



## Food loss analysis: causes and solutions

### Tomato supply chain in Trinidad and Tobago

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Tomato (*Lycopersicon esculentum* Mill.) is one of the most popular and versatile vegetable crops with many uses. It is one of the key vegetable crops identified in the Trinidad and Tobago national food production plan. Production is continuously increasing with small volumes being exported to regional markets in CARICOM. Tomato makes a significant contribution to human nutrition because of it contains sugars, acids, vitamins, minerals and antioxidants such as lycopene and other carotenoids.

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

One of the major production areas of tomato is in Macoya, northern Trinidad. The demand centre is also in Macoya Debe where tomatoes are sold wholesale. The marketing system is disorganized with farmers making individual sales to intermediaries. Thus, intermediaries generally handle collection and distribution of tomatoes although farmers have the option of selling directly to municipal retail markets and hotels. Retail markets are in Tunapuna, Chaguanas, Sangre Grande and Marabella. Supermarkets and hotels are also the major buyers of tomatoes. Farmers also sell tomatoes to small-scale processors (Table 1).

Farmers prefer to grow dual purpose cultivars such as Hybrid 61 and Mungal because these produce a large number of fruit per cluster, are less susceptible to physical

injury, exhibit more uniform ripening and have longer shelf-life. Tomatoes are harvested manually at the breaker and pink stages of maturity, placed in bags or buckets, and are then taken to a shed adjoining the house and laid on newspaper or on the cardboard-covered concrete floor for ripening. Farmers sort the decayed and unmarketable fruits daily. At the red ripe stage, tomatoes are sorted based on size, packed in boxes, baskets, and buckets and transported to the wholesale and retail markets. Tomatoes packed in buckets and crates are then loaded into multi-shelved pick-ups or trucks for transport to the wholesale market in Macoya Debe, about 15 to 20 km from the farm or homestead.

There are three critical loss points (CLP): harvesting (CLP 1) amounting to a 7 percent loss, packinghouse operations (CLP 2) at 8 percent and during retail (CLP

3) amounting to 12 percent (Table 1). The faulty harvesting method, wherein the fruit is hand-pulled, results in stem end breakage leading to fast deterioration. CLP 2 occurs during packinghouse operations when tomatoes are sorted daily until they are red ripe. Physical damage like puncturing, scuffing and abrasion, which are not visible during harvesting, become prominent during ripening and the fruit is culled. Tomatoes may also decay as they ripen contributing to losses. Improper temperature management during ripening results in ripe tomatoes with blotchy peel colour and, in most cases, the fruit fails to attain the desired red peel colour. The highest CLP of 12 percent occurs during retail marketing when all the damage incurred at the earlier stage of the supply chain becomes apparent. Decay, which often manifests in ripe fruit, also contributes to loss. The poor conditions during retail in municipal markets and roadside stalls where the fruit is often not protected from the heat of the sun lead to loss in marketable weight.

#### Impact of post-harvest losses

Losses at the level of the farmers amount to 15 percent and occur during harvesting, sorting, packaging and ripening of the tomatoes.

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

| Supply Chain               | Production   | → Wholesale<br>Retail<br>Processing facility                                   | → Municipal markets<br>Hotels<br>Supermarkets | → Consumption      |
|----------------------------|--|--|---|--------------------|
| Stakeholders               | Farmers<br>Transporters  | Intermediaries<br>Transporters<br>Exporters                                    | Retailers                                     | Consumers          |
| Operations                 | Harvesting<br>Sorting<br>Ripening<br>Packaging<br>Transporting | Sorting and grading<br>Packaging<br>Transporting<br>Distribution<br>Processing | Retailing                                     | Consumption Buying |
| Critical Loss Points (CLP) | CLP 1: Harvesting<br>CLP 2: Packing house                      |  | CLP 3: Retail markets                         |                    |
| Losses                     | CLP 1 = 7 %<br>CLP 2 = 8 %                                     |  | 12 %  |                    |

**TABLE 2**  
Profitability of using plastic crates as field and transport containers in Guyana

| Item/Unit                                  | Value    |
|--|----------|
| Product quantity (tonne/yr)                | 14.77    |
| Product value (USD/tonne)                  | 3 280    |
| Loss (%)                                   | 7        |
| Food loss (tonne/yr)                       | 1.03     |
| Economic loss (USD/yr)                     | 3 378.40 |
| Cost of intervention (USD/pc)              | 150      |
| Total cost of intervention (USD/yr)        | 180*     |
| Client cost of intervention (USD/tonne)    | 12.19    |
| Anticipated loss reduction (%)             | 65       |
| Volume of loss reduction (tonne/yr)        | 0.67     |
| Loss reduction savings (USD/yr)            | 2 197.60 |
| Profitability of the intervention (USD/yr) | 2 017.60 |

