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Full Length Research Paper

Assessment of post harvest losses of fruits at Tshakhuma fruit market in Limpopo Province, South Africa

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The study on post-harvest losses of fruits was undertaken at Tshakhuma fruit market in Limpopo Province, South Africa. Fifty women hawkers were randomly selected and interviewed to obtain information on their socio-economic characteristics and post-harvest loss of fruits. Descriptive statistics was used to analyze the data collected. The results indicate that most of the women were in the middle age category (74%) with what can be described as basic education only. Of the five types of common fruits sold, bananas were the most prevalent followed by guavas, avocados, oranges and pawpaw. About 50% of the fruits were lost mainly due to over-ripening as a consequence of lack of proper storage facilities and appropriate technologies.

Key words: Assessment, postharvest losses, fruits, banana.

INTRODUCTION

A large portion of fresh fruits were lost worldwide after harvest. The main causes are physiological (wilting, shriveling and chilling injury, etc), pathological (decay due to fungi and bacteria) and physical (mechanical injury). These causes, in most instances can be interrelated, that is, mechanical injury can lead to postharvest decay in many cases (FAO, 1989; Madrid, 2011). Losses are estimated at 20 to 40% in developing countries and 10 to 15% in developed countries, depending on the crop and the season (Kader, 2005; Garnett, 2006; Ogunleye and Adefemi, 2007; Madrid, 2011). It is estimated that post-harvest losses in developed countries are an average of 12% from production to retail warehouses, and an estimated 20% at retail stores and foodservice sites (Madrid, 2011). Losses in developing countries run even higher because of poor storage and food-handling technologies (Salami et al., 2010). The general difference between developed and developing countries is that fresh fruits and vegetable infrastructure losses are greater in developing than in developed countries (Parfitt et al., 2010). Most post harvest technology is devoted to reducing respiration and other metabolic reactions associated with quality retention by manipulating the external environment (Saltveit, 2004a).

The Limpopo province produces 31% of the country's sub-tropical fruit approximately, 25% of the citrus, 75% mangoes, 65% of papayas (pawpaw), 60% avocados, 25% of bananas, and 20% of litchis (LPFTDB, 2003). All fresh fruits are subject to damage when exposed to extremes of temperature (FAO, 1989). Fruits vary considerably in their temperature tolerance. Low temperatures are of great importance in maintaining fruit quality which attracts buyers (FAO, 1989). Informal markets in which large numbers of small traders participate are common across the agro-food value chain (Aliber et al., 2010). Informal sector activities, such as street vending, provide sustenance for many citizens and contribute substantially to the economy (Kamunyori, 2007). It is the segment of a country's economy that operates outside the regulation and protection of the state (Kamunyori, 2007). However, a study by Mitullah (2003) in Kenya, Uganda, Zimbabwe, Ghana, Cote d'Ivoire and South Africa, showed that in most of these

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countries, street vending is unaccounted and unrecognised in national economic statistics.

In their study of the Tshakhuma and Khumbe informal markets in the Limpopo province, Nesamvuni et al. (2005) found that both markets trade mainly in subtropical fruits. Women comprise roughly two-thirds of the sellers and 30% being children. Over half of the women respondents reported income from trading as their only source of livelihood. Smallholders supply a limited range of fruits with low-input intensity and indigenous varieties (such as mango and avocado). However, most of the fruits sold in the market were bought in relatively larger volumes from large-scale commercial farms (Aliber et al., 2010), transported and delivered by hawkers.

Fruit trade can be adversely affected by climate change. Evidence indicates that South Africa has been getting hotter over the past four decades, with average yearly temperatures increasing by 0.13°C a decade between 1960 and 2003 (SAFWCCP, 2009). Temperature is the most important environmental factor that influences the deterioration of harvested fruits. It has been shown that temperature has a profound effect on the rates of biological reactions, for example, metabolism and respiration (Saltveit, 2004a) and a range of 0 to 30°C in most crops increased temperatures caused an exponential rise in respiration.

Paull and Chen (2004) indicated that holding the fruit in the temperature range of 20 to 23°C provides the best appearance, improves palatability and control decay in ripening mangoes. Kader and Mitcham (2008) agreed that holding the fruit between 15.5 to 18°C during ripening provides the most attractive skin colour; however, the flavour remains tart unless the fruits are held for an additional 2 to 3 days at 21 to 24°C.

