



**Ministry of Fisheries,
Crops and Livestock**
Regent Road, Bourda
Georgetown
Tel. (592) 226-1565
Fax (592) 227-2978
e-mail:
minfcl@sdpn.org.gy
www.agrinetguyana.org.gy
/moa mfcl



**New Guyana Marketing
Corporation**
87 Robb Street
Georgetown
Tel. (592) 226-8255
Fax (592) 227-4114
e-mail:
newgmc@networksgy.com



**National Agricultural
Research Institute**
Mon Repos
East Coast Demerara
Tel. (592) 220-2049
Fax (592) 220-2841-3
e-mail:
nari@networksgy.com
www.agrinetguyana.org.gy

Postharvest Handling Technical Bulletin

BUNCH COVERS FOR IMPROVING PLANTAIN AND BANANA PEEL QUALITY

Postharvest Care and Market Preparation



Technical Bulletin No. 4

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POSTHARVEST HANDLING TECHNICAL SERIES

BUNCH COVERS FOR IMPROVING PLANTAIN AND BANANA PEEL QUALITY

Postharvest Care and Market Preparation

Ministry of Fisheries, Crops and Livestock
New Guyana Marketing Corporation
National Agricultural Research Institute

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With the assistance of the United States Agency for International Development

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Preface

This publication is part of a series of technical bulletins that seeks to provide specific recommendations for improvements in postharvesting and market preparation for selected non-traditional agricultural products. The intended audience for this series is primarily extension agents.

Initial market assessments in current export markets and visits with producers and exporters in Guyana have shown the quality of fresh produce currently exported is uneven and in some instances very poor. Stages all along the export chain from harvest and pre-harvest to transportation and final export are all in need of improvement. Pre-harvest practices, sanitation at the packinghouse, packaging, bacterial and fungal problems, and transportation were all identified as areas where improvement could benefit the quality and increase the shelf life of Guyana's fresh produce exports. The technical bulletins address these issues specific to each product. Harvesting techniques and crop maturity indices are provided. Preparation for market, including cleaning, sorting, packing and transportation are covered. The bulletins address and recommend specific storage conditions, covering temperature and humidity controls. Finally the bulletins address postharvest diseases and insect damage.

The undertaking of these technical bulletins is a joint effort of the Ministry of Fisheries, Crops and Livestock; the New Guyana Marketing Corporation (NGMC) and the National Agricultural Research Institute (NARI) to improve quality, increase production and promote exports. As a team, the three agencies are working on the problems, limitations, and constraints identified in the initial reconnaissance surveys, from production and postharvest handling problems, to packaging and transportation, to final market.

Introduction

External appearance and market quality of plantains and bananas are significantly influenced by pre-harvest production practices. The physical appearance of the peel is especially important in the highly competitive export market. Buyers of plantains and bananas in these premium market destinations require consistent supplies of uniform colored fruit with blemish-free peels. The ability to supply the market with cosmetically sound fruit becomes difficult due to various types of mechanical injury and insect damage imparted on the delicate peel surface during growth and development. The principal agents of peel damage are wind and insects.

Wind is an ever-present threat to plantain and banana growers worldwide. It causes surface scarring of the peel in several ways. Blowing dust and debris which hits the delicate outer skin causes cellular damage and subsequent fruit scarring. Also, the blowing of adjacent leaves and rubbing of leaf petioles onto the developing bunch can impart considerable physical injury and abrasion damage to the fruit peels.

Pre-harvest insect feeding is also a main cause of peel damage to plantains and bananas. Growers in regions with a high population of peel feeding insects have great difficulty in producing blemish-free fruit. Many growers suffer a significant loss in market quality of their fruit due to the pre-harvest feeding of these insect pests. Plantains produced in Region 3 (Parika area) are especially prone to insect damage.

Flowering and Fruit Development

The plantain/banana flower is a complex structure consisting of a stout peduncle (stalk) on which the flowers are arranged in nodal clusters. Each node is comprised of two rows of flowers. The basal (proximal) nodes bear the female flowers, which develop into fruit and generally range in number between 5 to 15 nodes per stalk. The nodes containing double rows of fruits are called 'hands' and the individual plantain/banana fruit are called 'fingers'. The distal nodes contain male flowers which remain tightly enclosed in the form of a conical structure called the 'bell'. In between the female and male nodes are several nodes containing hermaphrodite (male and female) flowers which do not develop into edible fruit (Figure 1).

