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Postharvest Handling Technical Bulletin

GREEN ONIONS

Postharvest Care and Market Preparation



Technical Bulletin No. 15

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POSTHARVEST HANDLING TECHNICAL SERIES

GREEN ONIONS

Postharvest Care and Market Preparation

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

Technical Bulletin No. 15

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Preface

This publication is part of a series of technical bulletins that seek 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

Green onions (*Allium cepa*) are immature forms of white onion cultivars planted at high density. Green onions are harvested while the leaves are still fresh and green and the bulb is either undeveloped or very small in diameter. Green onions can be categorized into two types, based on bulb diameter. The first type, commonly called a bunching onion, is harvested prior to bulb enlargement. The second type, known as a shallot or spring onion, has a small partially enlarged bulb. Both types of green onions have a high respiration rate and are very perishable. They are both marketed over a short period of time. Lowering and removing the heat of respiration as well as preventing water loss are critical. The principal postharvest problems are wilting, elongation, yellowing, and decay. The postharvest care recommendations are identical for both types of green onions.

Harvest Maturity Indices

Number of days from seeding can be used as a rough guide to predict harvest maturity. Bunching onions are typically ready for harvest 50 to 60 days after seeding, depending on environmental conditions, planting density, and cultivar. Shallots are generally ready for harvest 60 to 70 days after seeding.

The most commonly used indices of harvest maturity are size of the plant and bulb diameter. The plant should have fully grown crisp green leaves with a minimum length of 30 cm (12 inches). In some cultivars the leaf length may extend up to 60 cm (24 inches). Green onions should be harvested when they reach the proper bulb diameter for the particular market. Bunching onions should be harvested prior to bulb formation, with at least 5 cm (2 inches) of white shank. The stem should have the thickness slightly larger than the diameter of a pencil. Shallots should be harvested when the bulb at the base of the plant has enlarged to 0.6 to 1.3 cm (¼ to ½ inch) in diameter.

Harvest Methods

Green onions should be carefully harvested by hand pulling the plant from the soil with the thumb, forefinger, and index finger clasped around the base of the plant. They should not be pulled from the leaves, as tearing and tissue damage will occur. The onions should be put directly into the field container and transported to a nearby packing area for market preparation. Ideal harvest containers are well-ventilated plastic crates. They are light weight, strong, and have a smooth inner surface. Reed baskets or wooden crates can be used if they are lined with newspaper to protect against abrasion damage to the delicate leaf tissue. Field sacks should not be used for collection of green onions as tissue damage and overheating of the plants will occur.

Green onions which are injured, diseased, or unmarketable should be separated and not mixed in the same harvest container as the marketable plants (Figure 1). The culled green onions should be removed from the field to avoid the buildup of insect pests and diseases.



Figure 1. Field separation of marketable and unmarketable green onions before washing.

Preparation for Market

Green onions are highly perishable and should be prepared for market within several hours after harvest. The steps involved in market preparation include washing, grading, bunching, and packing.

Washing

Damaged, broken, or partially yellow leaves should be removed from the green onion bunch prior to washing. For some export market destinations, the green tops are trimmed to a length of 30 cm (12 inches). Trimming should be done gently to avoid crushing of the leaf tissue (Figure 2).



Figure 2. Green onions trimmed off at the tips to a length of 30 cm.

Green onions should be washed in clean, properly sanitized water to remove soil particles, dirt, and surface stains. Ideally, the water should be chilled to assist in field heat removal. It is very important to sanitize the water with 150 ppm hypochlorous acid and maintain a pH of 6.5. 150 ppm is equal to 2 oz of household bleach (such as Marvex) per 5 gallons of water, or .3 liters of bleach per 100 liters of water. This will help to minimize the spread of bacterial soft rot. However, water chlorination may not eliminate the more tolerant postharvest fungal pathogens. The chlorine level and pH of the wash water should be checked frequently with paper test strips or a portable meter. If a conductivity meter is used to check the sanitizing potential of the water, the oxidation- reduction

potential (ORP) should be at least 650 mV to kill the soft rot bacteria suspended in the water.

Depending on the amount of green onions to be cleaned, the process can be done manually or automatically. Small scale operations usually choose to clean the individual green onions by dipping them in a tank of water (Figure 3). Larger volume operations may choose to use an overhead spray wash system for cleaning (Figure 4).



