

# Postharvest Losses, Current Issues and Demand for Postharvest Technologies for Loss Management in the Main Banana Supply Chains in Sri Lanka

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## Abstract

Banana is the main fruit crop cultivated in Sri Lanka. It's a commercial crop giving high income to the cultivators. It is distributed from farm gate to consumers through the supply chain which involves farmer, collector, whole seller, retailer and transporter and with a high post harvest loss. Therefore, this study was conducted to assess the present status of the banana supply chain. A total sample of 100 including farmers, collectors, whole sellers, transporters and retailers were randomly selected from two growing areas and a high banana retailing municipal council areas. Data were gathered through a survey using a questionnaire, key informant interviews, direct observations and secondary sources. The study revealed that the banana supply chain follows the conventional chain with some deviations. All whole sellers were acting as bulk transporters. Majority of stakeholders preferred and transported bananas as whole bunches bulk packed in vehicles. Preference in selling in retail outlets were also as intact bunches. The commonly used transportation vehicles were two wheel tractors, open trucks, and lorries. The total postharvest loss of banana was 20 % from farm gate to retailer. A suitable bulk packing method should be introduced to reduce the post harvest loss of banana.

## INTRODUCTION

Fruits are delicacies relished all over the world. Banana (*Musa cuminata* Colla) is the most widely grown fruit crop in tropical countries and has a high consumer demand throughout the world. The ripe fruit is a rich source of energy, vitamins, minerals and protein. The fruit is prized for its excellent taste and medicinal value.

Sri Lanka is a country with an agricultural economy where banana is the most important fruit crop cultivated in terms of hectareage, production and consumption

(Kudagamage et al., 2002). In Sri Lanka, about 50,000 ha of land area are under banana cultivation and the annual production is about 450,000 (Wasala et al., 2012). One of the reasons for its attractiveness for Sri Lankan farmers is its high economic gains throughout the year (Hirimburegama et al., 2004).

As described in figure 01 the bananas produced in the farms are distributed to other parts of the country through the supply chain, which involves farmer, collector, whole seller, retailer and the transporter.

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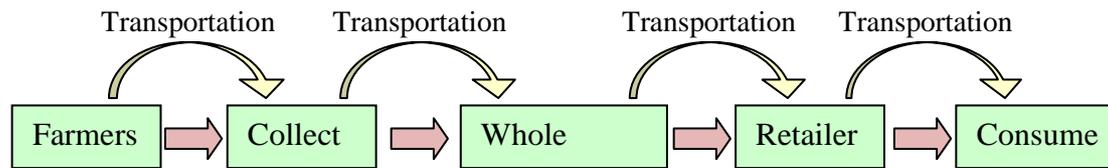


Figure 01: Supply chain of fruits and vegetables (Fernando, 2006)

Farmers sell their fruits and vegetables to the collectors and collectors collect the fresh produce from one or more farmers and sell these produce to the whole sellers in the whole sale market. Retailers purchase produce from the whole seller. The consumers buy these fresh produce from the retailers. In between each member of the supply chain, transporters are involved.

Banana is a climacteric perishable fruit and therefore, its postharvest losses are relatively high and occur mainly during handling and transportation in the supply chain. Although bananas are harvested at the mature green stage, the external appearance of the ripened bananas at the retail shops is extremely poor due to excessive mechanical damages due to improper handling in the supply chain (Sarananada, 2000). With all these factors, the postharvest losses of banana in Sri Lanka accounts for about 30%. According to Ekanayake and Bandara (2002), this loss is mainly due to the lack of appropriate packaging methods to transport from farm gate to the consumer. Close observations and field visits reveals that in the normal distribution chain, banana bunches are bulk packed in trucks with little or no cushioning or lining materials. The trucks are over-filled and bunches are stacked in a number of layers leading to a very high compression damage. Further, they are unloaded without any care at the destinations. Additionally, involvement of many middlemen such as collectors and whole sellers in the supply chain also contributes to these losses and price increase at the retailer level while reducing

the amount of consumer rupees that goes to farmers.