Fruits such as bananas and apples that continue to ripen after harvest are said to be climacteric while citrus that do not ripen after harvest are called non-climacteric (FAO, 1989; Saltveit, 2004a). Ethylene gas is an important factor in starting off the ripening of fruits (FAO, 1989) with production increases during the ripening of climacteric fruits such as apples, avocados, bananas, melons, pears and tomatoes (Saltveit, 2004a). Its production also increased when fruits were injured or attacked by moulds causing decay (FAO, 1989; Saltveit, 2004b). This can start the ripening process and result in early ripening of climacteric fruit, which therefore emphasize fruits should be handled with care to avoid injuries leading to decay (FAO, 1989). The author found no account of progress towards the (FAO, 1985) post-harvest loss reduction target, but Lundqvist et al. (2008) has advocated for a 50% reduction in post-harvest losses use by 2025 (Parfitt et al., 2010). The absence of complementary investments in storage facilities and appropriate transport needed to improve the absorption capacity of these informal traders, as well as, to reduce the rapid deterioration of fruits on display has forced traders to sell at huge losses (Aliber et al., 2010). Most sellers at the informal market do not have adequate access to agricultural information and technologies (Saito and Surling, 1993). It is against the aforementioned background that the study was carried to assess post-harvest losses of fruits at Tshakhuma, an informal fruit market. The findings can be applicable to other informal fruit markets in the region and continent.

MATERIALS AND METHODS

Study location

The post-harvest loss assessment study was conducted at Tshakhuma fruit market in Limpopo Province in the Republic of South Africa. It was selected because of the high agriculture production potential leading to apparent surplus especially, of fruits with a high likelihood of losses.

Sampling procedure

A sample size of 16% was randomly drawn from a population of 300 women fruit sellers. In picking the sample, attempts were made to ensure representation of all fruits sold in the market.

Primary and secondary data collection

The study was conducted in 2011 using the self- administered questionnaires approach designed to address specific objectives of the study. The approach enabled the collection of both qualitative and quantitative information on various aspects from respondents (Prinsloo, 2000). The questionnaire was divided into two parts: section A (Personal information) and section B (information on postharvest loss of fruits).

The administered questionnaires generated information on age of respondents, level of education, type of fruit sold, distance of farms or source from the market, type of transport used to the market, frequency of fruit harvest, purchase or supply, quantity sold or lost, most frequent type of losses, type of storage facilities, problems encountered during storage, security of produce at the location, measures taken to control post-harvest loss and any suggestions to minimize losses. Secondary data were from various relevant books, electronic media and other sources (Aliber et al., 2006).

Data processing and analysis

The data generated from the questionnaire were captured using a template before applying descriptive statistics of frequency and percentage (Trochim, 2006). Statistical Package for the Social Sciences (SPSS) program was used to generate data.

RESULTS

Socio-economic characteristics of respondents:

The data revealed that majority of the women selling fruits in the study area were of middle age. Table 1 showed that 74% of the respondents were within 41 to 60 years of age, 16% were 61 to 80 years of age, 8% were

Table 1. Socio-economic characteristics of the respondents (n=50).

Variables	Frequency	Percentage (%)
Age (years)		
<20	-	-
21-40	4	8
41-60	37	74
61-80	8	16
>80	1	2
Level of education		
Never been to formal School	22	44
Primary	22	44
Secondary	6	12
Tertiary	-	-
Sole business		
Owner	50	100
Employee	-	-

Table 2. Types and sources of fruits and their frequency of purchase at Tshakhuma fruit market (n=50).

Variables	Frequency	Percentage (%)
Types of fruits		
Banana	50	100
Orange	18	36
Avocado	19	38
Guava	33	66
Paw-paw	18	18
Others (tomato, macadamia nuts)	6	12
Sources		
Own	1	2
Purchase	49	98
Both	1	2
Frequency		
Daily	-	-
Weekly	48	96
Fortnight	2	4
Monthly	-	-

21 to 40 years of age, and 2% were above 80 years of age. About 56% of the respondents had some education (44% primary and 12% secondary) while the rest had no formal education. All respondents owned the business.

Postharvest loss of fruits

Table 2 shows the types and percentage distribution of fruit sold at the Tshakhuma market. Banana fruit (100%) tops the others, followed by guava (66%), avocado (38%), orange and paw-paw (36%) and other fruits (6%). About 98% of the respondents purchased fruits from the nearby farmers and also in the market, while only 2% bought and also harvested the fruit. About 96% purchased fruit on a weekly basis, while only 2% purchased fruit on a fortnight basis.

