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**Code of good agricultural practices (GAP) for banana
production**



BUREAU OF PRODUCT STANDARDS

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Foreword

The Philippine National Standard (PNS) Code of Good Agricultural Practices (GAP) for Banana Production was prepared by the Technical Working Group on GAP for Banana Production chaired by the Bureau of Agriculture and Fisheries Product Standards (BAFPS) created per Special Order No. 788 series of 2012 dated November 2012.

In the preparation of this standard the following documents were considered.

ASEAN Secretariat 2006. Good Agricultural Practices (GAP) for Production of Fresh Fruits and Vegetables in the ASEAN Region. Cardno Acil / RMIT International / Australian Government AusAid

Bureau of Agriculture and Fisheries Product Standards (BAFPS).2011. Code of Good Agricultural Practices (GAP) for Fruits and Vegetable Farming. PNS/BAFPS 49:2011

Codex Alimentarius Commission.2003. Code of Hygienic Practice for Fresh Fruits and Vegetables (CAC/RCP 53-2003).

EUREPGAP c/o FoodPlus GmbH. 2004. EUREPGAP Control Points and Compliance Criteria Fruits and Vegetables version 2.1 – Oct04.

Marfori, J.M.P. and Pancer H.G. 2006. A Manual on Good Agricultural Practices for Banana Growers. Davao City Chamber of Commerce and Industry, Incorporated.

World Health Organization. 1989. Guidelines for the Safe Use of Wastewater and Excreta in Agriculture and Aquaculture.

Introduction

Banana is considered as one of the most important horticultural commodities of the country being a top export and dollar earner. In 2010 alone, the production of banana reached P106.4 billion at current prices thereby contributing to 8.5 percent to the overall agricultural production, while statistics showing exports amounted to US\$360 million during the same year accounting for 9.0 percent of the total agricultural export value (Macabasco, D.R., 2011).

From the production figure of 9.1 million tons in 2010, 50 percent of the total output is Cavendish banana coming from commercial plantations and small farmers in Mindanao. These fresh Cavendish bananas are then shipped to 40 countries worldwide. In 2010 industry sources recorded an exportation of about 2.3 million tons of Cavendish banana, equivalent to 175 million boxes (Macabasco, D.R., 2011).

Even with all efforts to open up new markets and ensure continuous exportation of our Cavendish banana, exports saw a decline of 8.4 percent per annum from 2006 through 2010, based on NSO data. Challenges in the industry include issues on consumer safety, workers welfare, pests and diseases and stagnation of our regular market.

1 Scope

This standard covers specific guidance related to the production, harvesting, postharvest handling and transport of banana intended for direct human consumption. It does not cover practices for banana intended for industrial processing.

This standard provides specific guidance to ensure the minimization of microbiological, chemical and physical food safety risks associated with the production of banana intended for fresh consumption during production, harvesting, and post-harvest handling and distribution.

This standard also enumerates practices aimed towards protection of workers' health and safeguarding their safety and welfare; and environmental management.

This standard provides additional and specific guidelines for banana production and should be read in conjunction with of the Code of good agricultural practices (GAP) for fruits and vegetable farming, PNS/BAFPS 49:2011.

2 Definitions

2.1

barrier

physical obstruction that aims to prevent entry of vermin and other animal influences from the production area to the packing shed (e.g. nets)

2.2

block identification

identification of areas in the production site (e.g. parcela)

2.3

defingering

removal of deformed, fused and excess fingers

2.4

deflowering

removal of flowers from the tip of the finger of the hand. Deflowering can be done in the field before bagging or during post-harvest operations

2.5

hand pruning

removal of hands just before bagging operations to promote optimum growth of individual fingers within the bunch

2.6

dehanding

removal of the hands from the stalk of the bunch in preparation for packing

2.7

debelling

removal of bud prior to bagging

2.8

guying

process of strapping the bunch to an overhead cable or neighboring plant to prevent from tipping over. Guying is a form of propping

There are two types of guying: overhead and ground. Overhead guying is done by strapping the twine in the neck of the bunch to the overhead cable. Ground guying is done by strapping a twine in the neck of the bunch to the neighboring plant

2.9

lot identification/box code

pertains to identification code of produce packed/processed in a specific packing shed at a specific time and date

2.10

mat/hill

refers to the set of mother plant and corresponding followers/suckers

2.11

packinghouse

a place where harvested fruits are processed and packed. The term can be used interchangeably with packing shed, packing plant throughout the text. The term also includes mobile packinghouse and on-site packinghouse

2.12

production area

refers to an area planted for banana production

2.13

propping

process of providing support by using two (2) poles tied together to support the weight of the bunch

2.14

skimming/pre-calibration

selection of fruits based on calibration by using fixed caliper before harvest or selection of fruits based on diameter using fixed caliper

2.15

site

refers to the whole plantation

3 Primary production of banana

3.1 Farm location

3.1.1 General considerations

3.1.1.1 The production site must comply with related or applicable regulations of the Department of Environment and Natural Resources (DENR), local government units (LGUs) or municipal environment and natural resources office (MENRO).

3.1.1.2 In order to minimize degradation, areas should be supervised through sustainable land management practices.

3.1.1.3 Depending on the size of the planted area, a topographic contour map representing the set of operations should be prepared. A good graphic representation is required, covering both altimetry and planimetric properties.

3.1.1.4 Records of the daily minimum and maximum temperatures and rainfall from relevant agencies and/or organizations should be obtained, kept for future reference and for drawing up a leaf disease control program, work schedules for repair of drainage canals, monitoring of pests, designing of Integrated Pest Management (IPM) program and fertilization.

