

Postharvest Losses of Mango (Mangifera Indica, L.) in Iloilo and Guimaras, Philippines

Sheryl N. Galvan^a, ^aCollege of Agriculture, Iloilo State College of Fisheries, Dingle, 5035 Iloilo, Philippines, Email: agrapesshe1975@gmail.com

This study assessed the nature and extent of postharvest quality losses of 'Carabao' mango fruits in all stages of supply chain in Iloilo and Guimaras, Philippines. This involved mango growers from mango producing municipalities during the off-season and on-season production. Mango growers were interviewed on their cultural management, production and postharvest handling practices. Field evaluation was done on the process flow starting from harvesting, harvest method, packaging tools used during transfer of fruits from the tree to the shed, transport vehicles from the farm to the wholesale storage area. Losses were also evaluated during harvesting until fruit reached the full ripening stage at the retail end. Losses were present in all stages of the supply chain. Highest losses incurred were during harvesting in which sap contamination and physical damages were the conspicuous causes. Prevalence of pathological damages such as anthracnose and diplodia stem-end rot as well as damages due to sap contamination were observed in the retail side seven days after harvesting. The extent of losses in Guimaras from harvest to fruit retail could have reached 19-20%, attributed most to mishandling during harvesting and anthracnose disease at retail end for Guimaras and 33-34% for Iloilo which are all considered as very high postharvest losses.

Key words: *Mangifera indica*, *postharvest losses*, *supply chain*.

Introduction

Without a doubt, fruit connoisseurs from all over the world consider the Philippine mango in general as one of the finest fruits in the world. However, despite of all its distinction and great importance to the economy, the mango industry is beset with problems of decreasing production volume due to postharvest losses. Contributory factors to these losses include damage caused by insect pests, diseases and inefficient postharvest handling system. Postharvest diseases are considered as the major cause for the drop in the quality of exported

mangoes (Lizada, 1994). The shelf life of the mango after harvest ranges from 8 to 12 days only, depending on the fruit maturity of the cultivars. The mango should reach the market during this critical time before decomposition happens. Shelf life decreases if the fruit becomes infected that will cause rapid spoilage of the fruit.

Fruit postharvest losses in the Philippines can run up to an average of 28 percent, occurring during harvest, packing, transport, displaying, and even during consumption. Postharvest losses are caused by mishandling, poor storage, inefficiency in the distribution system, and pest and disease damage. Exacerbating the losses caused by factors inherent in the fruits and in our climate, are poor infrastructure, transport limitations, the archipelagic nature of our country, and lack of technology (Bautista, 2007).

Western Visayas is a region located at the heart of the country and is one of the mango producing regions in the Philippines. It ranks No. 8 in terms of the number of bearing trees in the country and ranks No. 6 in terms of production. Contribution to production amounts to 771, 144 metric tons a year in 2009 (BAS, 2009). Western Visayas volume of production in 2011 was 50,445 mt and the area planted was 11,392 hectares with a contribution of Guimaras in production of 8,701 mt at 5,203 hectares, respectively (BAS, 2011).

Guimaras island is one of the mango producing areas of the country, one of the provinces of Western Visayas. The province is well-known for its sweetest and quality mangos that made the province the only area in the country at present that is allowed to export its mangoes to the United States of America and Australia. The popularity of the Guimaras mango as the sweetest mango in the world is recorded in the Guinness Book of World Records.

Iloilo province is the number one mango producing province of Western Visayas and the top 7th mango producer in the country (DA-BAR 2011). Although the area of production is 3,720 ha, which is much lower than Negros Occidental, which is 4,538 ha, the volume of production by 2009 was 20,923.87 metric tons far from Negros Occidental which only have 13,607.05 metric tons (BAS, 2009). Leon mangoes are mostly marketed to San Dionisio UNI-PEACE processing plant being processed into scoop and purees and exported to Japan.

Since postharvest losses occur at different stages along the supply chain, and considering the importance of mango farming as one of the economic drivers of Iloilo and Guimaras provinces, this study will provide the estimates and nature of these losses at independent stages of the supply chain (harvest maturity; harvest method, packing, transportation and marketing – wholesale and retail) and recommend measures for reducing losses.

Materials and Methods

Survey Participants

A total of 30 selected mango growers, 15 from each province (Iloilo and Guimaras) were interviewed on their cultural, production and postharvest handling strategies in mango production. Actual field evaluation was conducted in the farm of each of the mango growers on the process flow starting from harvesting, harvest method, packaging tools used during the transfer of fruits from the tree to shed, and transport vehicles from farm to the wholesale storage area. Postharvest losses were also evaluated during harvesting, wholesale marketing and until the fruits reached the full ripening stage at the retail end.

