Food and Agriculture Organization
of the United Nations

Post-harvest handling and quality management of sweet potato

Ipomoea batatas


©FAO

POST- HARVEST HANDLING AND QUALITY MANAGEMENT OF SWEET POTATO

Ipomoea batatas

Professor Majeed Mohammed
Post-harvest consultant

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2022

Required citation:
Professor Majeed Mohammed Postharvest Consultant, 2022. *Postharvest Handling and Quality Management of Sweet Potato (Ipomoea batatas)*. Rome. FAO.

Contents


©FAO

Introduction

The sweet potato (*Ipomoea batatas L.*) is highly nutritious and a versatile member of the Convolvulaceae or morning glory family and ranks as the world's seventh most important food crop. Referred to as a super food, it is high in calcium, potassium, vitamins A and C, iron, thiamine and is a good source of fibre and other important vitamins and minerals. Sweet potato contains beta-carotene, has a low glycemic index and could reduce the risks of certain life style diseases. Sweet potato can be boiled, baked, used in soups, desserts, breads, or in stir-fried dishes.

Sweet potato roots are susceptible to postharvest losses at various stages of the postharvest handling system as shown in Table 1. These losses result from mechanical injury, weight loss, sprouting, diseases and pests and reduce both the quality (economic value) and quantity of the root. To realize the full potential of sweet potato as a source of good nutrition, reliable food security and income generation for farmers in the Caribbean, it is essential to increase productivity of high quality roots and strengthen diversified market opportunities by reducing postharvest losses at each step in the handling system (Table 1). This factsheet has been prepared to acquaint all stakeholders with recommendations for good postharvest handling of sweet potatoes.

Photo 1. *Sweet potato cultivation in greenhouses*
Photo 2. *Sweet potato varieties produced across tropical regions.*

Quality requirements

Quality refers to the characteristics, which give the sweet potato root value in terms of food for people and which also facilitate the marketing and distribution process. Sweet potato is an edible root which is either long or tapered, ovoid or round with a skin colour ranging from white, brown, purple or red and the flesh colour ranging from white, pale cream, orange or purple depending on variety. The skin of high quality roots should be intact, free of mechanical damage such as bruises, punctures, and cuts, free of infections and chemical residues. Roots should have no unusual outgrowths, and must be smooth, firm, with uniform shape and size and weight 0.25 to 1.5 kg (0.5 to 3.0 lbs).

Table 1. Changes in sweet potato roots that result in qualitative and quantitative post-harvest loss

Symptom of Loss	Underlying cause
Weight loss	Roots can lose weight both by losing water, and also by metabolizing the starch reserves of the potato through the process of respiration. Under normal marketing conditions most weight loss (90 %) is through water loss (Van Oirschot *et al.*, 2000; Rees *et al.*, 2008. Water loss causes the root to become less attractive as it shrivels and, as described below, also appears to make the root more susceptible to rotting.
Rotting	Rotting of tissues results from attack by fungal and bacterial pathogens. When rotting starts a root quickly becomes unsaleable.
Sprouting	When a root sprouts, it will often become sweeter as starch is converted to sugar to provide energy for the growth of sprouts. The appearance of sprouts and loss of starch reduces the root value.
Loss of good taste	Many changes can occur in the root composition after harvest, which may affect the taste and texture of the cooked root.
Infestation by insects	The most important insect pest of the storage root is the sweet potato weevil (*Cylas* spp.). With only slight infestation, the root can become completely unsaleable due to the production of bitter tasting phytoalexins as part of the defence mechanism of the root.

Source: Rees, D., van Oirschot, Q. E., & Aked, J. (2008). The role of carbohydrates in wound-healing of sweetpotato roots at low humidity. Postharvest Biology and Technology, 50(1), 79-86.

Maturity indices

Depending on the cultivar and method of planting, sweet potato should be harvested when fully mature, six to twelve weeks after planting. During the dry season, the vines should be removed three to seven days before harvesting. During the rainy season, the vines should be left intact until just prior to harvest. Maturity of the root can be determined in the field by cutting harvested roots and observing the colour of the latex exudation. In immature sweet potatoes the latex turns black, when mature it remains creamy-white (Plate 1).