A considerable increase in agricultural productivity either through sustainable agricultural development or through rapid growth in incomes will be essential to meet the coming challenges of worsening poverty, feeding the growing population and protection of the environment. Effort to increase food production is one aspect of the solution, but equally important is the issue of postharvest loss management that has not received adequate attention in developing countries. In Sri Lanka the government as well as many nongovernmental organizations have identified the importance and have launched many programs to attain these goals. But no scientific study has been conducted in the recent past to assess the current situation of the banana supply chain to identify current practices and techniques used, level of involvement of middlemen in the supply chain and post harvest losses, etc. It will provide a basic guideline and standing ground to assess the work done as well for planning and implementing future strategies of development in the light of up lifting the agriculture based economy of the country. Therefore, this study was conducted with the objectives of to assess the present status, identify practices and techniques used, post harvest losses, current problems and related issues of handling and transportation of banana in conventional Sri Lankan distribution channels.

### Materials and Methods

For the study three areas of the country were selected while considering the

importance with regards to banana. Two major districts (Rathnapura and Anuradhapura) where banana is most cultivated and another district (Colombo) which is one of the prominent banana consumer bases in the country were selected as the study areas. One Divisional Secretariat (DS) Division from each banana producing districts (Embilipitiya and Thambuttegama DS divisions) and one Municipal Council from Colombo District (Colombo Municipal Council) were selected based on the highest cultivation/consumers in these districts. From these areas a total sample of 100 was selected. Data were collected from five main categories of the supply chain; farmers (30%), collectors (10%), whole sellers (15%), transporters (15%) and retailers (30%). Farmers were selected randomly from 10 villages (where banana cultivation is prominent) from both Embilipitiya and Thambuttegama DS divisions. Whole sellers and transporters were also selected randomly from the major banana selling economic centers Thunkama (in Embilipitiya) and Thambuttegama of each of the DS divisions under study. All the retailers who sell banana were selected randomly from the Colombo municipal council area. Data were gathered through a field survey using a pre-tested semi

structured questionnaire to gather both qualitative and quantitative information on postharvest handling, packaging and other relevant information of banana distribution channels. Furthermore, data were collected through interviewing key informants such as officers from Department of Agriculture, Department of Agrarian Development, Sri Lanka Mahaweli Authority, Chairmen of Farmer Organizations and Traders Associations, Managers of Economic centers in these areas and other related personals. Direct observations and secondary sources were also used to collect the information. Data were analyzed by using Minitab statistical package.

## Results and Discussions

### The banana distribution channel

As shown in figure 02 the members in the supply chain deviated from the supply chain of fruits and vegetables that were reported by Fernando (2006) (figure 01). The study revealed that out of the sample taken, 67% farmers did not sell their produce to the collectors. They transport produce directly to the whole sale markets or to retailers. All the whole sellers taken in the study were acting as bulk transporters as well.