Study Sites

Iloilo and Guimaras are major mango producing provinces of Western visayas and the higher percentage of postharvest losses on mango has been observed. The respondents were all mango producers of the Provinces of Iloilo and Guimaras, (Table 1).

Table 1: Municipalities and Barangays in Guimaras and Iloilo Provinces where the study was undertaken

Province	Municipality	Barangay
Guimaras	Nueva Valencia	Calaya Oracon Pandaraonan
	Buenavista	East Valencia Piña Taminla
	Jordan	Alaguisoc Sta. Teresa San Miguel
	Sibunag	Concordia Sur Maabay Sebaste
	San Lorenzo	Tamborong Constancia Cabano
Iloilo	Oton	Cabo-luan Rizal Trapiche
	San Miguel	San Agustin Sto. Anghel Poblacion
	Sta. Barbara	Tagsing Binangkilan Balibagan Este
	Alimodian	Poblacion Manguining Bangkal
	Leon	Camando Pandan Lanag

Figure 1. Location Map of Study Showing Guimaras and Iloilo Provinces Indicating 5 Municipalities in each Province where the Study Was Undertaken



Sampling Procedures and Sample Size

The details of the 30 consignments for Iloilo and Guimaras Provinces is presented below:

Table 2

Iloilo Province			Guimaras Province		
Origin	Destination	Duration (Harvest to Retail)	Origin	Destination	Duration (Harvest to Retail)
Leon			Nueva Valencia		
1. Camando	Japan	4 – 8 days	1. Calaya	Negros Occ.	5-7 days
2. Pandan	Leon market		2. Oracon	San Miguel, Jordan	
3. Lanag	Metro Manila		3. Pandaraonan	Iloilo City	
Oton			Jordan		
1. Cabo-luan	Kalibo, Aklan	5-6 days	1. Alaguisoc	San Miguel, Jordan	7 days
2. Rizal	Iloilo City		2. Sta. Teresa	San Miguel, Jordan	
3. Trapiche	Oton market		3. San Miguel	San Miguel, Jordan	
San Miguel			Buenavista		
1. San Agustin	Dao, Capiz	6-8 days	1. East Valencia	San Miguel, Jordan	6-7 days
	Iloilo City		2. Piña	Piña, Buenavista	
2. Sto. Anghel	San Miguel market	6-7 days	3. Taminla	San Miguel, Jordan	
3. Poblacion	Iloilo City		San Lorenzo		
Sta. Barbara					
1. Tagsing	Kalibo, Aklan	5-8 days	1. Tamborong	San Miguel, Jordan	4-6 days
2. Binangkilan	Processed-Japan		2. Cabano	Bacolod City, Negros Occ.	
3. Balibagan Este	Processed-Japan		3. Constanca	San Miguel, Jordan	
Alimodian			Sibunag		
1. Poblacion	Processed-Japan	6-8 days	1. Concordia	San Miguel, Jordan	5-6 days
2. Manguining	Iloilo City		2. Maabay	San Miguel, Jordan	
3. Bangkal	Processed – Japan		3. Sebaste	San Miguel, Jordan	

Data Analysis

The raw data that were collected from the field were examined sorted, edited and coded. Final data were then analysed using the Statistical Package for Social Sciences (S.P.S.S) and presented as tables and charts to frequencies and the percentages. The qualitative aspects were discussed and summarized in the form of texts, quotes and extracts.

Results

Socio-Economic Profile

All farmer respondents in Guimaras and Iloilo were male and young to adult age. Their ages ranged from 39 to 72 years, married with 5 or more children. Most mango growers reached high school education.

Mango Production

Most of the respondents produced mango on-season and they owned from a few to 10 mango trees.

Production Practices

Local market is the concentration of the Guimaras mangoes due to patronage and higher preference of local and international buyers. Iloilo mangoes are likewise marketed locally and the lower volume had reached the neighbouring provinces like Capiz and Aklan. Most of the Class B mangoes of Iloilo are marketed to UNI-FISH Incorporated mango processing firm which exported the processed mango halves to Japan.

Handling Practices

Mango growers of Iloilo province preferred to use woven bamboo baskets or kaing as the transport container for mangoes from harvest to the retail end. This was due to the lower cost of the basket compared to plastic crates. Most Guimaras mango growers preferred bamboo baskets, however, some growers preferred to use plastic crates in transporting the mangoes produced from their farm to the wholesale market. The result of the evaluation on this stage of postharvest chain showed minimal contamination of sap with the use of plastic crates with the lining of newspapers in every layer of the fruits.