Figure 1 shows percentage distribution of quantity of fruit sold or lost by respondents. 47 fruit vendors sold

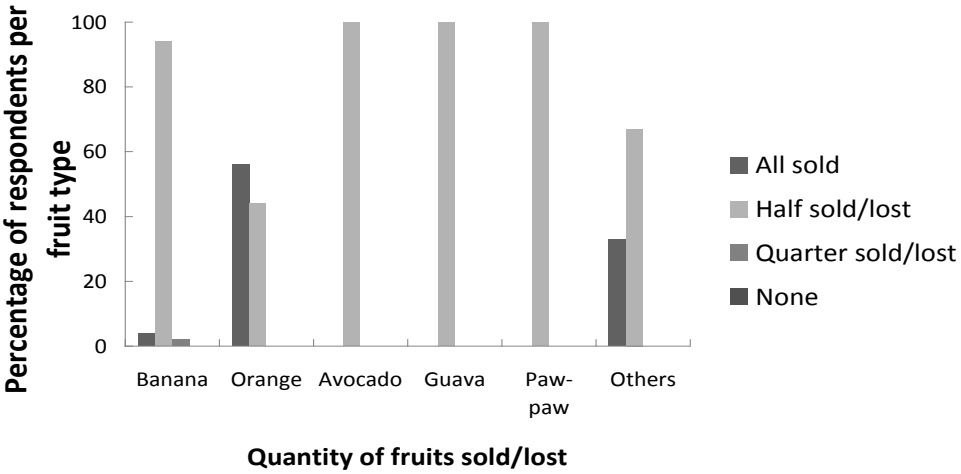

Figure 1. Quantity of fruits sold or lost at study location (Other fruits includes tomatoes and macadamia nuts).

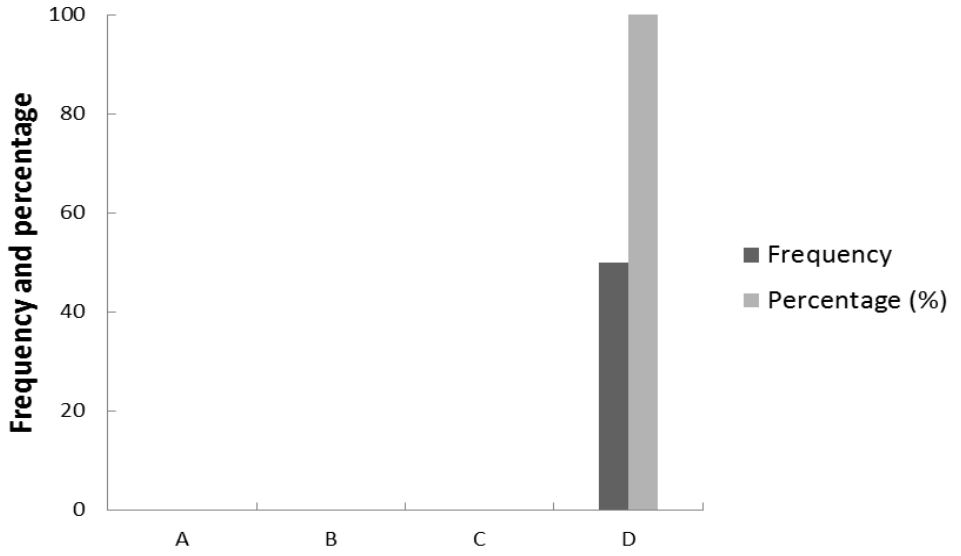

Figure 2. Causes of post-harvest losses of fruits at study location. A = microbial, B = mechanical, C = physical and D = other (over-ripening).

50% of bananas taken to the market while one vendor only sold 25% meaning the average loss for the 50 sellers was 2.5%. Oranges where about ten sellers had no loss was compared to 50% loss for the other 8, making an average loss of 2.8%. For the three tropical fruits, guava sellers realized 16.6% loss followed by 9.5% for avocado and 9% for pawpaws. Of the six fruit sellers who had tomatoes and macadamia nuts, four of them only sold 50% of what they took to the market making an average loss of 3.0%. The aforementioned report shows the total post-harvest fruit losses at Tshakhuma market was 43.3%. Figure 2 shows the causes of loss that occurs during fruit selling. All (100%) of respondents indicated over-ripening as the biggest problem. This could be that due to their educational background, fruit sellers could not relate damage like cuts, bruises, blemishes or rotting to fruit loss.

DISCUSSION

Socio-economic characteristics of respondents in the study area

All the 50 respondents were women, a sign that they play a significant role in agriculture and post-harvest processes in many parts of the world. In spite of the fact that majority were middle aged and of basic education, all were able bodied and very active in their pursuit of

economic development. Lack of higher education could have been responsible for their failure to notice other causes of fruit loss citing only over ripening. Education is generally considered as an important variable that enhances adoption of new technologies (Sabo, 2006) especially, fruit preservation technology. According to Adams (1982), education has the potential to enhance understanding and communication in post-harvest technology especially, for the fruit sellers in Tshakhuma market since all respondents owned the business (Table 1).