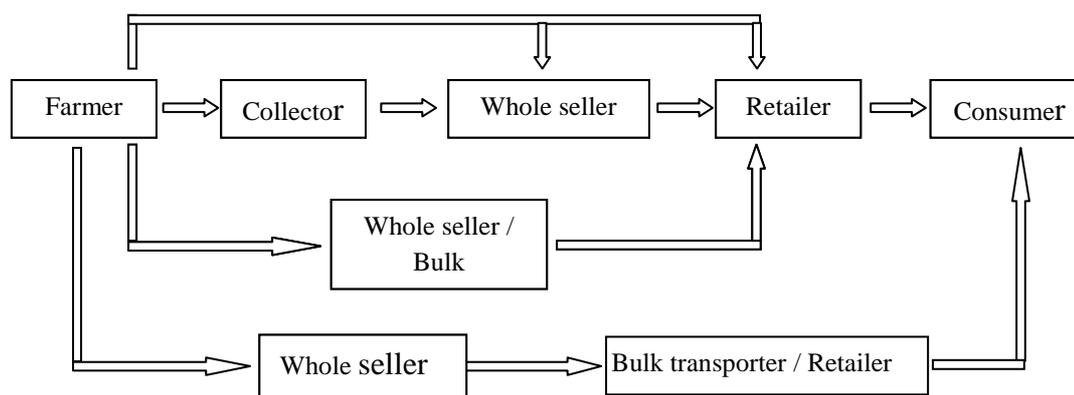


Figure 02: The banana supply chain

### Banana production and marketing

According to the study, the weight of banana harvested per one harvest by

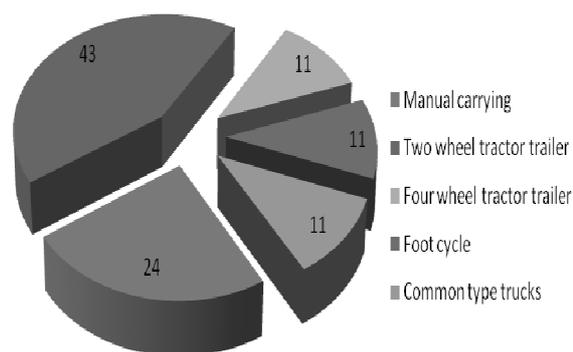
farmer ranged from 200kg to 2225kg with mean value of 975kg. Majority of farmers (43%) harvested less than 500kg at a time,

23% of the farmers' harvest was between 500-1000kg and 23% of farmers' harvest was about 1500-2000kg. There were no farmers having a harvest in the range of 1000-1500kg of banana in both DS divisions. The rest of the farmers (11%) had a harvest of more than 2000kg of banana per harvest. Of these farmers, the average number of times of harvesting per month was three while the number of harvest ranged between two to three times per month. The major banana cultivar grown in both locations is *Embul* which is also reported by other authors (Kudagama, 2002; Sarananda and Wijerathnam, 1994)

The vast majority of farmers (67%) took the banana bunches to the closest economic center for sale while 23% of farmers sell their bananas to the collectors who came to their farms. The rest (10%) were taking their harvest directly to retail outlets for sale. When the location of the sales point is considered, only 13% of farmers were taking their own produce outside their own district. The rest were selling their produce within their own district.

### Mode of transport and packaging

With respect to the mode of transportation, the study revealed that 24% of farmers manually carry whole banana bunches to the sales point. All of these farmers were the ones who sell their bananas to the collectors that come to their farms in lorries to purchase. The others also carried the banana manually within the farm but used different vehicles such as two wheel and four wheel tractor trailers, foot cycles and trucks for transporting to the wholesale markets. As depicted in figure 03 two wheel tractors with trailers were the most commonly used vehicle for banana transportation.



**Figure 03:** Modes of transportation used by banana farmers of the study area

Farmers those who use vehicles to transport bananas to the sales point, 87% used their own vehicles while the rest used hired vehicles. When using hired vehicles, the average cost per bunch per trip was LKR 25.00. This had led to an average cost of transportation of LKR 1625.00 per one time of transportation (US\$ 01 = LKR130.80).

Time taken for these banana bunches to be transported to the economic centers or other sales points had ranged between 15 minutes to five and a half hours (5 ½ hours) with an average of one hour and 40 minutes. This indicates that the farmers are taking the harvest even to very long distances. The average distance of transportation was 34km ranging from 2 to 160km. Majority of farmers (87%) transport their bananas within a distance of 5km indicated that the majority of farmers transport very short distance. Of the farmers who take their produce out of their farms to sell, 57% bring some commodities (fruits and vegetables and mainly papaya) on their return for sale while others did not involve in such an activity.

All the farmers taken in the study were selling and preferred to sell bananas as the whole bunch. Common reasons given by the farmers were that it was easy to transport, easy to sell, the buyer can easily

inspect the whole bunch, less handling and the market demand is for the whole bunches and they have to cater to the demand.