3.1.1.5 The farmer should be able to identify the potential sources of contamination from the natural or manmade environment. Specifically, production and primary processing should not be done in areas near or previously used as dumping sites for solid/liquid wastes and mine tailings

3.1.1.6 Physical risk assessment of the site, for existing and new site(s) should include considerations on flooding, wind velocity, drainage problems, and erosion. A record of all potential hazards identified should be kept. Risk assessment should consider the prior use of the site and potential impact of adjacent sites to the new site(s).

3.1.1.7 If results of the evaluation of the production using geo-hazard maps as tool for risk assessment, adjoining sites or prior land use lead to the conclusion that potential hazard exist, the sites should be further evaluated through analysis and characterization of the identified contaminants. Activities may include monitoring of pesticide contamination of ground water.

3.1.1.8 If the contaminants are found to be at unacceptable levels, the site should not be used for production and primary processing until corrective or control measures are carried out as soon as possible. Once corrective actions are instituted or conducted, these should be monitored for their effectiveness and results of monitoring should be properly recorded.

3.1.1.9 Whenever remedial action is required to manage the risk, the action taken should be monitored regularly to ensure that contamination of the produce is eliminated or kept within acceptable levels. A record should be kept on the action taken and the results thereof

3.2 Farm structure and maintenance

3.2.1 Production site and property map

3.2.1.1 Sites for banana production may range from shrublands, pastures or renovated old plantations. Other agricultural land, for as long suitability for banana production are established may also be used and converted.

3.2.1.2 Soil analysis must be performed, to determine if the site is suitable for banana production and in preparation for a soil fertility management program. If possible risks of contaminations exist, the soil should be analyzed for occurrence of pathogenic microorganisms and/or heavy metals and other pollutants. If risks are present, corrective measures should be done. Upon the conduct of relevant analyses, the condition of the soil may be adjusted to make the conditions favorable for cultivation of banana. Interventions like adjustment of soil pH, decontamination and variation in the installation of drainage canal can be carried out. Water logging in the production area should be prevented.

3.2.1.3 In order to assist the farmer in assessing the possible sources of contamination and /or for monitoring purposes, a property lay-out map within the site should be prepared to indicate the locations of the following, as applicable:

- crop production area;
- primary processing area;
- sources of water used on the farm (well, reservoir, rivers, lakes, farm ponds, etc.)
- pesticides and fertilizer storage and mixing areas;
- tools and equipment cleaning and disinfection areas;
- storage area for tools and equipment;
- post-harvest chemical treatment area;
- water storage, distribution networks, drainage, and discharge points of waste water;
- solid waste disposal area;
- composting areas;
- property buildings, structures and road networks;
- toilet facilities and hand-washing areas; and
- environmentally sensitive and highly degraded areas (e.g. saline/acidic soil)

When constructing facilities, the necessary and relevant local government requirements should be fulfilled.

3.2.1.4 In case of multiple production areas in a given site, each area should be identified by a name or Code, and must be indicated in the property map. The name or Code should be indicated in all documents and recorded.

3.2.2 Site management

3.2.2.1 Domestic and farm animals must be excluded from the production site to avoid microbial contamination and minimize transfer of pest/diseases.

3.2.2.2 Entrance and exit to the farms should be controlled in order to prevent cross-contamination due to entry of pests and diseases. Disinfection methods like footbath, tire bath, or tire spray should be installed by individual growers, as may be applicable.

3.2.2.3 Name of the farm should be displayed at the entrance.

3.2.2.4 Adequate areas for waste collection measures and storage for biodegradable, non-biodegradable and toxic material wastes should be provided. Non-biodegradable waste should be stored separately from biodegradable waste materials. There should also be a clear disposal mechanism for treated and used biodegradable and non-biodegradable materials.

3.2.2.5 All debris from leaf trimming operations, stem and mat sanitation, stems and other degradable materials in the field should be disposed of properly or collected for composting purposes or use as mulch.

3.2.3 Building and storage facilities plan

3.2.3.1 There should be separate storage facilities for chemicals and fertilizers. These facilities must be located away from employee housing facilities and the packing shed.

3.2.3.2 The packingshed should be enclosed and secured with a barrier (e.g. net), to ensure physical separation from the production area and prevent the entry of vermin and other animal influences.

3.2.3.3 Chemical and fertilizer storage areas should be provided.

3.2.3.4 Barriers should also be provided to confine spillage and avoid contamination of the adjacent surroundings.

3.2.3.5 In cases when insect pest management control gadgets such as nets, and traps for vermin control are employed, these should be maintained to minimize contamination of produce.

3.3 Cultural management

3.3.1 Selection of quality planting material

3.3.1.1 Planting materials to be selected should have high market demand, must be resistant to pests and diseases and environmental stress conditions, high yielding and have good / excellent postharvest quality of fruits.

3.3.1.2 Tissue cultured planting materials coming from the Bureau of Plant Industry (BPI)-accredited tissue-culture laboratories are recommended.

3.3.1.3 For efficient chemical, water and other input utilization, planting materials may be selected based on their nutrient and water use efficiencies, and pest and disease resistance.

3.3.1.4 Good quality suckers as re-planting materials for missing hills should be selected from disease-free mat/hill and from an area with no observable virus, bacterial- and fungal-diseases.

3.3.1.5 The suckers should be dipped in registered disinfectant to minimize infection. The chemical used for treatment and purpose of the treatment should be documented.

