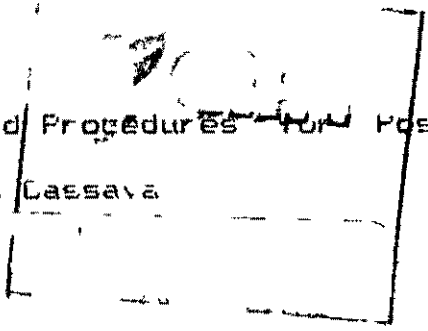


Quality Standards and Procedures for Postharvest Treatment in the Conservation of Fresh Cassava



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1. Quality before harvesting

1.1 Cooling quality To assure good cooling quality, it is necessary to cook several roots from randomly selected plants in the cassava plot. The roots selected must meet the following standards:

- a) low hydrocyanic acid content (absence of bitter taste),
- b) low sugar content (absence of sweet taste),
- c) no fiber and/or lignified tissues within the parenchyma. Fibers are detected by testing the samples, not by their external appearance, which can be misleading.
- d) firm but not hard ('glassy') texture, and starchy (white/yellow color, not transparent),
- e) not more than 30 minutes cooling time.

1.2 Quality for conservation Root shape is related to varietal quality for conservation (Figure 1). Cylindrical or conical-shaped roots having a well-developed, cylindrical or conic pedicel suffer less mechanical damage during harvesting and subsequent storage. Roots with a short pedicel are difficult to separate from the stump.

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without breaking the peel and damaging the parenchyma. Round roots suffer longitudinal damage of the peel during transportation and storage, and long roots break easily during harvest. The use of varieties having medium-sized roots with a well-developed pedicel helps reduce losses both during harvest and selection of roots as well as during storage.

1.3 Pre-harvest root infections. Discard roots showing internal and/or external rotting. Even minor rotting of one root may completely ruin the whole content of the bag in which it is packed. Special attention must be paid to internal rotting as in the case of "smallpox" disease, caused by fungi introduced into the root by an underground beetle (Lyrtomenus bergii Froeschner), which cannot be noticed externally and can only be detected by peeling the root. Certain stem diseases can infect the root through the lignified pedicel.

## 2. Harvesting and selection of the roots

2.1 Harvest. Harvesting must be carefully done to reduce to a minimum the percentage of broken roots or those with marked mechanical damage. Figure 2 shows the level of root damage that can be accepted. The root is separated from the lignified stem with a machete, or better, with garden shears which allow more precision and care. A small piece of pedicel should be left attached to the root, to avoid exposure of the parenchyma to the air.

2.2 Selection The cassava harvestes is classified in three categories, as follows

	A	B	C
Size	Non-commercial	commercial	commercial
Damage	with or without damage	with damage	without or slight damage
Current use	on-farm-consumption	fresh root market	fresh root market
Proposed use 1	drying	drying	conservation
Proposed use 2	on-farm consumption	fresh root market	fresh root market
Proportion	5-10%	5-10%	80-90%

Slightly damaged cassava for commercial use is selected and treated for conservation. Good quality cassava roots of commercial size, but with severe mechanical damage, represent a potential loss to the farmer if these cannot be used for conservation. They could be sold in the normal market for fresh roots for immediate consumption, however, the best option would be sun drying to produce dry cassava for animal feed. The advantage of this system is that total production is utilized, and even undersized, non-commercial roots, currently without value can also be used in the drying process.

### 3 Procedures for treatment and packaging of cassava roots for conservation

#### 3.1 General observations

3.1.1 Delay between harvesting and packaging. Experimental studies and experience agree on the need to carry out all treating and packaging operations immediately, after harvesting. A delay of only 4 hours may result in total loss of the product due to physiological

deterioration. The following steps are recommended within 2-3 hours after harvesting and require that packaging and treating take place in or close to the cassava plot. Thus, a centralized treating unit becomes impractical.

3.1 - Effect of direct sunshine. The position of the cots to direct sunshine during long periods of time also increases losses due to physiological deterioration. Harvesting in the morning or late in the afternoon, or under available shadow, reduces such risks.

