



## Food loss analysis: causes and solutions

### Cassava supply chain in Guyana

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Cassava (*Manihot esculenta*) is widely cultivated in the CARICOM Subregion for its tuberous roots from which cassava flour, starch, bread, and casareep are produced. Casareep is a value-added product where production is increasing thus contributing to the sustainability of the cassava industry in Guyana. Cassava is a good source of dietary fibre as well as folic acid, thiamine, magnesium and potassium.

damage caused during packaging and transport. The high post-harvest loss of 14.5 percent occurs at CLP 3 during retail marketing where all forms of deterioration become evident. Damage incurred during harvesting, packaging in 42 to 44 kg capacity polypropylene bags, the abusive loading and unloading aggravated by the high temperature during retail, eventually result in decay, weight loss and further development of vascular streaking. The latter disorder is characterised by the development of blue-black pigmentation of the vascular tissue, which commonly occurs at or near the infected areas of the roots. This is followed by the discolouration of the flesh rendering the roots unmarketable.

#### Impact of post-harvest losses

Total losses that are incurred at the level of the farmer during harvesting (CLP 1) and packinghouse operations such as sorting and packaging (CLP 2) amount to 8.5 percent. This loss translates into reduced volume of cassava that can be sold resulting in loss of income for the farmer. If the farmers are also the ones doing the retailing, an additional loss of 14.5 percent occurs because all the deteriorative changes become apparent during retail. The total loss of 23 percent therefore significantly impacts the livelihood of the

#### The cassava supply chain and the critical loss points

Cassava is produced by smallholder farmers across varying soil types in all regions of Guyana. The two main supply chains are the Parika/Salem area of East Bank Esquibo in Region 3 and the Craig/Friendship area of East Bank Demerara in Region 4. The cassava industry is characterised by a highly diverse number of producers and traders, widely scattered production areas and fragmented marketing system. From the farm, cassava tubers are transported by intermediaries to the wholesale markets, packinghouses, processing facilities, supermarkets, and retail markets such as municipal markets, roadside stalls, and mobile markets in Stabroek, Mon Repos, Georgetown and adjoining areas.

Several cassava cultivars are planted throughout the year with minimal inputs. Cassava is harvested when the leaves turn yellow and start to fall. Harvested roots are then packed in polypropylene bags of 42 to

44 kg capacity with some of the roots protruding from the bags. The bags are loaded onto pick-ups, trucks or vans in several layers and transported over rough, narrow roads. Depending on the intended use, cassava roots are taken to the wholesale and retail markets or to the processing facility to be converted into various value-added products.

There are three critical loss points (CLP) in the cassava supply chain. CLP 1 occurs during harvesting where losses amount to 6.5 percent mainly in the form of punctures and abrasions incurred when a spading fork is used to loosen the soil. Breakage of the distal end of the roots also occurs because of the manual force exerted when the plant is uprooted. Damaged portions become an entry point for decay-causing micro-organisms, the symptoms of which become apparent during retail. Insect damage is also evident leading to the development of brown streaks in the roots. CLP 2 occurs at the packinghouse with losses amounting to 2 percent attributed to physical

**TABLE 1**  
The cassava supply chain, stakeholders, operations and the critical loss points

Supply chain	Production	→ Wholesale Retail Processing facility	→ Municipal markets Roadside stall/Mobile market Supermarkets	→ Consumption
Stakeholders	Farmers Transporters	Wholesalers Transporters Processors	Retailers	Consumers
Operations	Harvesting Sorting Packaging Transporting	Sorting and grading Packaging Transporting Processing Distribution	Retailing	Consumption Buying
Critical Loss Points (CLP)	CLP 1: Harvesting CLP 2: Pack-house		CLP 3: Retail markets	
Losses	CLP 1 = 6.5 % CLP 2 = 2 %		CLP 3 = 14.5 %	