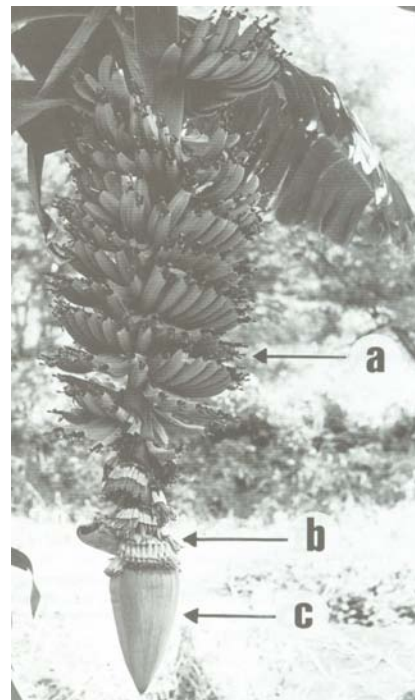


Figure 1. A developing banana bunch with basal female nodes which form fruit (a), sterile hermaphrodite flowering nodes which do not form fruit (b), and distal male nodes which form the bell (c).

The flower bell is normally cut off when the distance between the last hand and the top of the bell is about 15 cm (6 inches). This is done to prevent further meristem growth and to direct the plant photosynthetic energy to increasing the fruit size. The bell also is a potential shelter for thrips and mites. The hermaphrodite flowers below the developing fruit usually abscise and leave a callus scar on the stalk. The number of hands per bunch and fingers per hand depends on a number of factors, including variety, plant vigor, and environmental conditions. Therefore, the size and weight of the plantain/banana bunch can vary widely. It generally takes about 3 months from the beginning of flowering until harvest in Guyana.

Responsible Insect Pests

Most banana bunch pests cause superficial peel damage which does not affect the eating quality of the fruit. The domestic market in Guyana allows a degree of tolerance for superficial damage caused by insects. However, external blemishes caused by bunch pests are totally unacceptable for the discerning export market, where quality standards are strict. Several insects are primarily responsible for peel damage, including thrips, fruit scarring beetles, and the tar honey wasp.

Thrips

Several different species of thrips can cause damage to banana and plantain fruit. Thrips are small insects, about 1 to 2 mm long, that occur on the fruit as the bunch is emerging and the bracts lift. Red rust thrips (*Chaetanaphothrips* spp.) cause rust-colored blemishes to form on the fruit due to feeding of nymphs and adults. They feed on the soft skin of the immature fruit, usually on the hidden surfaces between the closely packed fingers, especially in areas where the fingers are touching. The top hands are usually the most seriously affected. The damage should not be confused with maturity bronzing, which occurs on the exposed outer curve of the fruit and is not confined to areas where the fingers are touching. In severe cases the fruit develops longitudinal cracks and damage may extend over most of the fruit surface. Although the damage does not reduce the eating quality of the fruit, it negatively affects the external appearance and market value. Flower thrips (*Frankliniella* spp.) are common throughout Guyana and cause a small raised pimple, capped by a black spot, to develop on the fruit surface. This is due to the adult female laying its eggs in the skin of soft immature fruit. Most species of thrips are effectively controlled by applying chlorpyrifos-impregnated bunch covers soon after bunch emergence.

Fruit Scarring Beetle

The fruit scarring beetle, *Colaspis hypochlora*, is a common insect pest in most of the plantain and banana producing areas of Guyana. Adult beetles feed on the fruit peel causing a localized scarring of the tissue in the damaged area. A clear fluid, which eventually turns black, is exuded from wounds. The wounds are only superficial and do not extend to the edible portion of fruits. Symptoms of fruit damage include raised lesions and scars along the peel surface, especially along the midrib area of the fruit

(Figure 2). This pest invades the bunches when the fruits are very young. The adherence to proper cultural practices will greatly reduce the incidence of this pest. Such practices include keeping the fields relatively free of weeds, providing adequate drainage, and



allowing sufficient sunlight to penetrate the canopy. In addition, insect pressure can be reduced by spraying the bunches with a 0.1% sevin (carbaryl) solution or 0.05% malathion solution. Control is also achieved by covering the developing plantain and banana bunches with chlorpyrifos-impregnated bunch cover.