Figure 3. Manual washing of green onions for limited volume operations.



Figure 4. Overhead spray wash cleaning of green onions in a large-scale operation.

Sorting

There are no established grade standards for green onions in the domestic Guyana market. However, the plants should be sorted into different quality classes according to various external characteristics. Green onion quality is primarily based on size, thickness of the stem or bulb, straightness, leaf colour, amount of surface blemishes, and uniformity of plants within the bunch. Additional quality indices are the amount of insect damage, tissue injury, and incidence of decay. High quality green onions should be fresh and turgid, and have an appropriate leaf length.

Green bunching onions should have a thin, white shank or neck at least 5 cm to 7.5 cm (2 to 3 inches) in length. Bunching onions should be well-formed, straight, uniform in shape, thin-necked, turgid, bright in colour, well cleaned, and free from excessive roots, decay, insect injury, mechanical damage, broken or crushed leaves, or dehydrated, clipped ends. Bunching onions destined for export should be separated into 3 size categories, based on thickness of the lower stem. A minimum thickness of 0.6 cm ($\frac{1}{4}$ inch) is desired. Small sized bunching onions have a lower stem thickness of 0.6 to 1 cm ($\frac{1}{4}$ to $\frac{3}{8}$ inch), medium sized ones have a 1 to 1.9 cm ($\frac{3}{8}$ to $\frac{3}{4}$ inch) thickness, and large sized bunching onions have a stem thickness greater than 1.9 cm. Generally, only small and medium sized bunching onions are preferred for export.

Shallots destined for the export market are typically sized based on bulb diameter. Shallots with bulbs less than 1.3 cm (½ inch) are classified as small; between 1.3 cm to 2.5 cm (½ to 1 inch) as medium; and greater than 2.5 cm (1 inch) as large. For the North American export market, the total length of the shallot should not exceed 55 cm (22 inches).

Bunching

Green onions are typically bunched prior to packing. The number of individual plants per bunch depends on the market destination and type of green onion (bunching or scallion). For domestic markets, green onions are usually wrapped into large bunches of 25 to 30 plants per bunch (Figure 5).



Figure 5. Bunches of green onions in Stabroek Market.

For export markets, green onions are wrapped into small bunches of 6 to 9 plants (Figure 6), weighing about 110 gm to 120 gm (¼ lb). Exporters should, however, verify desired bunch sizes with importers and wholesalers in the **importing market**. Either soft textured string or rubber bands can be used as wrapping material, and there are usually two wraps per bunch. Bunching should be done carefully to avoid crushing of the leaves and damage to the tender bulb tissue.

Packing

Green onions marketed domestically are typically laid flat on a canvas sack that has been opened up and tied in the center around the green onions (Figure 7). This type of pack provides little or no protection to the delicate green onion plants. However, it does allow for air exchange and minimizes heat build-up. A preferred package for domestic marketing is a well-ventilated durable plastic container. This type of package has smooth inner walls to protect against tissue damage and leaf tearing and allows for the bunches to be stacked.



Figure 6. Wrapping of green onions in small bunches for export.



Figure 7. Knotted open sack for packing green onions for domestic marketing.

Green onions for export to North America are packed 24 or 48 bunches per carton, depending on size. Each bunch should weigh about ¼ lb and the net carton weight is approximately 5.5 or 11 lb (2.5 or 5 kg). The cartons are typically waxed, with easy opening tops for icing (Figure 8). Adding crushed ice to the carton will help maintain the cold chain during transport (Figure 9).



Figure 8. Waxed fiberboard carton used for exporting green onions.

To reduce shipping weight, a semi-permeable plastic film enveloping the green onions can be used instead of ice, provided the cold chain is maintained during transit (Figure 10). The film will minimize moisture loss during transit and help maintain green onion freshness. However, a plastic wrap should not be used if a proper cold chain cannot be maintained. The plastic may actually result in unwanted heat build up.



Figure 9. Crushed ice added to the carton of green onions helps maintain the cold chain.



Figure 10. Green onions wrapped with semi-permeable film for export in 2.5 kg carton.