When transported, banana bunches were stacked horizontally by keeping bunches one over the other. Of all the farmers, 90% were using banana leaves as the cushioning materials either around bunches or in between layers of bunches. According to the Laistroglai et al., (2000) the most used natural packaging in the world is banana leaves. Most of the farmers (63%) preferred to use fresh leaves over dry leaves. The reason given was that the damages caused to the bunch are comparatively less with fresh leaves than the dry leaves. The dry leaf might cause abrasion damages on fruits surface. The farmers claimed that the average postharvest loss of bananas at farmer level was very low and was about 1%.

### **Role of Banana Collectors in the distribution chain**

The collectors collected the fresh produce from one or more farmers. The study revealed that all the collectors participated in the study had travelled to the farms and purchased bananas and transported in tractors then sold in the economic centers.

The average amount of bananas collected by the collector at a time ranged between 2000 to 3500kg with an average of 2833kg. The average number of times they collected and transported was 12 times per month. All the collectors participated in the study used their own open trucks to transport bananas to the whole sellers. Further, they all were collecting bananas from their neighborhood and within their own district. The average distance travelled for collection was 20km. Only one third of banana collectors was taking banana out of their district for sale and sold to whole sellers and retailers in other districts such as Colombo, Gampaha, Galle

and Kandy. The others were selling their produce to whole sellers at the closest economic center within the district. The average distance travelled while transporting to the sales point was 132km ranging from 20 to 350km.

Majority (67%) of collectors in the study did not bring any other commodity back on their return journey. Only 33% of them were bringing other commodities on return journey and the main commodity was papaya. The vast majority (95%) of the banana collectors transport as whole bunches wrapped with fresh banana leaves while the rest 5% transport hands in plastic crates and in corrugated cartons to supply for supermarket chains. But everybody preferred to use the whole bunch for transporting. All the collectors claimed that there was no postharvest loss observed at the collectors point.

### **Whole sellers / Bulk transporters**

All the whole sellers who participated in the study were acting as bulk transporters as well. As shown in the table 01, the average weight of banana transported at a time was 2394 kg and ranged between 150 kg to 5500 kg. The minimum number of times that bananas were transported per month was four and the maximum is eight. The majority of the participants were transporting four times per month with an average of five times per month. Two thirds of them (66%) use lorries, of which one half are closed lorries. Open Trucks were also being used by 30% of the whole sellers. The rest (4%) used two wheel tractor trailers. All the whole sellers/bulk transporters used their own vehicles for transportation. The average distance they travelled was 172 km, but that varied from 15 to 240 km. Almost all of them (96%) transported bananas to other districts outside their district. The rest (4%) sold their bananas to retailers and village fairs within the district and they

used two wheel tractor trailers for transporting this short distance. Majority (85%) of those who transport bananas to other districts, transported to retailers in Kandy, Gampaha and Colombo districts, which are the three main consumer bases in the country. The balance (15%) sold bananas to the whole sellers in other districts, which increases the number of the members in the supply chain. This might lead to high postharvest loss due to poor handling for long distances for long durations and to increase the price of banana at retailer level. Fernando (2006) stated that highest losses occur at the retailer outlets, since damage is cumulative. However, Wanjari and Ladaniya (2004) reported that profit margin at retailer point for banana is very high. The study further revealed that the average time travelled by these whole sale transporters was four hours. The time duration ranged between 1 to 10h.

**Table 01:** Transportation details of whole sellers/bulk transporters

	Mean	Mode	Range
Weight of banana transported per time (kg)	2394	1000	150 - 5500
No of times transported per month	5	4	4 - 8
Distance travelled per time (km)	153	160	15 - 220
Time travelled per one time (h)	4	5	1 - 10
Post harvest loss (%)	9	5	0.5 - 20

In the return journey 66% of wholesalers were bringing fruits, 4% bring vegetables and fertilizer and the rest do not bring any commodity.