Figure 2. Fruit scarring beetle damage symptoms on plantain fruit.

Bunch Covers for Plantain/Banana Fruit Protection

The use of polyethylene bunch covers is widespread throughout the commercial banana growing regions of the world. They are also commonly used to protect export market-intended plantain fruit during development. The practice is regarded as essential to improve the market quality and yield of the fruit. Bunch covers provide protection to the fruit surface against wind damage, leaf and petiole scarring, dust, light hail, sunburn, bird feeding, and handling damage during harvest and transport. A significant reduction in peel surface damage from insect pests may be obtained by covering the plantain or banana bunch shortly after pollination. In addition, the incidence of postharvest anthracnose disease has been shown to be significantly less on fruit from sleeved bunches. The net effect of bunch cover use is better fruit quality and increased marketable yield.

Bunch covers are typically made of thin plastic (low density polyethylene; 5 to 40 microns) and are 81.3 to 91.4 cm (32 to 36 inches) wide and range in length from 1 to 1.5 meters (3.3 to 5 feet). The thin bunch covers are designed to be used only once. The thicker ones can be re-used, but the removal process is time consuming and it is difficult to avoid damaging the plastic. Commercially available bunch covers generally are colored white or translucent blue. The plastic may also be colored silver to reflect heat. The recommended type of bunch cover varies according to environmental conditions. Thicker non-perforated types are best suited for cooler sub-tropical growing areas (i.e. Australia) where heat build-up inside the cover is desired (Figure 3). In tropical growing environments like Guyana, the thicker non-perforated bunch covers usually result in excessive heat and humidity build-up inside the cover. Thin perforated bunch covers which allow for aeration inside the cover are the preferred type for tropical growing areas (Figure 4).



Figure 3. Thick non-perforated bunch cover popular in Australia.



Figure 4. Thin bunch covers in a commercial banana plantation in Ecuador.

The optimum type of perforation design may vary according to growing location. The two most widely used perforated bunch covers for tropical areas are the pinhole type (Figure 5) which has 0.47 cm diameter holes, and the 1.27 cm (1/2 inch) hole type (Figure 6).



Figure 5. Pinhole type bunch cover.



Figure 6. Harvesting bananas covered with half-inch hole type bunch cover.

The distance between perforations (vertically and horizontally) is 2.5 X 3.0 cm (1 to 1.2 inches) in the pinhole style and 7.6 X 7.6 cm (3 x 3 inches) in the half-inch style of bunch cover. Perforated bunch covers may also be impregnated with a slow-release volatile insecticide to protect the fruit against insect pests during growth and development (Figure 7). The most commonly used insecticide impregnated in the plastic is chlorpyrifos, an organophosphate insecticide sold under the trade names of Lorsban or Dursban. Several other insecticides, dichlorvos and diazinon, are also effective in warding off bunch pests. They are typically impregnated into plastic strips which are placed inside the bunch cover. The preferred type of bunch cover depends on the amount of insect pressure, environmental conditions, and market requirements.



Figure 7. Perforated bunch covers impregnated with chlorpyrifos insecticide.

Four different types of bunch covers were introduced to plantain and banana growers in Guyana, in August, 2002 and trialed on commercial plantings in 3 different sites [Parika (Naamryc Farmers Cooperative), Caribaro Island (Mr. Takur Persaud Lokram farm), and Pomeroon River area]. Demonstrations were made to growers in each site on the appropriate technique for sleeving the bunches. Racemes of plantains were covered several weeks after flowering with the 4 following commercially-used polyethylene bunch covers:

1. white, pin hole perforations (5mm), without insecticide
2. white, 1.27 cm (0.5 inch) perforations, without insecticide
3. light blue, 1.27 cm (0.5 inch) perforations, with chlorpyrifos insecticide
4. blue-sided/gray-sided, non-perforated, without insecticide

Source and Cost

Bunch covers are highly specialized items available from only a few plastic companies in the areas of commercial banana production. There is no company in the U.S that makes bunch covers. Therefore, a more extensive worldwide search was made and several sources of bunch covers were found. Several companies in Costa Rica, Guatemala, Mexico, and Ecuador fabricate a wide diversity of bunch cover types for the Latin American banana export industry. Commercial growers throughout the region, and as far away as Hawaii, use these companies as their source of bunch covers. The specific company which supplied the bunch covers for the introductory trials in Guyana was Empaques Universal, S.A., located in Costa Rica (phone: 506-438-0525; fax: 506-438-0557). The other source of bunch covers was a company in Queensland, Australia, called Green Harvest, which sells a non-perforated bunch cover for the sub-tropical banana industry in the Queensland area (phone: 617-5494-4676; fax: 617-5494-4674).

