

POSTHARVEST HANDLING OF PUMPKINS: MAINTAINING QUALITY AND ENSURING FOOD SAFETY

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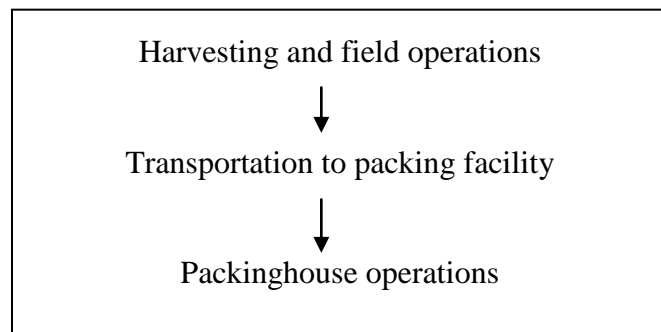
INTRODUCTION

The tropical Pumpkin is an important crop grown in several parts of the world. The crop has tremendous export potential if the correct postharvest handling practices are implemented from the field to the final consumer.

Poor postharvest handling practices compromise both the quality of the fruits as well as increase the risk of food borne pathogen contamination. Postharvest handling consists of several components which must be seen as a systematic series of operations aimed at achieving several objectives including:

- Maintenance of fruit quality
- Reduced incidence of postharvest diseases
- Reduction in moisture loss
- Reducing the risk of food borne illnesses

A good postharvest system involves the following steps:



Typical postharvest operations

Postharvest losses occur in the present system because of the following reasons:

- Lack of knowledge by growers of the correct stage of maturity
- Rough harvesting and handling during field operations
- Poor transportation operations
- Poor packinghouse operations

Harvesting and field Operations

Maturity Indices

Horticultural maturity coincides with physiological maturity in pumpkins. Fruits are generally harvested by hand. Determination of the correct stage of maturity is critical to shelf life and marketability. Immature fruits have a very short shelf life: they lose water rapidly leading to shrivelling and loss of saleable fresh weight, they have a high propensity for developing post harvest rots, and are easily bruised and damaged during postharvest operations because of an underdeveloped peel or rind. The determination of the correct stage of maturity is essential if one is to obtain the maximum shelf life from this crop. Maturity is determined by looking at a number of characteristics while the fruits are still on the vine. These characteristics include:

(a) Change in fruit colour: Immature developing fruits are shiny green. As they begin to mature the peel (rind) colour changes from green to yellow starting with the ground colour (i.e. the colour of the peel that is contact with the soil). The peel then loses its sheen due to the development of a surface wax.

(b) Change in the stem end of the fruit: At maturity there is corking of the stem with the stem going from light green to brown and the development of a distinct abscission layer (line of fracture). The tendrils nearest to the fruits dieback.

(c) Flesh colour: When assessed objectively there is an intense yellow flesh colour due to carotene synthesis and maximum accumulation of sugars and solids which are well correlated with good eating quality.

(d) Latex flow: Some growers will make a small incision at the stem end to check for latex flow. The absence of latex is indicative of fruit maturity. Once the incision is small enough the rind heals.

Care should be taken when harvesting to maintain the integrity of the product along the postharvest chain. Fruits should be harvested in the cooler times of the day - early mornings or late evenings.

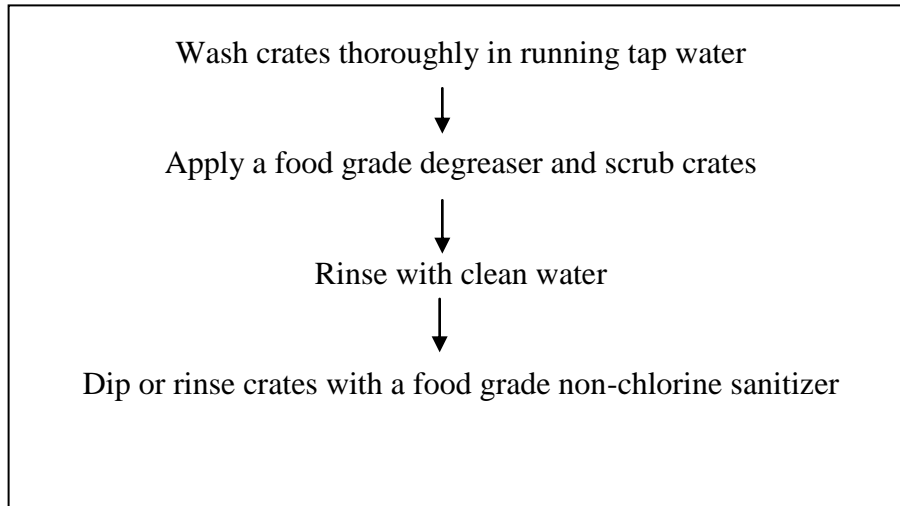
Fruits should be harvested by cutting as close as possible to the stem scar without damaging the calyx. This calyx serves a protective function since it is waterproof and prevents the entry of organisms which may cause rots in storage. Fruits with damaged calices will rot very quickly after harvesting. Fruits which have not been properly trimmed will bruise adjacent fruits during transportation. The photographs show the proper and improper trimming of the stem end.