3.3.1.6 Records of planting materials should be kept including the name and varietal characteristics of the cultivar, the name of the supplier, and the date of procurement

3.3.2 Land preparation

3.3.2.1 The site can be prepared through a series of activities involving clearing, and primary and secondary tillage operations.

3.3.2.2 During land preparation, hardpan layer and highly compacted soils should be broken up in order to promote water infiltration and root growth.

3.3.2.3 If applicable, zero tillage may be done.

3.3.3 Drainage and irrigation system construction

3.3.3.1 In areas where there are pronounced dry periods, the use of an efficient irrigation system is recommended.

3.3.3.2 For the construction of irrigation system, drip irrigation and under tree system (microrisers) is preferred over overhead sprinklers.

3.3.3.3 Drainage and irrigation plans using a topography survey may be prepared depending on the area. The resulting topography map may be superimposed with soil map obtained through soil analysis.

3.3.3.4 As applicable and depending on the area, the following components may be considered in designing irrigation and/or drainage systems:

- a. infiltration index as well as physical soil characteristics.
- b. indicators result from drawing moisture retention curves, according to water storage capacity and availability for the plantation.

3.3.3.5 Canopy evapotranspiration levels are related to different methods such as penman, Thornthwaite and evaporation pan.

3.3.3.6 When using an irrigation system, the use of an evaporation pan or rain gauge, tensiometer is recommended.

3.3.3.7 Once installed, the irrigation system should be checked for operational efficiency and maintained to ensure efficient delivery.

3.3.3.8 To prevent water logging, drainage canals (primary, secondary and tertiary) must be constructed in consideration to volume of water in the area. As deemed necessary and in order to further control erosion in the area, check-dam may be constructed.

3.3.3.9 A record is kept of irrigation use, date, location, volume of water applied or duration of irrigation, unit area, and name of person who managed the irrigation activity.

3.3.3.10 The risk of chemical or biological contamination of produce from the water used for irrigation, fertigation, application of chemicals, washing, treatments, cleaning, sanitation and other forms of handling the produce should be assessed. Moreover, the proximity of water sources to possible sources of contamination (e.g. near the dumping site, near septic tanks, etc.) should be considered during assessment. A documentation of any occurrence of significant hazards should be kept. If contamination occurs, corrective actions should be carried out and actions taken should be properly documented. Once treated, water should follow and conform with World Health Organization (WHO) Standard on Water Quality and/or Food and Agriculture Organization (FAO) Irrigation and Drainage Paper on water Quality for Agricultural Water.

3.3.3.11 As applicable, a pyzometer should be constructed underground along the area to monitor the water table from root zone.

3.3.4 Cableway construction

3.3.4.1 In cases when the topography allows, cableways may be constructed.

3.3.4.2 For plantation type production system, a network of cables may be constructed before or after planting. A network of cables consists mainly of one main and several secondary cables. Depending on the drainage channel lay-out, secondary cables are perpendicular to the main cable.

3.3.4.3 The construction of cable network should be designed in a way that allow easy movement of workers, farm inputs and bunches.

3.3.4.4 Cable must be placed approximately 2.10 m above the surface, and must be held in place by galvanized tubes or treated wood arches, spaced between 8 and 10 meters for optimized strength and durability.

3.3.4.5 The cable itself must consist of a metal rod approximately 7/16 inch in diameter, with a strength of 100 kg/mm to avoid the risk of breaking, dropping bunches to the ground.

3.3.4.6 Cableways should be regularly inspected for signs of damages. Appropriate preventive measures and maintenance should be done.

3.3.5 Lay-out of planting holes

3.3.5.1 Initial population density is determined prior to field marking of planting holes. The density varies and ranges from 2,000 to 2,700 and planting distance from 2.0 m x 2.5 m and 1.8 m x 2.0 m, respectively. The planting design can be square, quincunx and hedge row.

3.3.5.2 Planting density will depend on the cultivar used and soil conditions. Smaller plants are planted closer for higher density provided that there is proper penetration of sunlight.

3.3.5.3 Once population density is determined, approximately 30 centimeter bamboo stakes are pegged on the spot where the center of the planting hole is to be placed.

3.3.6 Planting

3.3.6.1 Approximately 30-cm diameter planting hole is dug, with the bamboo stake used as the center of reference.

3.3.6.2 Soil ameliorants like agricultural lime may be broadcasted at this stage to correct pH, calcium and magnesium deficiencies.

3.3.6.3 Basal application of recommended rates of mineral fertilizers and organic fertilizers is done around the base of the planting hole.

3.3.6.4 A hole is covered with a layer of topsoil that has been dug from the same hole. Enough soil should be filled back into the hole so the seedling is high enough to be at the same level as the surface.

3.3.7 Fertilization

3.3.7.1 To optimize nutrient use and minimize nutrient losses, organic and/or inorganic fertilizers should be applied based on the quantitative information on soil nutrient obtained through soil analysis and/or leaf analysis.

3.3.7.2 Fertilizers and soil additives should be judiciously selected to minimize the risk of contamination of produce, particularly with heavy metals. If commercial inorganic and/or bio/organic fertilizers are used in the farm, only duly Fertilizer and Pesticide Authority (FPA)/Bureau of Agriculture and Fisheries Product Standards (BAFPS)-registered fertilizers (inorganic and commercial bio/organic) should be procured.

3.3.7.3 In cases where the farm produces its own organic fertilizer, the composting areas should be separated from the crop production area and should be at least 50m away from drinking and farm water sources.