Bunch covers can be purchased in rolls, which range in length from 60 to 100 meters, or as pre-cut bags. The rolls and pre-cut bags come in different widths and thickness of plastic. In addition, the bunch covers come in different styles, including non-perforated, perforated (pinholes and 1.3 cm [0.5 inch] holes), and perforated with chlorpyrifos impregnated insecticide. A typical bunch cover length is 1.2 meters (4 feet), therefore, a total of 83 bunch covers can be obtained from one 100 meter roll. The cost per roll and per bunch cover varies slightly depending on the style and length of bunch cover and the number of rolls purchased. The cost per 100 meter roll (from Empaques Universal) is approximately \$3.60, or slightly less than \$0.05 per bag. Another company in Costa Rica (Yanber S.A., phone: 506-763-3245; fax: 506-222-6244) sells pre-cut chlorpyrifos bunch covers in 500 unit amounts for \$34. This is equivalent to about \$0.07 per bunch cover. However, these prices do not include the freight cost from Costa Rica to Guyana. Nevertheless, the price is very reasonable in relation to the positive benefits obtained from use of the bunch covers. It may also be possible to source the bunch covers at competitive prices from other Caribbean banana-growing countries (i.e. Jamaica, St. Lucia, Guadeloupe), Surinam, Colombia or Venezuela).

The cost of the non-perforated bunch cover from Australia is \$1.23 per meter. Thus, a 1.2 meter length bunch cover costs \$1.48, plus freight. This is extremely expensive, and in addition, this type of bunch cover is not likely to be adapted to the humid, tropical production areas of Guyana.

Timing of Application

Bunch covers should be applied after the bracts covering the hands have fallen, the fingers are curling upwards, and the floral remnants have hardened (Figure 8). Typically, this occurs about 2 to 3 weeks after flowering. The schedule for bunch covering in a plantation is usually every 1 to 2 weeks. A colored polyethylene strip of a different color is commonly used to attach the bunch cover to the stalk (peduncle). This helps the workers identify the proper bunches to harvest. The time period from bunch covering until harvest will be slightly over 2 months.



Figure 8. Application of bunch covers when the fingers start to curl upward.

Method of Application

Bunch covers are usually fabricated in the form of a continuous tube made to the desired width. The tube should be cut in lengths of 1 to 1.5 meters, depending on the length of the plantain or banana bunch. The hollow plastic tube should be slid up the bunch from the bottom and securely tied or attached to the bunch stalk above the first hand of fruit. The bunch cover should be left open at the bottom and hang at least 150 mm (6 inches) below the last hand of fruit. If bunches are composed of more than 7 hands, removal of the terminal bell (male flower bud), which keeps on growing, will result in somewhat fuller bananas, thus increasing bunch weight. The cut should be made about 10 cm (4 inches) below the last hand so that the rotting tip of the severed stalk will not affect the fruits.

Disadvantages of Bunch Covers

Although the positive benefits of bunch cover application typically far outweigh the undesirable effects, it is important to point out several possible negative consequences. The use of non-perforated bunch covers in hot, humid climates such as Guyana may damage the bunch physiologically due to overheating, rotting, and premature ripening. In addition, insect pests may proliferate inside non-insecticide treated bunch covers. Another negative consequence of ineffective bunch covers is the economic loss due to the extra cost of the material and the labor needed for application.

In tropical countries, the negative consequences are avoided by using perforated bunch covers for aeration and cooling, and insecticide-impregnated covers for pest control.

Postharvest shelf life and market quality of plantains and bananas are significantly influenced by pre-harvest production practices. Covering the developing plantain/banana bunch in the field shortly after flowering with a perforated bunch cover is usually very effective in reducing both physical and insect damage to the peel. This practice is widely done throughout the world, especially where plantains and bananas are grown for export. It is likely the positive benefits of this practice will be noticeable for Guyanese producers as well.