3.1.3 Coordination of activities. The previous considerations highlight the importance of coordinating well all tasks involved in cassava harvesting, treating, and packaging. The operation becomes more efficient and low losses are assured if all tasks are distributed among the different laborers in a permanent work-line instead of having everybody harvesting at the same time, then selecting, packing, etc. Thus, a minimum amount of the product accumulates before the next step, and only a short time elapses between harvesting and packing or between any of the other steps. Also, in case of an unexpected interruption in work (for example intense rains) the amount of cassava damaged is minimal.

### 3.2 Working materials.

a) A high-pressure back sprayer with a maximum capacity of 20 liters for application of the Murtect solution.

b) Mertect 450 FW (0.4% concentration). A full pump is equivalent to 80 ml of Mertect in 20 liters of water.

c) Polyethylene bags. The 4- and 12-kg cassava bags have been found to satisfy best the market demand in Colombia. The dimensions of the 4-kg bag are 21 x 12 cm and have a thickness of 0.4 mm (gauge 4). The 12-kg cassava bags measure 65 x 45 cm and need to be thicker (0.6 mm) to support the weight. In a commercial operation, the following information to the consumer must be printed on the bag or on a label brand, harvest and packaging date, weight, information on guaranteed conservation time, and instructions for handling the bag.

d) A stapler, with staples, to close the bag.

e) A balance to weigh the contents of the bag before closing, allowing weight adjustment if necessary so that each bag has the stated weight.

### 3.3 Procedure

3.3.1 Packaging of the selected cassava. Selected roots (commercial size, slight damage) are packed vertically, with the pedicel upwards. Different size roots should be distributed among all the bags so that the small roots do not end up in the last bags to be packed.

3.3.2 Treatment with Mertect. The nozzle of the pump is introduced in the bag to spray all the roots, paying particular attention to both root ends. A 4-kg bag requires approximately 100 ml of solution (1 liter of Mertect is sufficient to treat 10 tons of cassava).

3.3.3 Elimination of the excess Mertect solution After finishing the spraying treatment, an excess of Mertect solution remains in the bottom of the bag. This liquid must be eliminated to avoid development of fungi during storage due to excessive humidity. There are two ways of doing this:

a) Drain the bag by holding it upside down, taking care that the roots remain inside. This implies an extra task and an increase in labor.

b) Prior to harvesting, make a diagonal cut at one or both corners of the bottom of the bag to allow drainage of the excess liquid without using more labor. During packing care should be taken to not obstruct this hole with a root. A hole in the bottom of the bag does not affect conservation efficiency, and can be advantageous if harvesting is conducted during the rainy season when humidity is excessive.

3.3.4 Closing of bags Once the excess liquid has been drained, the next step is to close the bags. The top of the bag should be folded two or three times before stapling it shut. The use of string or wire has not been effective, since these may untie and open during transportation or after storage.

3.3.5 Transportation The bags can be transported in trucks in the same way as fresh cassava roots. During transportation the temperature inside the bag to be from should be within the range of 30

to 40°C. This means that in warm climates the bags must be kept the shortest time possible inside the truck. In temperate climates the bags must be covered with a tarpaulin to protect them from the cold. If the transport route passes through very cold climates (Andean region), or if the trip at low temperatures is long, the bags must be kept during a minimum of 24 (preferably 48) hours in a warmer climate before beginning the trip, to ensure adequate root curing. If the route is long and over a bad road, mechanical damage can result during the trip. This adversely affects successful storage. Various measures can be taken to solve this problem:

a) Arrange the bags inside the truck so they do not bump against each other during the trip. Feasible plastic containers, wooden or cardboard boxes may be useful.

b) Drive carefully, avoiding potholes and excessive speed.

c) Except during conservation periods, for example from 7 to 10 days instead of the 15 days possible under good transportation conditions.

The same temperature restrictions in the bag are valid during the first days of storage. Once the cassava roots have been cured, lower temperatures can be permitted, but in no case temperatures over 40°C.

#### 4. Commercial sale

Experience, and marketing studies in Colombia have demonstrated that a

4-kg cassava bag, at a cost of US\$40/kg\*, is acceptable to urban consumers. This quantity is estimated to meet an average family's needs for one week, and enables the consumer to buy a whole bag to be stored at home. Smaller families or those which consume less, can purchase individual roots from the 12-kg bags. Thus the retailer benefits from advantages in storage, and the consumer benefits from the price and quality of the product.

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\*US\$100 = Col \$124 82, February 1987