3.3.7.4 Undecomposed organic materials must not be applied because the presence of potential contaminants may affect the produce.

3.3.7.5 Organic fertilizer production procedures, such as: composting, solarization, heat drying, etc., should be designed to reduce or eliminate pathogens in manure, biosolids and other natural fertilizers. The method, date and duration of the treatment should be recorded. The level of pathogen reduction (*E. coli* and *Salmonella* should be zero) achieved by different treatments should be documented and supported by laboratory analyses.

3.3.7.6 The use of human sewage as source of fertilizer is not allowed.

3.3.7.7 If a product containing organic materials is obtained outside the farm, a certification indicating that the material has been treated should be issued by a BAFPS-licensed supplier.

3.3.7.8 Equipment used for the application of fertilizers and soil additives should be maintained in good working condition and should be checked regularly by a technically competent person. The farm should maintain a documented equipment maintenance program.

3.3.7.9 For the storage of fertilizer materials:

- Storage area must be separated from other agro-chemical products to prevent cross contamination;
- The storage area should be dry, well-ventilated and appropriately covered to protect inorganic fertilizers, such as powder, granules or liquids from sunlight, rain, humidity, and other atmospheric factors;
- Storage area should be free from waste, does not constitute a breeding place for rodents, and where spillage and leakage is easily cleared away; and
- All inorganic fertilizers should be stored in a prescribed manner to avoid or minimize risk of contamination to water sources. For instance, liquid fertilizers must be banded and proximity of water courses and flood risks, etc. should be considered; and

3.3.7.10 Fertilizers should not be stored with harvested crop or yield, packaging materials and plant propagation materials.

3.3.7.11 The utilization of inorganic fertilizer should observe First-In First-Out (FIFO) or First Expiry, First Out (FEFO) practice.

3.3.8 Record keeping

3.3.8.1 A record of fertilizers and soil additives obtained should be kept with the following specifics: source, product name, and date and quantity obtained.

3.3.8.2 The application of fertilizers and soil additives should be recorded, detailing the following: date, name of the product or material used, treatment location, application rate, application method, and operator name.

3.3.8.3 Records of procurement, inventory and utilization of inorganic/synthetic fertilizers should be maintained and updated regularly. These should include: source, product name, date and quantity, expiration date (for liquid fertilizers) and the nutrient composition of the materials.

3.4 Integrated pest management

3.4.1 Leaf disease control

3.4.1.1 Fungal leaf disease management program

1. The farm must have a leaf fungal disease control management program and should be based on the status of the farm, topographic location, rainfall pattern, and other environmental factors, which influence leaf fungal disease build up.
2. Manual leaf disease control in the form of leaf trimming of fungal leaf disease-infected portions of the leaves should be carried out at least one cycle/week as soon as the infection of the leaves is detected. Leaf trimming maybe increased to twice a week when disease pressure is high. Infected leaves may be left on the field as mulch.
3. Depending on the disease pressure, fungal leaf disease control through chemical spraying and/or non-chemical alternatives may be initiated two to three months after planting for new areas. For established areas, fungal leaf disease control should be conducted at least once a week.
4. During the rainy season or when fungal leaf disease pressure is high, 1 or 2 cycles of systemic fungicides are inserted (between 7-10 days) between cycles of protectant spraying, or as needed based on the leaf disease survey. The following symptoms may be used to evaluate if there is high disease pressure in the area.
 - Location of the streaks;
 - Number of leaves;
 - Location of visible spots, etc.
5. Cycles of spraying may also be shortened. Use and mixing of oil and fungicides must be done according to a set of sequence.

3.4.2 Population management

3.4.2.1 Desuckering / Thinning / Replanting

1. For newly planted area, after third month from planting and when the first suckers start to emerge, they should be pruned as soon as possible in order to select the potential follower.
2. In permanent plantations, population control may be done through de-suckering, thinning or re-planting. Sucker pruning should be performed in order to maintain 1 mother plant and 1-2 sucker(s) ratio.
3. Re-planting on the other hand is carried out to maintain the desired population density in area.

3.4.3 Crop protection

3.4.3.1 Disease, survey method, eradication and treatment method

1. In order to control the entry of diseases such as Moko, Bunchy Top, Mosaic, and Panama disease, the farm should regularly conduct survey for the presence of disease and implement eradication and treatment area interventions.

2. Visual inspection for the symptoms of diseases should be conducted regularly.

3.4.3.3 Once observed, the infected mat should be tagged, recorded and / or reported.

3.4.3.4 The record should include the location of the infected mat, type of disease infection, date of survey and the name of surveyor.

3.4.3.5 For eradication operations, equipment, personal protective equipment (PPE), and tools that will be used should be properly cleaned, sanitized or disinfected prior and after use.

3.4.3.6 To eradicate Moko infection, burning or injection of the plant with glyphosate may be conducted. The number of Moko cases eradicated should be properly recorded.

3.4.3.7 To eradicate bunchy top and mosaic disease, the infected plant and its neighboring plants should be sprayed with FPA-registered pesticides to kill insect vectors prior to chopping of the infected plant.

3.4.3.8 Considering that there is no existing effective control to eradicate Panama disease, farms should install preventive measures by installing footbaths and quarantine fence.

3.4.3.9 If chemical is used for eradication, the trade name and common name of the chemical used, kind of chemical used, active ingredient, rate/dosage used, method of application, date of application, frequency of application and name of applicator should be properly recorded.