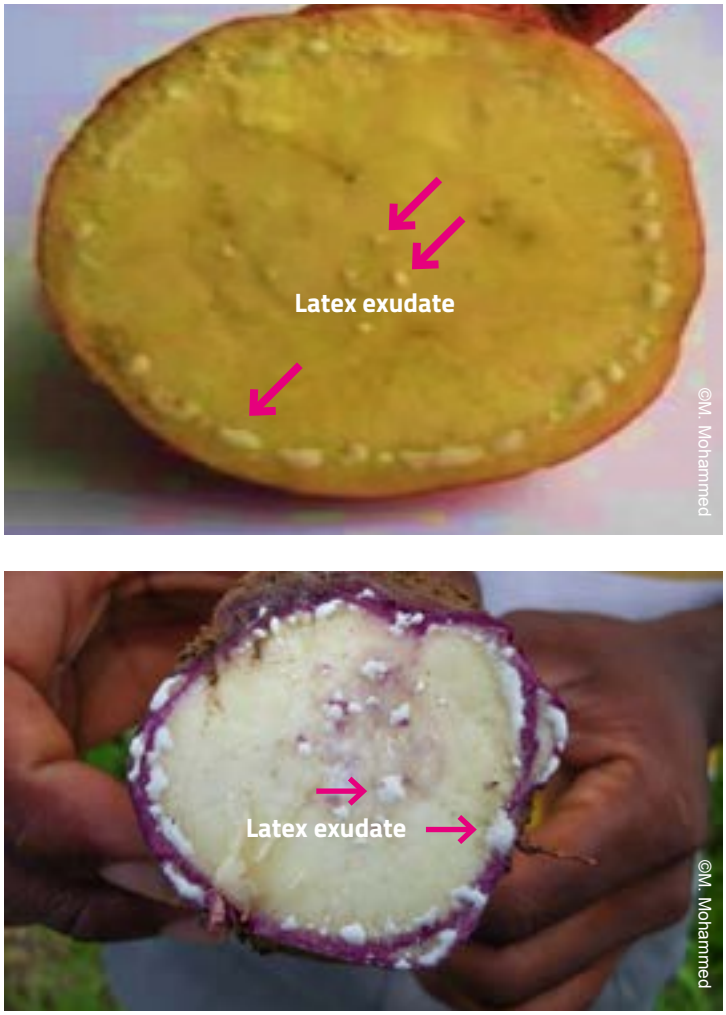

Plate 1. *Latex from mature sweet potato.*

Harvesting method

Monitoring harvest in a timely manner is essential in acquiring high quality roots with a prolonged shelf life. Harvesting too early can result in reduced yields. Harvesting too late may cause roots to become susceptible to rotting and weevil attack. Sweet potato can be harvested manually or mechanically. For manual harvesting, the vines are cut and a fork or cutlass is placed about 30 cm or one foot away from where the vine is attached to the storage roots. The soil is turned to expose the roots, which are separated by hand. Harvest is also done mechanically with a number of different types of harvesting aids. Typically, vines are cut off and roots are thrown to the soil surface using tractors with various types of dish ploughs; the roots are picked up by hand and transferred to containers in truck trays or trailers. Mechanical harvesting may result in damage, the extent of which depends on the depth of the harvesting tool or equipment, the speed of the tractor and the soil conditions.

Harvesting containers

Popular harvesting containers used in the Caribbean for transferring sweet potatoes from the field to the field shed or packinghouse include nylon sacks, reed baskets or wooden crates. Nylon sacks are the least durable and the least protective. Considerable root abrasion and skinning occurs during loading, transport, and unloading due to friction of adjacent roots within the container and the delicate skin against the inside surface of the sack. Plastic collapsible crates are highly recommended but should never be overfilled because this will negate proper stacking, which would induce injuries to roots not only on top of the crate but throughout the crate. Overfilled plastic crates can destabilize loads particularly during transportation over rough roads and steep topography and this would result in additional damage to the sweet potato roots. After sweet potatoes are placed in plastic crates they should be promptly relocated during transportation to a shaded area such as a covered shed in the field or to a nearby packinghouse facility to avoid the incidence of sunscald. Sunscald is a physiological disorder that can cause darkening or senescence of the skin, which may occur within as few as 30 minutes of exposure to bright sunlight. Sunscalded sweet potato roots are susceptible to secondary infections. Sunscald is more conspicuous on light or flesh-coloured cultivars.

Transportation

Transportation is a vital link in moving the roots from the collection point in the field to the packing shed or to the packinghouse and from there to the market. Several factors could influence the extent of damage that could be inflicted on the sweet potato. Factors that may cause damage include the packaging, climatic conditions, time of the day, prevailing temperature and relative humidity, smoothness of the road surface, integrity of containers, distance and speed. The use of an appropriate vehicle is critical in the efficient transportation of sweet potatoes. Transport vehicles should be covered to protect the top layers of roots from direct exposure to sunlight. Transport during cooler hours of the day or at night favours lower temperatures that could better preserve their quality and shelf life.