ANNEX I

PUBLICATIONS IN THE POSTHARVEST HANDLING TECHNICAL BULLETIN SERIES

- | | |
|--------------------|---|
| PH Bulletin No. 1 | Pineapple: Postharvest Care and Market Preparation, November 2002. |
| PH Bulletin No. 2 | Plantain: Postharvest Care and Market Preparation, June 2003. |
| PH Bulletin No. 3 | Mango: Postharvest Care and Market Preparation, June 2003. |
| PH Bulletin No. 4 | Bunch Covers for Improving Plantain and Banana Peel Quality, June 2003. |
| PH Bulletin No. 5 | Papaya: Postharvest Care and Market Preparation, June 2003. |
| PH Bulletin No. 6 | Watermelon: Postharvest Care and Market Preparation, October 2003. |
| PH Bulletin No. 7 | Peppers: Postharvest Care and Market Preparation, October 2003. |
| PH Bulletin No. 8 | Oranges: Postharvest Care and Market Preparation, October 2003. |
| PH Bulletin No. 9 | Tomato: Postharvest Care and Market Preparation, October 2003. |
| PH Bulletin No. 10 | Okra: Postharvest Care and Market Preparation, October 2003. |

PLANNED PUBLICATIONS - 2004

Cassava: Postharvest Care and Market Preparation.

Eggplant (Boulanger): Postharvest Care and Market Preparation.

Lime: Postharvest Care and Market Preparation.

Sweet Potato: Postharvest Care and Market Preparation.

Yam: Postharvest Care and Market Preparation.

Ginger: Postharvest Care and Market Preparation.

Pumpkin: Postharvest Care and Market Preparation.

HELPFUL HINTS

1. Bunch covers should be 1.2 meters in length.
2. The schedule for bunch covering in a plantation is usually every 1 to 2 weeks.
3. Bunch covers that are not damaged can be re-used.
4. If bunches have more than 7 hands, take off the male flower bulb, this will increase the bunch weight.

HOW TO ORDER

The cost per bunch cover is approximately G\$35.00. For specific information please contact:

Guyana Marketing Corporation
Tel: 226-8255, 227-1630,
226-2219, 226-9599
E-mail: newgmc@networksgy.com



NGMC

PLANTAIN AND BANANA BUNCH COVERS



Guyana Marketing Corporation
87 Robb & Alexander Sts.
Georgetown, Guyana
P.O. Box 10810
Tel: 226-8255, 227-1630,
226-2219, 226-9599
Fax: 227-4114
E-mail: newgmc@networksgy.com



With the assistance of
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WHAT ARE THE BENEFITS?

The use of plastic or polyethelene bunch covers can benefit your banana or plantain crop in two ways:

- They protect the skin of the fruit against leaf, insect and bird damage as the fruit matures.
- With use of the bunch covers fruit size is more uniform and larger throughout the bunch.

Bunch covers can increase yields by 5-25%. Bigger individual bananas or plantains with less skin damage means a better market price and higher profit.



HOW TO USE BUNCH COVERS



When to put on covers:

- 2-3 weeks after flowering
- The flower remnants at the base of the fruit should be hard and dry.
- The fingers of the fruit curl upward.

How to put covers on:

- Slide the bunch cover up from the bottom of the stalk.
- Securely tie or attached the bunch cover to the bunch stalk above the first hand of fruit.
- The cover should be left open at the bottom and hang at least 150 millimeters below the last hand of fruit
- Covers should be left on until harvest, about 2 months later.

IMPORTANT HANDLING INFORMATION

Poly D Durshan® sleeves are treated with an insecticide known as Cholorpyrifos. Safe usage is extremely important. Personnel should be trained in proper use.

- *Wear gloves, long sleeve shirts, trousers and shoes while working.*
- *Wash your hands with water and soap after handling.*
- *Wash your hands prior to eating during work time.*
- *Use clean clothes every day.*
- *Do no mix work clothes with ordinary clothes during laundry*
- *Do not eat or smoke while handling the bunch covers.*
- *Do not put the bunch covers in the mouth*
- *Do not hang the bunch covers around the neck*
- *Never rub eyes with the bunch covers.*