3.4.3.10 After eradication, strict quarantine measures should be followed.

3.4.3.11 In cases when there are available non-chemical methods to control the diseases, the farmer may opt to apply these non-chemical methods instead.

3.4.3.12 In order to prepare the farm, the farm should have a pest and/or disease control program to address emerging diseases aside from those enumerated above.

3.4.4 Plant care operation

3.4.4.1 Weed control

1. Weed control may be done by cultural, manual, mechanical, biological or chemical means or integrated weed control/management. Manual means of weed control is performed using slashing bolos and sickle. Mechanical weed control is performed with the use of a grass cutter. Mulching using indigenous materials such as grass cuttings or rice hulls may also be used for young plants.

2. Chemical weed control must be done with FPA-approved/registered herbicides.

3.4.4.2 Stem/mat sanitation

1. Removal of dried bracts from the pseudostem should be carried periodically to minimize insect infestation (scale insect, mealy bugs and aphids).
2. After the stem sanitation, FPA-registered pesticides or oil should be sprayed in order to control the insect infestation and spread of diseases.
3. During the operation, tools should be regularly disinfected using quaternary products (ex. ammonium sulfate salts) in order to prevent the spread of disease.

3.4.5 Fruit care operation

3.4.5.1 Thrips prevention and control

1. Thrips control can be initiated through chemical or non-chemical means. In most Cavendish banana farms, the emerging bud should be injected with registered insecticide when it is 50 % - 75 % bud out to minimize thrips damage.
2. When the bud has been injected, the pseudostem should be marked indicating the date of injection and chemical used.
3. Other non-chemical means that may be used include wrapping the emerging bud with a plastic until the first two (2) hands has emerged.

3.4.5.2 Bunch spray

A week after the bud injection and until before bagging, the bunch should be sprayed with FPA-approved and registered fungicide and insecticide. The interval or frequency of spraying will depend on pest pressure and other factors.

3.4.5.3 Deleafing/fruit obstacle removal

1. The obstacle or leaves, which come into contact with the bunch, should be re-aligned or re-positioned to minimize bruising of the fruits or removed, as deemed necessary.
2. Tools used for deleafing/fruit obstacle removal should be sanitized / disinfected prior to during and after use.

3.4.5.4 Propping/guying

1. In order to prevent tip over, the bunch should be secured by propping or guying.
2. Propping or guying should be done based on the 'bending' direction of the bunch.

3.4.5.5 Defingering /deflowering/hand pruning/debelling or debudding

Deflowering, defingering, hand pruning and debelling or debudding may be carried out either prior to bagging, before or during bagging.

3.4.5.6 Bagging / plastic insertion (suksok)

1. Bagging should be done when all the hands have emerged, after the buds and false hands have been removed and after the bunch has been sprayed with FPA- approved and registered fungicide and insecticides.
2. Early bagging should be done when scarring beetle damage is prevalent in the area and should be conducted when the bud has started to bend. A perforated polyethylene bag must be used only once and disposed properly.
3. Plastic insertion or 'suksok' should be carried out simultaneously with bagging of the bunch to prevent bruising.
4. For early bagging operations, plastic insertion or 'suksok' should be done after the buds and false hands have been removed.

3.4.5.7 Tagging

During bagging and plastic insertion operation, tagging with colored ribbon should be simultaneously carried out to facilitate harvesting. The week number when the bag was closed should be marked on the arrestor or stalk.

3.5 Harvesting

3.5.1 Tools used for harvesting should be properly disinfected prior and after each operation. Meanwhile, caliper should be regularly calibrated and verified.

3.5.2 Harvested bunches should not come in contact with the soil.

3.5.3 In most lowland farms, the use of cable systems may be employed to transport the bunches to the packinghouse. Additional measures like insertion of foams/plastic in between hands should be done in order to minimize bruising.

3.5.4 In farms where there are no cableways available, the hands are removed from the bunch stem while in the field/or packing shed and placed in padded harvesting trays. Padded harvesting trays should be properly washed prior to and after each operation. The trays are loaded into specially designed trucks or trailers and transported into the packing shed. Prior to loading, trucks and trailers should be cleaned. Harvested bunch may also be processed and packed in mobile packinghouse, whenever such provision is available.

3.5.5 Harvested bunches should undergo post-harvesting processing and cooling at most 24 hours after harvesting to maintain quality.

3.5.6 Record of harvested bunches per area or farm should be kept. Records may contain: date of harvest, quantity of harvest (number of bunches), bunch weight, rejected bunches, area harvested (including the name of the grower and harvester), color codes, and week number.

3.6 Packaging

3.6.1 Labels are placed on the produce or on the boxes. Each box should be identified with traceability code (i.e. time and day of packing, packinghouse number and grower code/packer code).

3.6.2 The specification for cluster packing depends on the market requirement and each cluster may be wrapped in polyethylene bag.

3.6.3 Produce may be carefully packed in poly bags or vacuum bags and placed inside a corrugated carton box, with padding sealed and weighed.

3.6.4 Boxed produce are piled on pallets not more than nine (9) boxes high with six (6) to seven (7) boxes per layer. Corner posts may be installed along the corners, and boxes are strapped together.

3.6.5 Boxes may be loaded into trucks for transport to the cold storage area prior to loading onto reefer boats.

3.7 Transport

3.7.1 Transport vehicle should be checked before use for cleanliness, chemical spills, foreign objects and pest infestation. Pallets should be thoroughly cleaned and covered with protective material or rejected if there is a significant risk of contaminating produce. Transport vehicles should be cleaned if there is a significant risk of mechanical damage and contaminating produce.