Field packing and transportation

Fruits are harvested by hand and thrown to a catcher on the transport vehicle. Fruits sometimes fall and are bruised. In addition, fruits are roughly placed on the tray of the vehicle which increases the risk of internal bruising. Over-stacking of transport vehicles is quite common resulting in damage to the fruits at the bottom of the pile and substantial bruising on arrival at the packinghouse. In fact, preliminary data has shown, the 25%-40% bruising is due to poor transportation practices resulting in rejection at the packinghouse. In some cases, fruits are transported during the hottest times of the day resulting in high internal fruit temperature and quality losses. High core temperatures result in the product spending a longer time to precool.

Sanitising harvesting crates

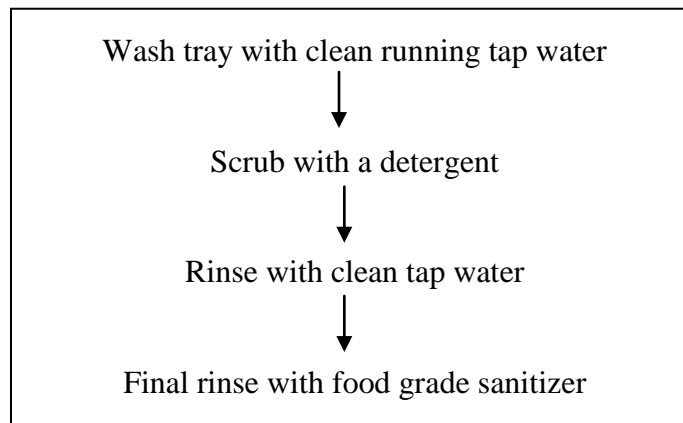
High density polyethylene crates can be easily sanitized. Sanitization will significantly reduce the risks associated with cross contamination. Crates can be sanitized using the procedure outlined below:



Procedure for sanitizing harvesting crates

Vehicle sanitation

It is quite common in Caribbean agriculture for farm vehicles to be used for a range of different tasks some of which may compromise the safety of farm produce. Farm vehicles that are used for transporting farm produce should not be used for transporting animal manure and as temporary storage for facilitating pesticide operations. Vehicles used to transport fresh produce must at all times be properly washed and the trays sanitised. Trays can be sanitized using the following simple procedure:



Local Packinghouse Operations

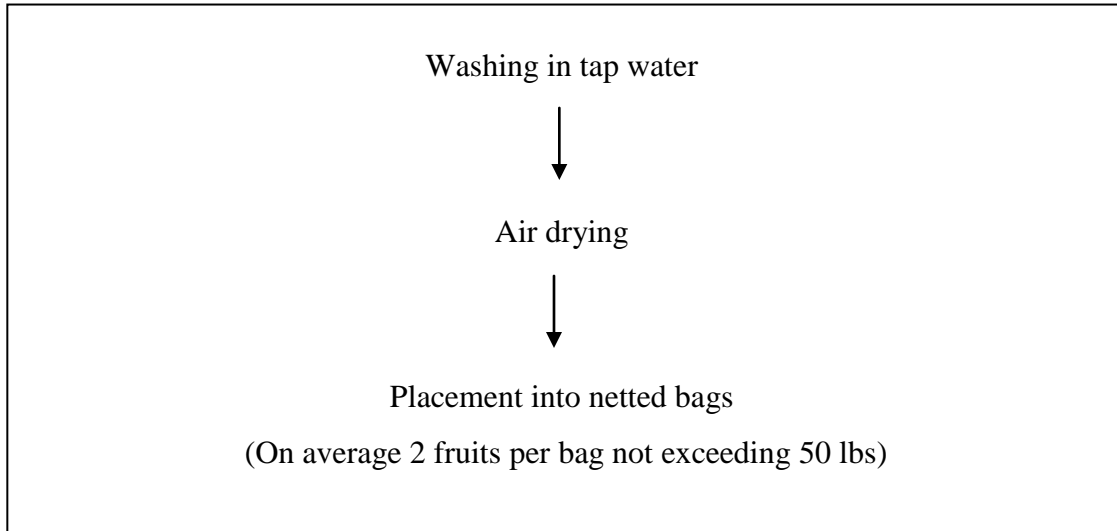
Most packinghouse operations are done in order to facilitate the export trade. For local marketing very little postharvest treatments are done as fruits are taken directly to wholesale markets or temporarily stored on farms and sold at the farm gate. The food safety concerns associated with local marketing are discussed in another section of this document.