The main reasons why the majority of the mango growers used cargo trucks in transporting their mango produced were due to the long distance travelled from the harvest area to the marketing depot and the high volume of mangoes for the market. For Guimaras growers, they stored their mango fruits both in farm sheds and open air sheds. They treated the pest and diseases infested mangoes by sorting and discarding those which were heavily infested. On the other hand, Iloilo mango growers preferred to store their mango fruits in farm sheds and practised both sorting, discarding and applying chemicals in treating their mangoes.

Postharvest Pests

Mango growers of Guimaras identified fruit fly as the number one pest present during the postharvest handling, while mealy bugs were the number one postharvest pest of Iloilo mango growers. In terms of postharvest practices, mechanical injuries are the number one problem of Guimaras mango growers due to cracking and bruising of fruits during harvesting. On the other hand, overloading of fruits in Iloilo province is the practice that causes higher losses among fruit quality which resulted to misshapen and bump evidence during the retail end.

Losses at Different Stages of the Mango Postharvest Supply Chain

Overall losses incurred during harvesting due to harvest method were 14.06% on Guimaras mangoes and 19.75% for Iloilo mangoes. The highest damage was on fruits contaminated with sap in Iloilo which was significantly higher than the Guimaras respondents mainly due to the cutting off of fruit pedicel that causes the outflow of sap. Iloilo mangoes exhibited a high percentage (12.56%) of fruits with physical damage but was not significantly different from damage in Guimaras (12.36%). Overall losses among fruits during transfer from tree to shed exhibited higher losses on fruits contaminated with sap (2.44%) in the Iloilo mangoes which was significantly higher than Guimaras (0.5%). This implies that sap contaminated fruits during the harvest stage have contaminated other fruits within the transport baskets. In totality, very low losses were incurred in both provinces on this supply chain stage of mango. In terms of transporting fruits from the farm to wholesaler, the damage caused by bruises and physical damaged were very minimal. Again, percentage of sap contaminated fruits in Iloilo province (1.68%) was significantly higher than Guimaras province (0.34%) which used mainly baskets.

The total volume of mango fruit that stays in the wholesale marketing stage of the supply chain did not show any trend. The Guimaras and Iloilo provinces were both rated low in bruises, sap contamination and physical damage. This implies that postharvest handling practices in the wholesale marketing stage such as storage area and the sorting of fruits, separating the damaged from undamaged fruits, were the same in both provinces. In terms of fruits that have reached the retail market, sap contaminated fruits of Iloilo province was still higher (1.45%) compared to Guimaras province but not significantly different from each other; the higher percentage of pathologically damaged fruits were noted in mangoes from Iloilo province of 1.74% and Guimaras with only 1.12%. However, results did not differ significantly. Based on the result, main causes of pathological damaged were caused by anthracnose and diplodia-stem-end rot diseases. Physically damaged fruits of Iloilo province were rated high (2.89%) which was significantly higher compared to the damaged fruit exhibited by Guimaras province losses. The results were due to overstocking of fruits in the

vehicle/truck during hauling, loading and transport at the farm to the wholesale and retail market.

Figure 2. A comprehensive diagram showing postharvest supply chain and the corresponding percentage of quality losses in each stage based on the study conducted in Iloilo Province, Philippines, 2015.