3.7.2 Produce should be transported separately from goods that are potential sources of chemical contamination and causes of biological and physical hazards. Moreover, mixing of non-compatible produce during transport should be avoided.

3.7.3 For long delays before transport, produce should be kept at the optimum temperature condition. Packed fruits should be kept in a well-ventilated facility and should not be directly exposed to sunlight.

3.7.4 When farm vehicle used for transporting harvested produce are also used for other purposes, it should be cleaned prior to hauling to avoid contamination of the produce.

3.7.5 Refrigerated transport vehicles should be equipped with temperature settings (13°C -14°C) that will minimize quality loss of the produce.

4 Pesticide management

4.1 Choice of crop protection products

4.1.1 Crop protection strategies should be appropriate for the control of pests and based on the approval of the competent authority.

4.1.2 Growers should use agricultural chemicals that are FPA-registered for cultivation of banana and procured from licensed suppliers and approved by the competent authority in the country where the crop is grown and in the country where the produce is to be traded. The use of such agricultural chemicals must be in accordance with the approved label instructions for the intended purpose/s.

4.1.3 If the choice of chemical products is made by advisers/consultants, proof of their technical competence should be made available such as certificates of trainings, education, experience and accreditation from competent authority.

4.1.4 The expiry dates of the chemicals to be procured should be considered.

4.1.5 These should be applied at approved dosages to prevent residue levels exceeding the maximum residue limits (MRLs).

4.1.6 If deemed necessary, the produce shall be subjected to residue analyses to be conducted by an accredited laboratory.

4.2 Mixing of crop protection products

4.2.1 The mixing area should be located and chosen in such a way that the risk of contaminating the workers and the environment is minimized.

4.2.2 Mixing of agricultural chemicals should be carried out in a manner that will prevent contamination of the ground- and surface water and the land in the surrounding areas.

4.2.3 The filling and mixing areas for the crop protection product should be equipped with appropriate tools for precise measurements and calibrations. The functionality of such should be checked before every cropping season by the grower/applicator. The filling and mixing areas should have floor brush, dustpan, plastic bags and adsorbent materials such as sand. These materials should be placed in a fixed location within the specific area, to be used in case of spillage of crop protection product.

4.2.4 Emergency facilities in the event of accidental spill during mixing should be readily available.

4.2.5 Prepare only the necessary volume of spray solution to avoid surplus application mix.

4.2.6 For bulk mixing of chemicals, there should be a designated chemical mixing station or area. This area should be appropriately contained with provision for catch basin where surplus mixture can be safely stored prior to discharge/disposal.

4.3 Application of crop protection products

4.3.1 The person responsible for application should be technically competent and should apply crop protection products under the direct supervision of a certified applicator. He should possess the relevant education, training and experience. Relevant rules and regulations of FPA should also be referred to.

4.3.2 The Integrated Pesticide Management (IPM) principles and techniques should be used whenever possible to maximize the benefits and minimize the risks in the use of pesticides. A rotation strategy for chemical application and other crop protection measures must be employed to avoid the development of pest resistance, i.e. use different chemical groupings (e.g. organophosphates, synthetic pyrethroids, carbamates, etc.) of pesticides.

4.3.3 The tank mixing of more than two (2) chemicals should be avoided, unless recommended by FPA, or specified in the product label.

4.3.4 Growers/applicators should observe established Pre-harvest Intervals (PHIs) or the period between chemical application and harvest.

4.3.5 Access to sites where chemicals are being applied or newly applied is restricted for an appropriate period relevant to the chemical used.

4.3.6 Workers should use well-maintained protective clothing during applications and observe established re-entry periods.

4.3.7 For ground or aerial application of chemicals, standards and/or provisions stipulated in related FPA regulations should be followed.

4.4 Safety and welfare of authorized worker/s during application

4.4.1 Authorized farm workers should be trained on the proper handling (e. g. application) of crop protection products. If and when necessary, the applicators should obtain license from the FPA (certified pesticide applicator and accredited responsible care officer).

4.4.2 Material safety data sheets (MSDS) or safety instructions from approved labels should be made readily available for reference. First aid facilities (e.g. kits) should be readily available to treat workers of minor cuts and bruises and those that have been accidentally contaminated with chemicals prior to medical attention/treatment in a hospital.

4.4.3 Authorized workers who are directly handling and applying chemicals should undergo pre-employment, periodic/annual and exit medical check-ups to ensure their health and welfare. In order to minimize the exposure of workers handling chemicals, workers rotation should be practiced. Reference to FPA-related rule should be done in this regard.

4.5 Storage of crop protection products

4.5.1 The crop protection product storage facility should comply with all the appropriate national or local regulations. It must have non-absorbent shelves such as metal or rigid plastic material to minimize the problem of contamination due to spillage.

4.5.2 Chemicals should be stored in a well-lighted, sound and secure structure, with access limited to the authorized personnel only. Additional cabinets/lockers for specific pesticides may also be provided. The structure should be located and

constructed to minimize the risk of contaminating produce and should be equipped with emergency facilities in the event of a chemical spill, fire and other natural or man-made calamities.

4.5.3 Crop protection products should be stored in the original container with legible labels.

4.5.4 Proper segregation in the storage of crop protection products (e.g. liquids should not be stored together with dry formulations) should be observed.

4.5.5 In order to avoid expired chemicals, a record or inventory of stored chemicals should be kept with the following details: common name (active ingredient) & trade name, date and quantity obtained, expiry date and date when completely used or disposed of. The stock inventory that will indicate the contents of the stored containers should be done before every cropping season.

