve as basis for corrective and preventive actions.

Subcontractors and visitors should be informed of relevant procedures on personal safety and hygiene (e.g. relevant instructions are in visible place where all visitors or subcontractors can read them)

3.3.3 Harvesting

Harvesting operations and methods should be carried out in a manner that considers the possible sources of contamination. Normally, papaya fruits are harvested when 25 percent or one-fourth ($\frac{1}{4}$) of the fruit shows signs of ripening (Color Break Peel Color Index #2). The pedicel may be cut using a knife. Proper handling should be observed in order to avoid injury (e.g., cuts, bruises) of the fruit, which can provide entry point for microorganisms. Harvested papaya should not be placed in direct contact with the ground. Instead, these should be placed in harvesting container where soft padding is provided in order to avoid bruising, thus, maintaining the quality of papaya.

Harvested papayas that are bruised, damaged, diseased, or over-ripe should be segregated. Those that cannot be made safe by further processing should be properly disposed by burying under the soil not only to avoid contamination of other harvested fruits but to eliminate the possible hosts of fruit flies.

During harvesting, a responsible person should be present to supervise the activity at all times and to ensure that harvesters observe proper hygiene e.g. regular hand washing.

3.3.3.1 Equipment Associated with Growing and Harvesting

Harvesting tools, implements and equipment that have direct contact with the produce should be regularly cleaned, disinfected and maintained in good working condition.

Equipment and containers used for harvesting should be made from non-toxic materials. These should be designed and constructed in a manner that, when necessary, these can be easily cleaned, disinfected and maintained to avoid contamination of the harvested produce.

When using reusable harvesting containers, a cleaning and disinfection schedule should be followed to ensure that these containers will not be a source of contamination. A record of cleaning should be kept and made available, as necessary. Containers that are

damaged and can no longer be kept in a hygienic condition should be disposed accordingly.

As far as practicable, harvesting containers should only be used to contain harvested produce. If these containers are used for other purposes, these must be cleaned and disinfected as necessary prior to use. Containers of agrochemicals shall not be used as harvesting containers.

SECTION 4 - HANDLING, STORAGE AND TRANSPORT

4.1 Preventing Cross Contamination

Harvested papaya is susceptible to bruising, damage and contamination during harvesting and postharvest handling operations. During harvesting, consideration should be given to the need for additional management; an example of which is adverse weather condition that increases the likelihood of contamination of harvested papaya.

During packing of produce, care must be taken in the field to avoid contaminating containers or bins due to exposure to manure or animal feces.

In cases when there is postharvest washing operations, clean water should be used. Papaya should be properly dried before packing to prevent growth of fungal pathogens. And when cleaning aid like sponge is used, care should be taken to ensure that it is clean.

Growers/agricultural workers should continually reinforce the importance of good hygienic practices since poor hygienic practices can significantly increase the risk of contaminating harvested papaya.

4.2 Field Packaging

Papaya that will be either sold fresh or for further processing should ensure that field packing operations are carried out in a way that minimizes and prevents contamination due to contact with soil and manure. Furthermore, field-packaging of the produce should be in such a way that it can withstand rough handling during loading and unloading, compression from the weight of other containers, impact and vibration during transport and high humidity during transit.

Growers and agricultural workers during this operation should ensure that clean pallets, containers and cleaning materials of containers are used, and efforts towards ensuring that these containers do not come in contact with the soil and other sources of contaminants are observed.

4.3 Storage and transport from the field to the packing/processing facility

Freshly harvested/field-packed papaya should be stored and transported under conditions that will not expose it to potential sources of microbial, chemical or physical contaminations.

Storage facilities and vehicles for transporting the harvested papaya should be designed and constructed in a manner that minimizes damage to the produce and entry of pests. These should be constructed from non-toxic materials that will permit easy and thorough cleaning; and in a manner that will reduce the opportunity for potential contamination from physical objects such as glass, wood, plastic, and the like.

Freshly harvested papaya should not be transported in vehicles used primarily or previously to carry animals, animal manure or bio-solids, pesticides or hazardous substances/materials, unless adequately cleaned and disinfected.

When not in use, clean harvest containers should be covered and kept in a protected location

SECTION 5 - ESTABLISHMENT: DESIGN AND FACILITIES

Refer to the *General Principles of Food Hygiene (CAC/RCP 1-1969, Rev 4 2003)*.

The provisions in this section apply to operations that involve off-field packing and processing (i.e. minimal processing) of papaya as indicated in the above Code:

5.1 Premises and Lay out

Harvesting, packing and minimal processing of papaya is a year-round operation. The design of the processing and packing areas should allow thorough cleaning and disinfection of food contact surfaces (e.g., chopping board, tables) to ensure that foodborne pathogens do not grow in the facility or on the equipment. Furthermore, cleaning operations in these areas should be conducted separately to avoid cross-contamination of tools and utensils used in each operation.

Where feasible, raw material handling areas should be separated from processing/packing areas. Meanwhile, areas or rooms where final products are packed and stored should be maintained to make it as dry as possible. The use of facility where moisture and humidity is high can enhance the growth and spread of foodborne pathogens.