**TABLE 2**  
Profitability of using a hand lifter to aid harvesting of cassava in Guyana

Item/unit	Value
Product quantity (tonne/yr)	22.72
Product value (USD/tonne)	330
Loss (%)	6.5
Food loss (tonne/yr)	1.48
Economic loss (USD/yr)	488.40
Cost of intervention (USD/pc)	300
Total cost of intervention (USD/yr)	50
Client cost of intervention (USD/tonne)	2.20
Anticipated loss reduction (%)	50
Volume of loss reduction (tonne/yr)	0.74
Loss reduction savings (USD/yr)	244.20
Profitability of the intervention (USD/yr)	194.20

\*Including yearly cost of investment (USD 30) and total cost of operation (USD 20)

farmer whose main source of income is farming and trading. If cassava is to be sold to the wholesalers, the farmgate price will be lowered to offset the losses that will be incurred by the wholesalers. On the other hand, retailers will charge consumers a higher price because losses at this stage are highest. The high postharvest loss of 20 percent at the three CLPs is equivalent to an economic loss of USD 839 619. In the case of the processors, losses will result in reduced volume of cassava that can be processed.

### The importance of good post-harvest handling

Cassava roots are highly perishable and normally remain marketable for only two days. Once the roots are harvested, physiological deterioration in the form of vascular streaking is initiated as a consequence of tissue damage during harvesting. Vascular streaking is the cause of loss of market acceptability followed by microbial spoilage, which starts at the damaged roots. During harvesting, damage can be prevented, and lifting of the roots can be facilitated by cutting the main stem at a height of 30 to 50 cm so the roots can be slowly drawn from the soil either manually or with the aid of a hand lifter. Care must be taken not to break the roots or to split the skin, which creates wounds that will serve as an entry point for decay-causing micro-organisms. Root breakage and skinning are also incurred during packaging in polyethylene bags that are piled several layers high in the vehicle.

Containers that are rigid like plastic crates can be stacked several layers high thus providing protection to the roots. Plastic crates also provide adequate ventilation during transport and even during wholesaling thus preventing microbial spoilage which is favoured by the high humidity inside the polyethylene bags. If a longer marketable life is desired and if the roots are intended to be stored, curing should be done immediately after harvest. During curing, the skin thickens and new tissues are formed beneath the injured roots resulting in reduced water loss and lower incidence of decay. Curing however, is not effective if the roots are severely damaged.

### Recommendations to reduce post-harvest losses and their economic benefits

Post-harvest losses in cassava are mainly the result of physical damage that takes place during manual harvesting using a spading fork to loosen the soil, followed by lifting the roots from the soil. The cassava hand lifter (Figure 1) that costs USD 300 per piece is recommended to aid harvesting particularly on sandy or clayey soils. On a 10-acre lot, the use of a hand lifter will reduce losses by 50 percent resulting in a profitability of USD 194.20 per year (Table 2). Packing cassava roots in polypropylene bags that are stacked several layers high in the vehicle coupled with improper loading and unloading is also a contributory factor to loss in the form of damaged roots. Plastic crates provide ad-

**TABLE 3**  
Profitability of using plastic crates as field and transport containers for cassava in Guyana

Item/unit	Value
Product quantity (tonne/yr)	22.73
Product value (USD/tonne)	330
Loss (%)	6.5
Food loss (tonne/yr)	1.477
Economic loss (USD/yr)	487.56
Cost of intervention (USD/pc)	300
Total cost of intervention (USD/yr)	60.00
Client cost of intervention (USD/tonne)	2.64
Anticipated loss reduction (%)	60
Volume of loss reduction (tonne/yr)	0.896
Loss reduction savings (USD/yr)	292.38
Profitability of the intervention (USD/yr)	232.38

equate protection to the roots because they are rigid and stackable (Figure 2). Using plastic crates as field and transport containers, losses will be reduced by 60 percent with a profitability of USD 232.48 per year (Table 3).



**FIGURE 1**  
Cassava hand lifter



**FIGURE 2**  
Plastic crates for cassava

This information sheet summarizes the results of the study on Food Loss Analysis: Causes and Solutions, Case Studies in Small-scale Agriculture and Fisheries Subsectors of the Food and Agriculture Organization (FAO) of the United Nations. For more information: Global Initiative on Food Loss and Waste Reduction ([www.fao.org/save-food](http://www.fao.org/save-food)).



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