Fruits sold and sources

The main reason of having banana sold by all respondents was because it was grown and harvested throughout the year by commercial farmers in Limpopo Province, while other fruits were seasonal. Banana fruits were also exported to other regions and countries including Europe. They are consumed in a variety of ways: mostly as fruit, staple food or for other therapeutic uses especially, in Eastern parts of the world (Mohapatra et al., 2011).

Fruit vendors rely mainly on purchased stocks. Ninety-eight percent (98%) of the respondents purchased fruits from the nearby farmers in Levubu District, about 5 to 8 km from the market. They use hired trucks for collection of fruits and because of short distance, there were no losses incurred during transportation. They also bought from subsistent farmers who sold fresh produce in the market. Only 2% bought and also harvested their own fruit.

The weekly frequency of fruit buying is understandable since previous stocks had to be cleared before getting fresh supplies. None of the sellers at the study location purchased fruit on a monthly basis due to the fact that fruits cannot last long without appropriate technology.

Post-harvest losses of fruits

The high percentage loss implies that being climacteric (FAO, 1989; Saltveit 2004a) bananas should be harvested at slightly earlier than usual to avoid over ripening. Once in the market, handling may cause injuries on fruits which increases ethylene production leading to more ripening process and attack by moulds causing decay (FAO, 1989). All the 33 guava, 19 avocado and 18 pawpaw sellers realized 50% losses translating to 16.5, 9.5 and 9.0% for individuals. This is a very high loss again blamed on lack of measures to control over ripening of fruits. The four tomato and two macadamia sellers had mixed fortunes. While the tomato sale realized 50% loss (2.0% average per seller) all the macadamia nuts were sold mainly because they are dried nuts with longer shelf life. As indicated by the respondents, over-ripening was the biggest problem. This could be as a result of high temperature (35 to 40°C in summer and 25 to 34ºC in winter) that is experienced around the market location as it is one of the warm places in the country. High temperature increases the biological reactions in fruits such as metabolism and respiration (Saltveit, 2004a). However, it was evident that they did not consider other factors such as mechanical injuries that in most instances can be interrelated, that is, mechanical injury can lead to post-harvest decay by microbial in many cases (FAO, 1989; Madrid, 2011). They were using umbrellas to protect the fruits from the heat but it does not work during summer season where the sun is too hot. Fruit injuries accelerate ethylene production (Saltveit, 2004b; Kader and Mitcham, 2008) causing an increase of the ripening rate. The poor storage of the fruits results in more losses due to cross-contaminating inside the crates. The type of infrastructure (packaging, transport, roads storage facilities) and distance to the final markets play a critical role in the distribution and marketing of fruits and vegetables (Debela et al., 2011).

However, this did not have significant impact on the losses because most of the fruits were purchased from the nearby commercial farms about 5km away. Proper facilities like refrigerated storage containers for fruits were lacking. Instead, fruit sellers were using a corrugated house for storage. There was no way their fruits could be kept at safe temperature (0°C for temperate crops or 10 to 12°C for chilling sensitive crops) to increase storage life by lowering respiration rate, decreasing sensitivity to ethylene and reducing water loss (Anonymous, 2002). Room cooling could be a good approach in reducing the fruit losses at the market. It is a relatively low cost but very slow method of cooling when electricity for mechanical refrigeration is unavailable (Anonymous, 2002). Rodent trapping could minimize fruit damage and loss due to their infestation. Hagenmaier and Shaw (1992) noted that fruit surfaces were often coated with waxes to reduce post harvest losses. Fruit coating serves as a barrier to water vapour loss (Morris, 1982) and is considered a cost-effective substitute where there is refrigerated storage (Dalal et al., 1971). The study also revealed knowledge gaps especially, in the use of proper packaging materials which could be addressed through public awareness campaigns.

Conclusion

The study was carried out to establish the kind of post-harvest losses fruit sellers experienced in the market. Fruit injuries: cuts, bruises and blemishes were expected to be among the common causes. However, fruit sellers recognized only over ripeness as the main problem. Despite the fact that road transport could have

contributed to some of the injuries noted earlier, no one thought that this could lead to fruit loss. Their level of education may have some role in the lack of understanding the relationship between transport and fruit rotting since to them it is just a means to the market. Lack of refrigeration cannot be taken as the sole reason for the high losses reported. This is because there were some fruit sellers who managed to sell all their weekly stocks. The problem could be in their inability to acquire only the stocks one can handle for the week. Probably, this can be addressed through simplified training targeting the level of their education. The study only used respondent answers. It would be worthwhile to conduct another study where actual fruit sampling could verify whether such losses were feasible. After all, many fruit sellers take whatever remains for home use, thereby, reducing the perceived 50% loss, a fact that did not appear to have been captured.

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