5.2 Drainage and waste disposal

The processing of fresh-cut papaya generates large quantity of waste that can serve as food and shelter for pests. Therefore, it is important for the processor to have an effective waste disposal system. Equipment used to implement the establishment's waste disposal system should be maintained in good condition so it does not become a source of product contamination.

SECTION 6 - CONTROL OF OPERATIONS

6.1 Control of Food Hazards

It should be recognized that while processing may reduce the level of contamination initially present on the raw materials, it would not be able to guarantee elimination of such contamination.

Consequently, the processor should ensure that steps are taken by their suppliers (growers, harvesters, packers and distributors) to minimize contamination of the raw materials during primary production. Processors should ensure that their suppliers adopt principles outlined in the main text of the standard.

6.2. Key Aspects of Hygiene Control Systems

6.2.2 Specific Process Steps

6.2.2.1 Receipt and inspection of raw materials

During unloading of raw materials, these should be checked for evidence of contamination and deterioration. The transportation vehicle should also be observed for cleanliness.

6.2.2.2 Preparation of raw material before processing

Papaya exhibiting or showing signs of physical hazards (such as presence of animal and plant debris, metal and other foreign material) should be removed through manual sorting. Raw materials showing signs of damage or rot should be removed from the lot.

6.2.2.3 Washing and microbial decontamination

Refer to section 5.2.2.1 of the *Code of Hygienic Practice for Fresh Fruits and Vegetables*. In addition:

- Water used for final rinses should be of potable quality, particularly for these products as they are not likely to be washed before consumption.

6.2.2.4 Pre-cooling of fresh papaya

Refer to section 5.2.2.3 of the *Code of Hygienic Practice for Fresh Fruits and Vegetables*

6.2.2.5 Cutting, slicing, shredding and similar size-reduction processes

Procedures should be in place to minimize contamination with physical (e.g., metal) and microbial hazards during cutting, slicing, shredding or similar size-reduction processes.

Cutting knives should be thoroughly cleaned and disinfected at a regular interval according to established standard operating procedures (SOP) to reduce potential

contamination. Disinfecting solutions should be prepared at sufficient levels to achieve the intended purpose.

6.2.2.6 Washing after cutting, slicing, shredding and similar size-reduction processes

Washing fresh-cut papaya with potable water may reduce microbial contamination. In addition, it removes some of the cellular fluids that were released during the cutting process, thereby, reducing the level of available nutrients for microbial growth. The following are additional considerations:

- Water should be replaced at a frequency and interval that will prevent the build-up of organic material, thus, preventing cross-contamination;
- Antimicrobial agents should be used, where necessary, to minimize cross-contamination during washing and when used should be in line with good hygienic practices. The level of antimicrobial agents should be monitored and maintained at effective concentrations. Application of antimicrobial agents, followed by washing as necessary, should be done to ensure that chemical residues do not exceed levels as recommended by the Codex Alimentarius Commission.
- Drying or draining to remove water after washing is important to minimize microbial growth

6.2.2.7 Cold storage

Fresh-cut papaya should be stored and maintained at low temperatures from cutting through distribution to minimize microbial growth.

6.3 Documentation and records

Where appropriate, records should be maintained to adequately reflect production and product information. Maintaining adequate documentation and records of primary production and post-production operations is important in the event of recall of minimally processed papaya. Records should be kept longer than the shelf life of the product to facilitate recalls and foodborne illness investigations, if required.

Records should be kept on the:

- types, varieties and sources of planting materials;
- types of pesticides and fertilizer and usage;
- production site with lot codes;
- suppliers of agricultural inputs;
- lot number of agricultural inputs;
- water management practices;
- use of agricultural chemicals;
- water quality and safety;
- if applicable, processing including the date, method and final volume of processed cherries; and
- pest control and cleaning schedules of premises, facilities, equipment and containers.

6.4 Recall Procedures

Refer to the *General Principles of Food Hygiene*

SECTION 7 – ESTABLISHMENT: MAINTENANCE AND SANITATION

Refer to the *General Principles of Food Hygiene*

SECTION 8 – ESTABLISHMENT: PERSONAL HYGIENE

Refer to the *General Principles of Food Hygiene*

SECTION 9 – TRANSPORTATION

Refer to the *General Principles of Food Hygiene*

SECTION 10 – PRODUCT INFORMATION AND CONSUMER AWARENESS

Refer to the *General Principles of Food Hygiene*

SECTION 11 – TRAINING

Refer to the *General Principles of Food Hygiene*

11.2 Training Programs

To evaluate the level of training required of persons responsible for the production of fresh-cut papaya, the additional following factors should be taken into account:

- the packaging system used for fresh-cut papaya including risk of contamination or microbial growth involved in this method;
- the importance of temperature control and GMPs.

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**TECHNICAL WORKING GROUP (TWG) FOR THE DEVELOPMENT OF THE
PHILIPPINE NATIONAL STANDARD (PNS) CODE OF GOOD AGRICULTURAL
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