Curing

Curing is the process whereby the sweet potato roots are allowed to heal the wounds on and in the skin (caused by handling) by the formation of new skin tissue (periderm) and by toughening of the skin (corky tissue formation and desiccation of the outer skin tissues). Curing also converts starch to sugars, which is necessary for taste and flavour development. Controlled curing requires temperature control between 27 °C and 32 °C at a relative humidity (RH) of 90 % to 95 %. The curing process is completed after 3 to 10 days depending on the stage of maturity.

Packinghouse operations:

a. Trimming and cleaning: This is the removal of soil and extraneous unattractive or damaged parts of harvested roots to facilitate treatments such as curing and fungicide application and to improve their appearance, keeping quality, shelf life and resistance to micro-organisms.

b. Washing: Washing sweet potatoes with clean water is necessary to remove soil particles and foreign matter. Re-circulated wash water must be treated with 50-100 ppm chlorine (active ingredient) to avoid fungal concentration in the water and also to sterilize the surface of the sweet potatoes. Bleach (sodium hypochlorite) is quickly deactivated by large amounts of soil in washing tanks, therefore recharging of the water at regular intervals must be undertaken. It is recommended that the water is replaced after every 500 kg of sweet potatoes washed. Sweet potatoes must be dried as soon as possible after treatment. Ventilated plastic crates are recommended for packing the sweet potatoes as they allow for easy drainage and can be cleaned before their re-use.

c. Pre-cooling: The sweet potato changes from a vegetative to a "reproductive" stage during curing and sprouting will be initiated when the environmental conditions (temperature and humidity) are favourable. Sweet potatoes should be cooled to 13 °C to avoid sprouting, weight loss and quality deterioration.

d. Grading and sizing: Sweet potatoes are graded according to size with 200 g (8 ounces) being the minimum weight, 450-800 g (16-28 ounces) classified as medium and more than 800 g (>28 ounces) as large. Roots may also be graded according to shape. The rigorousness of grading depends on the demands of the market and variability in root size and quality.

e. Wax coating: Wax coatings can be applied to the skin of sweet potatoes to reduce weight loss, maintain firmness and freshness and reduce spoilage during transportation and storage.

f. Fungicidal dip: Sanitized sweet potato roots should be subjected to a postharvest fungicidal treatment to control decay. Roots are dipped in a solution of Mertec 20S (500 ppm of Thiabendazole), then placed in plastic crates and allowed to dry overnight. Recently, a hot water dip (HWD) treatment has been recommended at temperatures ranging between 45 °C and 50 °C for a 10 minute immersion period.

Packaging protocols

Movement of high quality sweet potatoes along the postharvest handling system requires properly designed packages to contain, protect and inform all stakeholders (Plate 2). All packaging containers must protect against physical damage and environmental conditions during handling and distribution. Palletized sweet potato packages must have sufficient stacking strength to resist collapse particularly under conditions of high humidity. The package must also be informative to stakeholders and include the brand name, size, grade, cultivar, net weight, count, as well as information on the fungicide treatment, grower shipper and country of origin, to facilitate rapid tracking and tracing procedures if and when required.

Storage conditions

Recommended conditions for commercial storage are to keep roots cool and dry. Sweet potato roots can be stored from 6 to 10 months at 12.5 °C-15 °C and 90-95 % relative humidity. Sweet potato roots are, however, susceptible to chilling injury when exposed to temperatures of 12 °C and below. Symptoms of chilling injury include root shrivelling, surface pitting, abnormal wound periderm formation, fungal decay, internal tissue browning, and hard-core formation. Temperatures above 15 °C lead to more rapid sprouting and weight loss.

Value-Added Products

In the Caribbean, sweet potato roots are processed and marketed in a range of different formats, from minimally processed (peeled, cut and blanched) to completely processed forms such as flour, cereals, snacks and pudding mixes. Other value-added food products include sweet potato purees, used in pie fillings, sauces, frozen patties, baby foods and in fruit-flavoured sweet potato jams, e.g. with pineapple, mango, guava and orange. Sweet potatoes are sun dried to produce chips. The dried sweet potato chips are boiled and mashed with beans, or pounded to flour, which can be mixed with other flours for the production of porridge. Dried sweet potato chips can be stored for up to six months when packaged in airtight dark-coloured plastic bags. Sweet potato flour can be used as an ingredient in the preparation of doughnuts and pancakes. Sweet potato starch can also be used as an ingredient in producing pasta and as a substrate for the fermentation process in the production of alcoholic drinks. In the confectionery industry candies and sweets, and sugar-coated or salted sweet potato crisps are popular snack foods. Mashed sweet potatoes are used as ingredients in ice cream, tarts, bakery products and desserts as well as a substitute for more costly ingredients (Plate 3).

Plate 2. *Value added products from sweet potato.*

Plate 3. *Value-added sweet potato food products.*

Source: Author's own elaboration.


©FAO

incatema
consulting & engineering

CC0034EN/1/08.22