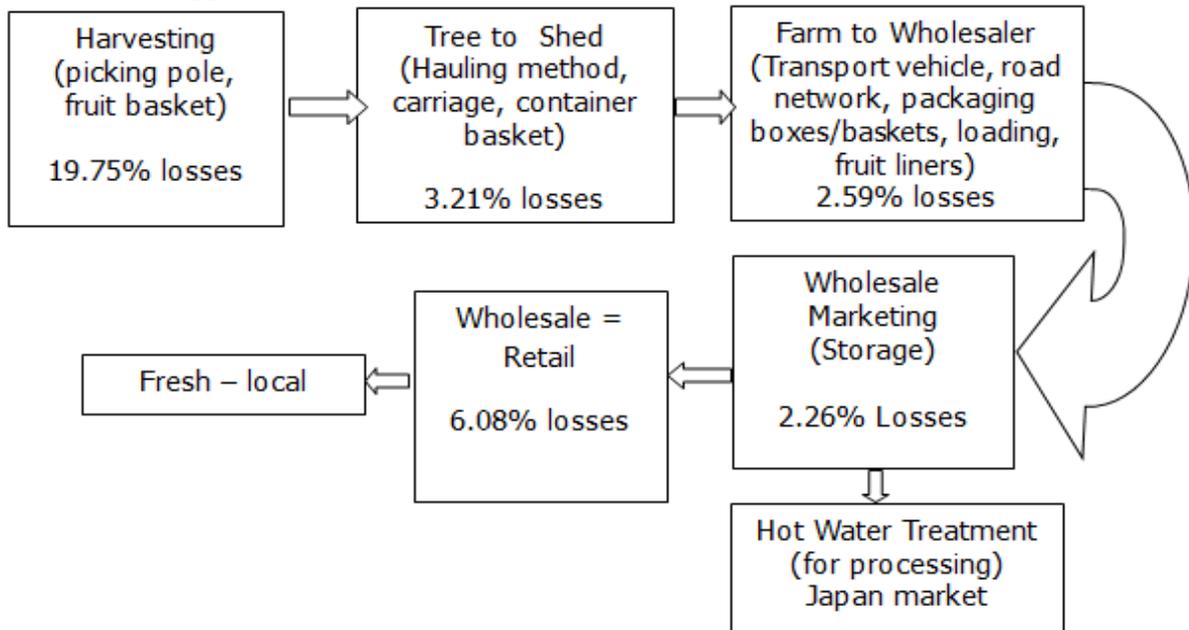
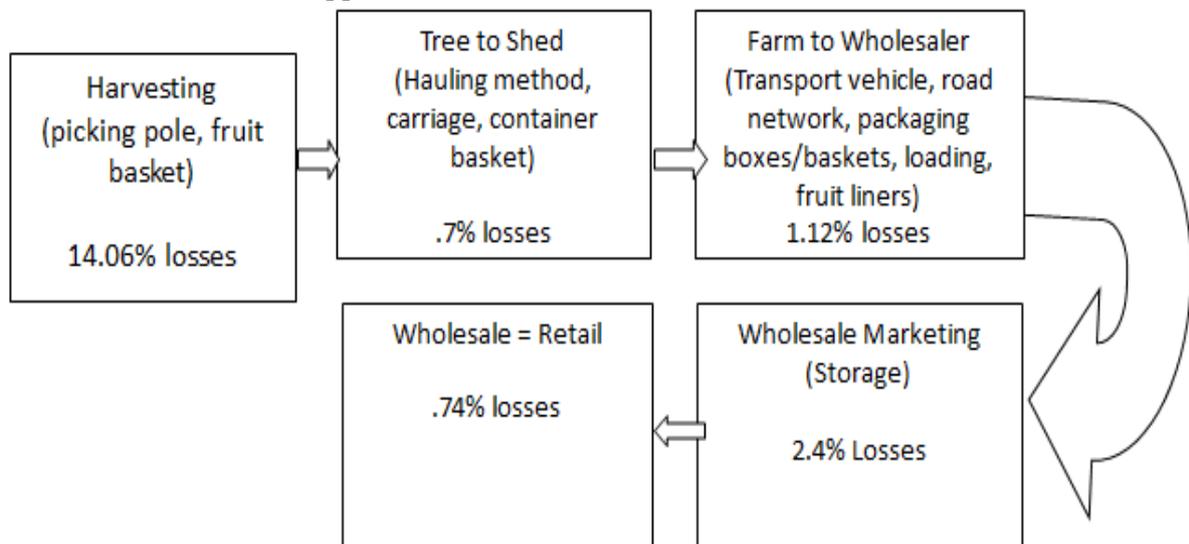


Figure 3. A comprehensive diagram showing postharvest supply chain and the corresponding percentage of quality losses in each stage based on the study conducted in Guimaras Province, Philippines, 2015.



Conclusion

The study has revealed that the extent of losses of Guimaras mangoes from harvest to fruit retail have reach to 19-20% for and 33-34% for Iloilo which are all considered as very high postharvest losses already.

The highest postharvest losses occurred during the harvesting stage which was caused particularly by the harvest method employed by harvesters, specifically in the harvesting pole design that cut-off the pedicel of fruit which caused overflow of latex/sap that burn the peel of mango fruits.

The overloading of fruits during transport with only basket or 'kaing' were used as container, contributed to higher physical damage that occurred as latent damage particularly during wholesale towards the end of retail in both provinces.

Other problems associated with postharvest handling of the mangoes, aside from mishandling, were problems of transportation and the unutilised packinghouse and postharvest treatment such as hot water treatment facility particularly in Guimaras province.

For the total harvest of 26,171 kg of mango harvested in Iloilo, almost 7,604kg can be lost due to postharvest losses with an estimated amount of 326,500.00.00 in one-season not yet including losses incurred during the production period

Of the total harvest of 21,148 kg of mango harvested by Guimaras mango growers, almost 3,485 kg can be lost due to postharvest losses with an estimated amount of 256,830.00 in one season not yet including losses incurred during the production period.

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