Temperature Control

Green onions are normally marketed promptly and not stored. Being immature, green onions have a very high respiration rate and deteriorate rapidly at ambient temperature. The leaves wilt within hours in the absence of refrigeration. The shoots also continue to elongate. Green onions should be cooled to 0°C (32°F) within several hours after harvest in order to prevent elongation and to minimize wilting and decay. Crushed ice spread over the onions is an effective cooling agent and supplies moisture to minimize wilting. About 1 kg (2.2 lb) of ice is required for every 2 kg (4.4 lb) of green onions to achieve rapid and effective cooling. However, the use of potable water as the source of ice and hygienic handling of the ice is essential to minimize the risk of a possible outbreak of food-borne illness.

A 10 day market life of bunching onions may be obtained at 0°C (32°F) and high relative humidity. Scallions have a slightly longer potential market life and may be held for up to 3 weeks at 0°C (32°F) and high relative humidity. Potential market life decreases rapidly with increasing temperature; at 5°C (41°F) the market life is less than half that at 0°C (32°F). Green onions have a maximum market life of 7 to 10 days at 5°C (41°F). Higher temperatures greatly accelerate yellowing and decay of the leaves. The leaves soon develop a slimy rot in the center of the bunch at ambient temperatures.

Relative Humidity Management

Green onion plants have a high leaf area and consequently are very susceptible to postharvest weight loss. Without supplemental humidification, green onions will rapidly lose their crispness and start to show signs of wilting. They should be stored at 95%-98% relative humidity (RH). Green onions benefit from light misting, especially while on display during marketing.

Principal Postharvest Diseases

Postharvest diseases are an important source of market loss of green onions. They may become severe within several days on inadequately cooled green onions, especially if the wash water is contaminated with decay causing bacteria and/or the onion plants were handled roughly. The most effective method of minimizing decay is to cool the green onions immediately after harvest and maintain a storage temperature of 0°C. The most common postharvest diseases are bacterial soft rot, white rot, smudge, white tip, and gray mould.

Bacterial Soft Rot

Bacterial soft rot is caused by several different bacteria, but predominantly by *Erwinia carotovora* and *Pseudomonas* species. The bacteria can infect the leaf and bulb tissue, causing water-soaked lesions and a soft, discoloured slimy rot (Figure 11). The decaying tissue emits a foul-smelling odour. Wounding of the tissue is a common predisposing factor to this disease.



Figure 11. Initial stages of bacterial soft rot of green onions.

White Rot

White rot, caused by the soil-borne fungi *Sclerotium cepivorum*, is a serious postharvest disease on green onions produced in poorly drained soils or during the rainy season. Plants may be harvested in apparently good condition, only to decay during storage and marketing. Disease symptoms include a soft decay and development of a fluffy white mould at the base of the bulb (Figure 12). Minute hard black spherical bodies (sclerotia)

develop on the surface and within the fleshy scales. Occasionally much larger sclerotia are formed as well. Eventually the bulb rots completely.

Smudge

Smudge, caused by the soil-borne fungi *Colletotricum circinans*, may persist in the soil for many years and may be severe during prolonged wet periods. External symptoms are minute black bodies which form smudgy spots on the bulb portion of the green onion (Figure 13).



Figure 12. White rot of green onions.



Figure 13. Black surface mould symptoms of onion smudge.

White Tip

White tip is caused by the soil-borne fungus *Phytophthora porri*. The tips of the leaves die back for several centimeters and turn white (Figure 14). Leaves are deformed and water-soaked areas develop towards the base of the leaves. A serious rot may develop on the bulbs during storage.



Figure 14. Die-back of the leaf tips caused by *Phytophthora* white tip disease.

Gray Mould

Gray mould, caused by various species of the fungus *Botrytis*, is another common postharvest decay of green onions. Symptoms begin as pale brown water-soaked lesions on the inside of the leaves. Eventually the entire green onion bunch may rot with the leaves shriveling and turning brown (Figure 15). A major source of this disease is infected onion seed, which may carry the fungus in its internal tissues. Such seeds give rise to infected plants, but symptoms may not be immediately apparent. Frequent periods of rain promote gray mould development. The primary means of control is to plant disease-free seed.



Figure 15. Gray mould rot of green onions.