Many of the local, small scale packinghouses do not meet the basic sanitation requirements during postharvest handling and packaging. The hazards that are associated with such facilities include:

- Poor worker health and hygiene
- Poor water quality used for washing
- No postharvest treatments
- No proper washroom facilities
- Conditions which do not exclude pets and birds

On arrival, pumpkins are removed from vehicles and placed on the ground close to where the packing operations are to take place. No attempts are made to properly store fruits probably because visible symptoms of quality loss take a longer time to appear when compared to other kinds of fresh produce. Fruits may be kept on the floor or on dirty wooden pallets for a few days until enough fruits are collected to fill a shipment. Temporary storage on the ground also exposes the fruits to pests of public health importance including rats and cockroaches which are nocturnal in their feeding habits and consequently their presence may not be observed. In addition, poor storage also exposes the fruits to bird droppings. Dead pigeons have been documented on piles of pumpkins waiting to be packaged. Because of its bulkiness, pumpkin is sea freighted in either 20' or 40' reefer containers.

Once the exporter has enough pumpkins they are prepared for shipping. A very basic set of operations is done before packing into refrigerated containers. The basic process flow is given below:



Local packinghouse operations for pumpkins

Fruits are often washed in batches in the same plastic container of water. Consequently, after a very short time, the water becomes discoloured due to dirt and other organic material brought in from the field. This dirty water containing food borne pathogens can easily infiltrate the fruits thereby posing a risk to human health. Dirty water will also increase the risk of rotting.

Additionally, workers who operate in these facilities sometimes seem to lack the basic hygiene and grooming required to meet the most basic requirements for good manufacturing practices. Bathroom facilities are often not readily available and workers are not trained in following basic hand washing procedures. All of these situations introduce risks to safe food handling.

Packinghouse infrastructure is sometimes woefully short of the safety requirements for good manufacturing practices. Dilapidated roofing, unsanitary floors, poor storage facilities, inappropriate packaging material, poorly maintained washroom facilities and poor water storage facilities etc. are quite common.

Fruits handled in these conditions result in high losses to the importer. In fact, some shipments arrive in such poor condition that the entire shipment is rejected. A number of reasons contribute to this problem including:

1. Growing fruits in raw poultry manure which itself contributes to fruit collapse during export. High nitrogen is well associated with poor shelf life of some fresh produce.
2. Placing fruits into containers directly without precooling the fruits. The reefer containers that are used are not refrigerated, they are only precooled. The already warm fruits become hot over time resulting in losses on arrival in the importing country.
3. High relative humidity (r.h.) is another concern. Pumpkins should be stored at r.h. of between 65-70%. Higher r.h. results in fruit collapse during storage. Fruits which have not been precooled would have higher respiration rates during storage and therefore the relative humidity of the entire storage area will increase.

The following photographs clearly demonstrate the need for improvements.



(a) Poor packinghouse facility



(b) Batch washing in contaminated water

Figure 19: Local packinghouse operations for pumpkins showing: (a) poor packinghouse facility and (b) batch washing in contaminated water.