\*Including yearly cost of investment (USD 30) and total cost of operation (USD 150)

These losses reduce the volume of tomatoes that can be sold by the farmers and greatly impact their livelihood. The agriculture sector consists mainly of small landholdings with 87 percent of farmers in Trinidad cultivating less than 5 ha and 45.8 percent having only 0.5 ha in Tobago. Moreover, about 76.5 percent of farmers indicated that farming is their only occupation. Losses during the early part of the chain result in a reduced volume of tomatoes supplied to various retail outlets, which is probably one of the reasons why Trinidad and Tobago import tomatoes. The high postharvest loss of 27 percent is equivalent to an economic loss of USD 1 904 621. Moreover, the loss in nutritional value represents the hidden loss, which is important since tomato is being consumed because of its contribution to human nutrition.

### The importance of good postharvest handling

Quality and quantity losses occur between harvest and consumption. In tomato, losses occur because of immaturity, physical damage caused by faulty harvesting, improper packaging, rough and repeated handling and poor transport conditions. Tomatoes can be harvested at any stage of maturity depending on the distance to the market. Generally, tomatoes are harvested at the breaker to pink stage of maturity using clippers, leaving the calyx attached to the fruit because the stem scar can serve as the main avenue

for water loss. Use of clippers prevents stem end damage, which often occurs when the tomatoes are hand-pulled. The most appropriate containers for tomatoes are rigid, stackable and returnable plastic crates. Plastic crates protect the fruit better than corrugated fibreboard boxes and baskets, which are traditionally used to transport ripe tomatoes. Ripe tomatoes have low resistance to vibration and compression damage thus they need to be packed in rigid containers that can be stacked properly in the vehicle. The quality of tomatoes at the ripe stage, especially the colour, is affected by temperature. The red peel colour is achieved at 18 to 22 °C. High temperature results in ripe tomatoes with blotchy peel, and fruit that is either yellow or orange when ripe. Relative humidity in the ripening room should likewise be maintained at 85 to 90 percent to prevent water loss from the fruit. Personal hygiene of workers and sanitation of the ripening facility, packaging materials, processing facility, and transport vehicle should be properly observed to ensure the safety of the fruit offered to consumers.

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

Physical damage to the fruit is one of the main causes of losses resulting from improper packaging. Corrugated fibreboard boxes and sharp-edged baskets, which are traditionally

**TABLE 3**  
Profitability of using a ripening room for tomato in Guyana

| Item/Unit                                  | Value     |
|--|-----------|
| Product quantity (tonne/yr)                | 54.54     |
| Product value (USD/tonne)                  | 3 278     |
| Loss (%)                                   | 8         |
| Food loss (tonne/yr)                       | 4.36      |
| Economic loss (USD/yr)                     | 14 292.08 |
| Cost of intervention (USD/pc)              | 4 200     |
| Total cost of intervention (USD/yr)        | 620*      |
| Client cost of intervention (USD/tonne)    | 11.37     |
| Anticipated loss reduction (%)             | 70        |
| Volume of loss reduction (tonne/yr)        | 3.05      |
| Loss reduction savings (USD/yr)            | 9 997.90  |
| Profitability of the intervention (USD/yr) | 9 377.90  |

\*Including yearly cost of investment (USD 200) and yearly cost of investment (USD 420)

used to transport ripe fruit do not provide adequate protection during transport and repeated handling. The shift to the use of plastic crates as field and transport containers should be continuously promoted. Plastic crates are rigid and stackable (Figure 1) and can last for 5 to 10 years hence the high initial investment cost can be readily offset by long use. Assuming the volume of production per year is 14.77 tonnes, with a post-harvest loss of 7 percent, this is equivalent to a food loss of 1.03 tonnes per year and an economic loss of USD 3 378.40 per year. With the use of plastic crates that cost USD 150 per piece, it is anticipated that losses can be reduced by 65 percent, resulting in a profitability of USD 2 017.60 per year (Table 2).



**FIGURE 1**  
Plastic crates for tomatoes as field and transport containers