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. |
| PH Bulletin No. 11 | Pumpkin: Postharvest Care and Market Preparation, January 2004. |
| PH Bulletin No. 12 | Lime: Postharvest Care and Market Preparation, January 2004. |
| PH Bulletin No. 13 | Grapefruit: Postharvest Care and Market Preparation, January 2004. |
| PH Bulletin No. 14 | Passion Fruit: Postharvest Care and Market Preparation, January 2004. |
| PH Bulletin No. 15 | Green Onions: Postharvest Care and Market Preparation, January 2004. |
| PH Bulletin No. 16 | Sweet Potato: Postharvest Care and Market Preparation, January 2004. |

PLANNED PUBLICATIONS - 2004

Cassava: Postharvest Care and Market Preparation.

Eggplant (Boulanger): Postharvest Care and Market Preparation.

Yam: Postharvest Care and Market Preparation.

Ginger: Postharvest Care and Market Preparation.

Harvest Maturity

Bunching onions are typically ready for harvest 50 to 60 days after seeding, depending on environmental conditions, planting density, and cultivar. Shallots are generally ready for harvest 60 to 70 days after seeding.

The most commonly used measure of harvest maturity are size of the plant and bulb diameter. The plant should have fully grown crisp green leaves with a minimum length of 30 cm (12 in). In some cultivars the leaf length may extend up to 60 cm (24 in). Green onions should be harvested when they reach the proper bulb diameter for the particular market. Bunching onions should be harvested prior to bulb formation, with at least 5 cm (2 in) of white shank. The stem thickness should be slightly larger than the diameter of a pencil. Shallots should be harvested when the bulb at the base of the plant is 0.6 cm to 1.3 cm (¼ in to ½ in) in diameter.

Harvest Methods

Green onions should be carefully harvested by hand pulling the plant from the soil with the thumb, forefinger, and index finger clasped around the base of the plant. They should not be pulled by the leaves, as tearing and tissue damage will occur. The onions should be put directly into the field container and transported to a nearby packing area for market preparation. Ideal harvest containers are well-ventilated plastic crates. Reed baskets or wooden crates can be used if they are lined with newspaper to protect against abrasion damage to the delicate leaves. Field sacks should not be used for collection of green onions as tissue damage and over-heating may occur. Green onions that are injured, diseased, or unmarketable should be culled and not mixed with the marketable ones.

Preparation for Market

Green onions are highly perishable and should be prepared for market within several hours after harvest.

Cleaning/Washing

Damaged, broken, or partially yellow leaves should be removed from the green onion bunch prior to washing. For some export market destinations, the green tops are trimmed to a length of 30 cm (12 in). Trimming should be done gently to avoid crushing of the leaf tissue.



Green onions should be washed in clean, properly sanitized water to remove soil particles, dirt, and surface stains. The water should be chilled. It is very important to sanitize the water with 150 ppm hypochlorous acid. This is equal to 2 oz of household bleach (such as Marvex) per 5 gallons of water, or .3 liters of bleach per 100 liters of water. The water pH should be maintained at 6.5. This will help to minimize the spread of bacterial soft rot.

Small-scale operations usually choose to clean the individual green onions by dipping them in a tank of water. Larger operations may use an overhead spray wash system for cleaning.

Sorting

There are no grade standards for green onions in the domestic market. However, the plants should be sorted into different quality classes. Green onion quality is best based on size, thickness of the stem or bulb, straightness, leaf colour, amount of surface blemishes, and uniformity of plants within the bunch. Additional quality indices are the amount of insect damage, tissue injury, and incidence of decay. High quality green onions should be fresh and turgid, and have an appropriate leaf length.

Green bunching onions should have a thin, white shank or neck at least 5 cm to 7.5 cm (2 ins to 3 ins) in length. Bunching onions should be well-formed, straight, uniform in shape, thin-necked, turgid, bright in colour, well cleaned, and free from excessive roots, decay, insect injury, mechanical damage, broken or

crushed leaves, or dehydrated, clipped ends. Bunching onions destined for export should be separated into 3 size categories, based on thickness of the lower stem. Small sized bunching onions have a lower stem thickness of 0.6 cm to 1 cm (¼ in to ⅜ in), medium sized ones have a 1 cm to 2 cm (⅜ in to ¾ in) thickness, and large sized bunching onions have a stem thickness greater than 2 cm. Small and medium sized bunching onions are preferred for export.