Almost all of them (95%) of these wholesalers transported bananas as whole bunch. Only 5% used plastic crates and separated hands to transport when

supplying to supermarket chains. Dharmasena and Sarananda (2012) have also reported that about 97% of bananas are also transported and distributed in traditional distribution channels as whole bunches for local marketing. Banana bunches are arranged one over the other horizontally, which will lead to high damage caused to the fruits (Swarnasiri, 2006). Majority (57%) of them use fresh banana leaves as a cushioning material to wrap banana bunches, while 33% used dry banana leaves. A minor fraction (5%) used polythene and the rest used straw or other plant leaves in between bananas bunches while stacking.

However, the vast majority (95%) preferred to transport whole banana bunches instead of separating them into hands. The common reasons given for this preference was, easy to transport and sell, low transport cost, demand from retailers as well as consumers for bunches. One of the other beliefs that these have was that the postharvest loss would be high if hands are separated and transported. They claimed that when separated into hands, high wilting and weight loss were seen. The hands ripen quicker when separated from bunch than keeping it as the whole bunch. They further claimed that all these factors lead to low shelf life at the retail outlet when hands are separated from the bunches. Ferris et al. (1998) stated that hand separation leads to the reduction of ripening period.

### Transporters

The transporters are usually a group of service providers providing vehicles to transport agricultural produce. The average amount of bananas usually transported by the transporters of the study had been 1575kg. The value ranged between 800 - 2500kg of banana. All had been using lorries of their own to transport bananas. They have been involved mainly to

transport banana from one district to another. The average distance transported from farm gate to retailers was 145km and the value ranged from 50 - 250km. The average transport time was three hours and 45 minutes and ranged between one and a half hours to six hours (Table 4.2).

**Table 02:** Transportation details of Transporters

	Average	Range
Weight of banana transported at a time (kg)	1575	800 – 2500
Distance transported from farm gate to destination (km)	145	50 – 250
Time travelled per one time (h)	3.75	1.5 – 6
Post harvest loss (%)	8.5	5 - 10

According to the study, 75% of them transported papaya on their return journey. The rest didn't transport anything on the return trip. All of them transported banana bunches in horizontal layers one over the other and wrapped with dry banana leaves. All of them prefer to transport as whole bunches. The main reason for this preference was the belief of transporting more bananas per trip. The average postharvest loss during transportation was 8.5% ranging between 5% - 10%. Ilyas et al., (2007) reported that 13% loss of banana during transportation.

### Retailers

One third of the retailers participated in the study purchased bananas from the whole sale markets in the area. The rest purchased bananas from transporters or farmers who brought fruits to their shops. Majority of the retailers (93%) received as whole bunches and only 7% received as hands to sell at their shops. However, all of them preferred to have banana bunches than hands. The main reasons given for this preference were, easy to sell when

hanged, can control ripening and banana fruits can be displayed to consumers properly. They also believed that when separated into hands, damage, ripening and loss could be high. Another reason given was that the requirement of labour and time could be high to separate hands from bunches. Mashau et al., (2012) has also reported that fruit sellers recognize fruit ripening is a main problem during the retailing. According to the information gathered, the average postharvest loss at the retailer was 10%.

### Conclusion

According to the study, bananas were supplied through the chain including farmer, collector, whole seller/bulk transporter and retailer. A vast majority of the stakeholders preferred and were practicing to transport bananas as whole bunches bulk packed in vehicles. Preference in selling in retail outlets were also as intact bunches. The common used vehicles for transportation was the two wheel tractors, open trucks and lorries. The postharvest loss of banana was 28.5% from farm gate to the retailer. A suitable bulk packing method to transport whole banana bunches should be introduced in order to reduce the post harvest loss of banana while continuous training and awareness programs should be conducted in order to improve the handling and transportation conditions of banana and to reduce the post harvest loss.

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