4.6 Maintenance and storage of equipment

4.6.1 Equipment used for chemical application should be maintained in good working condition. Such equipment should be checked by a technically competent person before each use.

4.6.2 Agricultural chemical sprayers should be verified/calibrated as necessary, to maintain the precision of the application rate. Records of maintenance and calibration activities should be kept.

4.6.3 Mixing containers, sprayers and other equipment and tools used for chemical applications should be triple rinsed after use, especially when used with different agricultural chemicals on different crops, i. e. to avoid contamination of the produce or damaging the crop. If and when possible, there should be a dedicated sprayer for herbicide application. Washings should be contained for proper disposal.

4.6.4 Protective clothing should be separately washed from other clothings and stored properly for future use.

4.7 Disposal of crop protection products and other contaminated wastes

4.7.1 Empty chemical containers must not be re-used and should be safely secured until these are disposed. Empty containers should never be used for food and drink-related purposes. Disposal empty chemical container should follow the relevant rules / guidelines of FPA.

4.7.2 Empty chemical container should be properly recorded and accounted for.

4.7.3 Crop protection product containers should be rinsed three (3) times (triple rinsed) prior to disposal and should be disposed according to label directions. Wash water should be disposed in a manner that will not cause contamination. As applicable, rinsing of empty crop protection product containers should be done in chemical mixing station, which can contain the chemical.

4.7.4 Expired or banned chemical should never be used for crop protection purposes. These chemicals are disposed of through official collection systems or in legal off-site areas.

Tank washings should be disposed appropriately to avoid contamination of the produce and minimize the risk of environmental harm within and outside the site.

4.7.5 All pesticide-contaminated wastes shall be disposed in a designated sanitary landfill.

4.7.6 Fuels, oils and other unusable non-agri-chemicals should be disposed of properly to avoid the risk of contaminating the produce.

4.8 Environmental safety

To prevent possible ecological imbalance, growers should use integrated pest management (IPM) strategies that are authorized for the cultivation of banana and should be used in accordance with the approved instructions for the intended purpose/s.

4.8 Record keeping

4.8.1 A record of procured chemicals should be kept, with the following details: chemical name, supplier of the chemical, date of purchase, expiry dates, and quantity procured.

4.8.2 After application, the following should be recorded: name of applicator, name of product/s used, application rate, total volume of spray used per area sprayed, frequency of application, method of application, date of application and PHI, and if applicable any unusual effect observed after spraying was done.

4.8.3 The records must always be accessible during inspection of the farm.

5 Packing establishments

5.1 The fresh produce should be processed in the packing house.

5.2 If applicable, the packinghouse should be accredited with the Bureau of Plant Industry (BPI).

5.3 The farmer should ensure that bruising of fresh produce is minimized by installing a packinghouse within a considerable distance from the farm.

5.4 When the postharvest treatments and subsequent packaging operations are conducted off-farm, the following are important considerations for the packing house:

- Floors should be designed with appropriate slopes, drainage channels and kept free and clear to ensure good drainage system.
- Produce handling facilities and equipment such as process lines and machinery, floors, storage areas, pallets as well as floors and walls should be cleaned and/or maintained regularly to prevent contamination. Documented records should be kept on these activities.
- Rejected produce and waste material should be disposed of properly in designated areas to prevent contamination of the produce. Documented records should be kept on these activities.

- Cleaning agents, lubricants, etc. should be kept in a designated area that is separate and apart from packing area to avoid chemical contamination of produce.
- In order to prevent the entry of domestic animals/ birds / rodents /pests, additional measures like installation of nets, fences, traps and others should be done. There must be monitoring and management systems for pest control to avoid or minimize pest infestation. Traps should be identified and actions taken must be recorded.

5.5 Whenever required, the produce should be treated with approved protocols to minimize disease development and loss of quality.

5.6 Water used for washing the produce should be clean. Produce should be washed and cleaned in chlorinated water with or without alum. In cases wherein chlorine is used, the level of available chlorine should be monitored and record of monitoring should be kept.

5.7 In case water is re-circulated or recycled for final washing of the produce, proper filtering and disinfection process should be done. The allowable concentration of disinfectant should be routinely monitored. The ideal pH level for postharvest washing should be maintained. A routine cleaning schedule according to the usage should be maintained and documented.

5.8 Post-harvest systems that use water for washing the produce should be designed in a manner that minimizes product lodges and dirt build up.

5.9 Produce is selected, sorted and classified according to market/customer requirements.

5.10 Produce may be applied with fungicide to prevent crown rot and tip end rot. Water used for mixing the chemicals for post-harvest treatment should also be potable.

5.11 In such cases, sprayers for postharvest treatments should be calibrated regularly to control the accuracy of the application rate. After use, sprayers should be thoroughly washed in safe areas, particularly when different chemicals are used to avoid contamination of the produce. Application of postharvest agrichemical should be recorded and maintained with the following information:

- produce identity (i.e. lot or batch of produce)
- location of application
- application dates
- pest or disease treated (common name)
- type of treatment
- product trade name/formulation
- product quantity applied
- operator's name

6 Farm management

6.1 Personal hygiene

6.1.1 Workers should have appropriate knowledge or must be trained in personal hygiene practices. A record of personnel training should be kept.