Shallots destined for the export market are typically sized based on bulb diameter. Shallots with bulbs less than 1.3 cm (½ in) are classified as small; between 1.3 cm to 2.5 cm (½ in) as medium; and greater than 2.5 cm (1 inch) as large. For the North American export market, the total length of the shallot should not exceed 55 cm (22 in).

Bunching

Green onions are usually bunched prior to packing. The number of individual plants per bunch depends on the market destination and type of green onion (bunching or scallion). For domestic markets, green onions are usually wrapped into large bunches of 25 to 30 plants per bunch. For export markets, green onions are wrapped into small bunches of 6 to 9 plants, weighing about 110 gm to 120 gm (about ¼ lb). Either soft textured string or rubber bands can be used as wrapping material, and there are usually two wraps per bunch.



Packing

Green onions marketed domestically are typically laid flat on a canvas sack that has been opened up and tied in the center around the green onions. This type of pack provides little or no protection to the delicate green onion plants. A preferred pack for domestic marketing is a well-ventilated durable plastic container. This type of pack has smooth inner walls to protect against tissue damage and leaf tearing and allows for the bunches to be stacked.

Green onions for export to North America are packed 24 or 48 bunches per carton, depending on size. Each bunch should weigh about 113 gm (¼ lb) and the net carton weight is approximately 2.5 kg or 5 kg (5.5 lb or 11 lb). The cartons are typically waxed, with easy opening tops for icing. Adding crushed ice to the carton will help maintain the cold chain during transport for domestic marketing.

To reduce shipping weight for export, a semi-permeable plastic film can be wrapped around the green onions instead of ice, provided the cold chain is maintained during transit. The film will minimize moisture loss during transit and help maintain freshness.



Temperature Control

Being immature, green onions have a very high respiration rate and deteriorate quickly at average temperatures. Green onions should be cooled to 0°C (32°F) within several hours after harvest in order to minimize wilting and decay. Crushed ice spread over the onions is a good cooling agent and supplies moisture to minimize wilting. About 1 kg (2.2 lb) of ice is required for every 2 kg (4.4 lb) of green onions for this rapid and effective cooling.

A 10 day market life of bunching onions may be achieved at 0°C and high relative humidity (RH). Scallions have a slightly longer potential market life and may be held for up to 3 weeks at 0°C and high RH. Potential market life decreases rapidly with increasing temperature; at 5°C (41°F) the market life is less than half that at 0°C. Higher temperatures greatly increase the rate of yellowing and decay of the leaves.

Relative Humidity

Green onion plants are very prone to wilting. Without extra moisture, green onions will rapidly lose their crispness and show signs of yellowing. They should be stored at 95% to 98% relative

humidity (RH). Green onions benefit from light misting, especially while on display in stores.

Principal Postharvest Diseases

Postharvest diseases are an important source of market loss of green onions. Decay may become severe within several days due to poor cooling, leaf and bulb injury or unsanitary wash water. The best method of minimizing decay is to cool the green onions immediately after harvest and maintain a storage temperature of 0°C (32°F).

Bacterial Soft Rot

Bacterial soft rot is typically the worst postharvest disease of green onions. Symptoms begin as water-soaked spots and develop into a soft, discoloured slimy rot. The decaying tissue gives off a bad odour.

White Rot

White rot is a serious postharvest disease of green onions produced in poorly drained soils or during the rainy season. Signs of the disease include a soft decay and development of a fluffy white mould at the base of the bulb. Small hard black dots develop on the surface and within the fleshy scales. Eventually the bulb rots completely.

Gray Mould

Symptoms of gray mould begin as pale brown water-soaked spots on the inside of the leaves. Eventually the entire green onion bunch may rot with the leaves shriveling and turning brown.

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With the assistance of
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New Guyana Marketing Corporation

GREEN ONIONS

Postharvest Care and Market Preparation Information Sheet



This information sheet provides growers and agriculture extension personnel with a summary of the recommended harvest and postharvest handling practices for green onions. A more technical and detailed bulletin is available from the New Guyana Marketing Corporation (NGMC) and the National Agricultural Research Institute (NARI).

Green onions are immature forms of white onion cultivars and can be classified into two types, based on bulb diameter. The first type, commonly called a bunching onion, is harvested prior to bulb enlargement. The second type, known as a shallot or spring onion, has a small partially enlarged bulb. The postharvest care recommendations are identical for both types of green onions.