8.7 Improving Packinghouse Sanitation

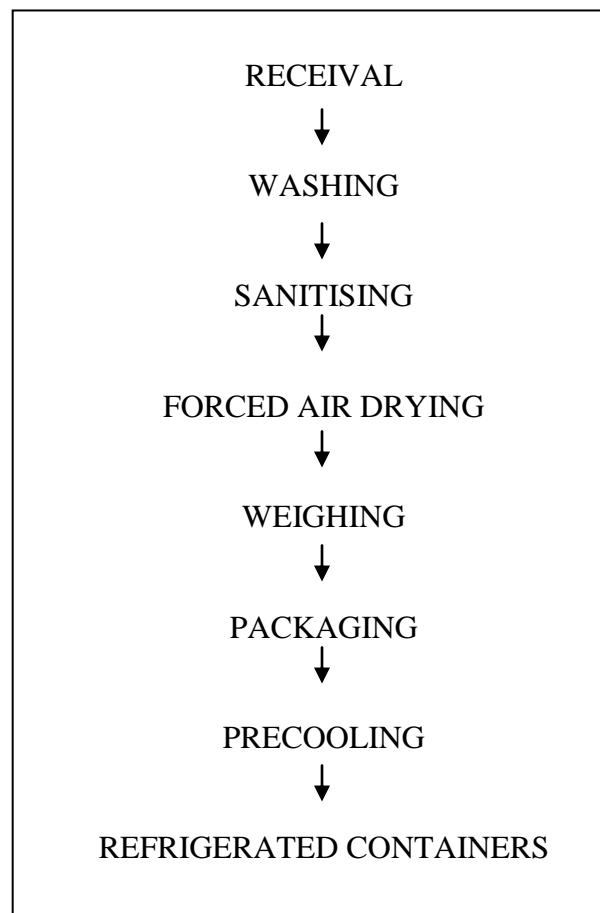
Good manufacturing practices form the basis of all food plant sanitation including packinghouse sanitation. Standard operating procedures and standard sanitary operating procedures are the foundation on which microbial and other kinds of contamination are prevented during packing of produce. These procedures are developed written in a sanitation manual. All workers must become familiar with the procedures especially those workers who are in charge of enforcing them. The general principles upon which good manufacturing procedures are built are:

1. Written procedures for sanitising restrooms, breakrooms, waste areas, processing areas, floors and storage rooms.
2. Written procedures for sanitising harvesting crates, palettes and vehicles
3. Sanitising procedures for packinghouse equipment used during washing etc. of fresh produce. The procedures must take into account work benches and sorting tables. These areas are to be sanitized at the end of each work day and at the start of each new day.
4. Sanitation procedures for outside walls, grounds, landscaping etc.
5. Daily sanitation logs for each pre-operational and operational sanitary requirement.

6. Container identification programmes. Containers used at receipt, during processing and in the bathroom and kitchen areas must be clearly demarcated.

IMPROVED PACKINGHOUSE OPERATIONS (THE NAMDEVCO MODEL)

National Agricultural Marketing Development Corporation (NAMDEVCO) is charged with the mandate of marketing (internally and externally) fresh produce grown in Trinidad and Tobago. In an effort to meet the stringent quality demands on export markets, NAMDEVCO established a modern packinghouse facility in 2002. The following procedure was developed at the packinghouse facility for the postharvest handling of pumpkins for export. This procedure can be successfully used as part of a quality assurance programme for pumpkins by any exporter. The basic steps involved in the operations are shown:



Postharvest operations for pumpkin at the NAMDEVCO Packinghouse, Piarco, Trinidad.

On arrival, pumpkins are removed from the transport vehicle, placed in gondolas (large harvesting crates), weighed, and placed in the receival bay. The gondolas are then taken into the packinghouse where the fruits are sorted. Rejects are culled and immediately taken out of the washing area. Rejects include the following:

- 1 Fruits that have been severely bruised during transport
- 2 Fruits infested with worms
- 3 Fruits with damaged calices
- 4 Fruits that show signs of rotting due to impact bruising or excessive manure usage
- 5 Fruits showing collapse due to excessive manure usage

Fruits selected for export are first washed in running tap water and scrubbed with a soft-bristled brush. They are then rinsed and placed in a chlorine-based sanitizing solution for 1-2 minutes. The fruits are then air dried and packaged in ventilated netted bags. They are then pre-cooled to a core temperature of 13°C at 65-70% r.h. The fruits are then loaded into pre-cooled reefer containers for export to regional and international markets.