6.1.2 Farm workers should comply with farm hygiene regulations such as observance of personal cleanliness and appropriate clothing (i.e. hand washing, wearing of jewelry and fingernail length and cleaning, etc) and personal behavior (i.e. no smoking, spiting, eating, chewing, etc).

6.1.3 Written instructions (e.g. pictogram on proper hand washing) on personal hygiene practices should be provided to workers. These signs should be posted in prominent locations.

6.1.4 Fixed or mobile toilets and hand washing facilities should be available and accessible (i.e. within at least 500 m) to the workers and should be properly maintained in good hygienic condition. These should be located in an appropriate area.

6.2 Farm sanitation

6.2.1 Measures should be taken in order to ensure that the cultivation area is free from possible sources of contamination (e.g. litter, etc.).

6.2.2 Packing, handling and storage areas that can be sources of contamination should be identified. Cleaning and sanitation procedures should be prepared and followed.

6.2.3 Sanitation procedures conducted during the harvesting operations should follow those provisions in the relevant clause(s).

6.3 Equipment, containers and materials

6.3.1 Containers used for harvesting, handling and packing produce must never be used for hauling or storing agricultural chemicals, lubricants, oil, cleaning chemicals, plant or other debris, tools, etc.

6.3.2 Equipment, reusable harvesting containers, harvesting tools that comes in contact with fresh fruits and vegetables should be made of non-toxic materials, easily cleanable and disinfected. These implements and the farm vehicle should be regularly maintained to avoid contamination. A cleaning and disinfection schedule, when needed should be followed and recorded.

6.3.3 Specific hygienic and maintenance requirements may be identified for each piece of equipment that is used.

6.3.4 Equipment, containers and materials should be stored in a separate area away from chemicals, fertilizers and soil additives storage areas. Measures should be taken to minimize contamination from pests.

6.3.5 Containers for waste, by-products and inedible or dangerous substances should be specifically identifiable, suitably constructed and, where appropriate, made of impervious material. Where applicable, such containers should be provided with locks to prevent malicious or accidental contamination of fresh fruits and vegetables or agricultural inputs. Such containers should be segregated and identified so that they will not be used as harvesting containers.

6.4 Building and structures

6.4.1 Building and structures used for production, packing, handling and storage of produce should be designed and constructed according to building standards and maintained to minimize the risk of contaminating the produce. Light bulbs should be shatter proof in areas where produce, packing containers and materials are exposed. In the event of bulb shattering, exposed produce is rejected while equipment, packing containers and materials are cleaned.

6.4.2 In cases where equipment tools, grease, oil, fuel and farm machinery are kept in the same building where produce are handled, packed and stored, these should be kept in a separate room to prevent cross-contamination.

6.5 Animals, pest and disease control

6.5.1 Domestic and farm animals must be restricted from the production site and from areas where produce are harvested, packed and temporarily held.

6.5.2 Measures (e.g. footbath) should be taken to prevent the introduction of pests and diseases within the cultivation, handling, packing and storage areas. When instituted, these should be regularly maintained.

6.6 Record keeping

6.6.1 Records of production, processing and distribution should be maintained for two (2) years to facilitate a food-borne illness investigation and recall, if any.

6.6.2 Growers and/or packers should always update all relevant information on agricultural activities such as the site of production, suppliers' information on agricultural inputs, lot numbers of agricultural inputs, irrigation practices, use of agricultural chemicals, water quality data, pest control and cleaning schedules for indoor establishments, premises, facilities, equipment and containers.

6.6.3 A record should also be kept on the following specifics: date of supply, quantity of produce and destination for each consignment of produce.

6.6.4 Growers and packers should have programs to ensure effective lot identification of packed produce.

6.6.5 In case of suspected contamination and/or recall, packed produce should be traceable to the production site where it is sourced from including the agricultural inputs used in the production.

6.6.6 Packed containers must be clearly labeled with an identification to enable traceability of the produce to the farm or site where the produce is grown.

7 Workers health, safety and welfare

7.1 Training

7.1.1 Employers and workers must have appropriate knowledge or must have proper training on their areas of responsibility that are relevant to good agricultural practice.

7.1.2 Records should indicate that the required instructions or training program are in place and copies of attendance certificates or a signed list of workers who attended the training course(s) must be compiled. Internal trainings on hygiene, farm operation, etc. should be conducted regularly and at a frequency as deemed necessary.

7.1.3 Based on the area of responsibility of the workers, appropriate knowledge or training should be available on the following areas:

- vehicles, equipment and tool operation;
- accident and emergency procedures;
- safe use of chemicals;
- personal hygiene; and
- proper handling of produce.

7.1.4 Personnel working in packing houses should be able to practice good manufacturing practices (GMP) and Good Hygienic Practices (GHP); and aware of their role and responsibility in protecting fresh bananas from contamination and deterioration. Packers should have the necessary knowledge and skills to enable them to perform packing operations and to handle fresh bananas in a way that the potential for microbial, chemical and physical contamination is minimized.

7.1.5 There are documented, understandable and verbally communicated instructions made to the workers enabling them to know how to act in accident and emergency situations. These instructions should be available in the predominant languages of the workforce and should be displayed in conspicuous places.

7.1.6 New workers should be informed about the risks associated with health and safety when starting at the worksite. A record on the orientation training should be kept.

7.2 Worker welfare

7.2.1 In case living quarters are provided by the employer, the structure must be suitable for human habitation and contain basic services and facilities.

7.2.2 The farm should employ workers at least 18 years old.

8 Review of practices

The farmer should conduct a documented annual internal self-inspection. Effective corrective and preventive actions should be implemented if necessary

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