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International Journal of Current Research
Vol. 3, Issue, 11, pp.040-043, November, 2011

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

IDENTIFICATION OF MAJOR CAUSES OF POSTHARVEST LOSSES AMONG SELECTED FRUITS IN JIMMA ZONE FOR PROFFERING VERITABLE SOLUTIONS

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ARTICLE INFO

Article History:
Received 28th August, 2011
Received in revised form
19th September, 2011
Accepted 28th October, 2011
Published online 20th November, 2011

Key words:
Banana,
Jimma,
Mango,
Postharvest loss,
Total Soluble Solid.

ABSTRACT

Horticultural crops are known for their high return per unit time and area. How ever, a significant proportion of postharvest loss of these produces is experienced in Ethiopia. This postharvest loss contributes to the reduction of profit from the produce and leads to food insecurity. This survey investigation and laboratory analysis was therefore conducted to study the causes and magnitude of post harvest loss of selected fruits in three different towns of Jimma Zone, South western Ethiopia from November 2010 to March 2011. The survey method was explored using carefully designed semi-structured questionnaire reflecting the proposed scope of study among producers, wholesalers and retailers of fruits in the fruit market chain. The chemical analysis was determined using the standard procedures in Postharvest laboratory of Jimma University College of Agriculture and Veterinary Medicine. The result indicated that there were greater postharvest losses of mango (35.5%) and banana (40.0%) especially in Jimma town than in Agaro and Seka Chekorsa. These postharvest losses were mainly attributed to poor handling during transportation and the use of poor marketing structures to sell their fruits. To reduce the losses of these fruits, it calls for a close integration of the beneficiaries along the value chain and a public awareness campaigns to increase their experience of using appropriate packing materials.

INTRODUCTION

Losses of horticultural produce are a major problem in the postharvest chain. They can be caused by a wide variety of factors, ranging from growing conditions to handling at retail level. Not only are losses clearly a waste of food, but they also represent a similar waste of human effort, farm inputs, livelihoods, investments and scarce resources such as water (Adeoye *et al*., 2009). Post-harvest losses for horticultural produce are, however, difficult to measure. In some cases everything harvested by a farmer may end up being sold to consumers. In others, losses or waste may be considerable. Occasionally, losses may be 100%, for example when there is a price collapse and it would cost the farmer more to harvest and market the produce than to plough it back into the ground (Wikipedia, 2010). A significant proportion of post harvest loss of agricultural produce is experienced in Ethiopia, most especially in perishable horticultural commodities like fruits (mango, banana, papaya, avocado, sweet orange etc.) and vegetables. Various efforts had been implemented by policy planers in insuring food security in the country over the years with emphasis mostly on production techniques, crop improvement through breeding efforts, intensive arable land utilization, extension efforts and effective marketing strategies (Getachew, 2004). Even though horticultural crops are known for their high return per unit time and area which is one major tool to achieve food security in the country, post harvest behavior and post harvest management of horticultural produce have not been given sufficient attention over the years, most especially perishable horticultural produce, due partly to the dearth of studies on the magnitude of losses attributable to post harvest technology occupying a significant position along the food value chain within the context of market driven industry and industry benchmark. As a result of less attention given to this sector, a significant proportion of postharvest loss of agricultural produce is experienced in Ethiopia, most especially in perishable horticultural commodities like fruits and vegetables accounting as high as 30 to 40% loss (Admasu, 2004).

Among fruits grown in Ethiopia this paper is concerned with some of major fruits such as mango, avocado, papaya, banana and sweet oranges. It is common to any body to observe the post harvest loss of these major fruits from production area till the last consumers' level which contributes to the reduction of profit from the produce and leads to food insecurity. It is with this view in mind that this survey investigation and laboratory analysis had been conducted to study the causes and magnitude of post harvest loss and the underlying principles towards proffering a veritable solution to the problem of post harvest losses of mango, avocado, papaya, banana and sweet orange in Jimma, Agaro, and Seka Chekorsa town, South western Ethiopia.

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MATERIALS AND METHODS

The study was conducted in production season of 2010 in Oromia regional state, Jimma zone in three specific locations: Jimma, Seka-Chekorsa and Agaro town. Jimma zone is geographically located at latitude 7^0 40'and 36^0 10' S with an altitude of 1710 meter above sea level. The mean maximum and minimum temperature are, respectively 12.1^{0}C and 28^{0}C having mean annual rainfall of 1450-1800 mm (BPEDORS, 2000). The survey method was explored using carefully designed semi-structured questionnaire reflecting the proposed scope of study among producers, wholesalers and retailers of fruits in the fruit market chain from November 2010 to March 2011. The survey was a pre-test profiling the presence of postharvest losses encountered in the market, storage and transportation and a preliminary investigation of magnitude and causes of post harvest losses. 35 respondents each from producers, wholesalers and retailers were randomly interviewed in each study sites for the fruits under investigation. For each fruits and study place, ten randomly selected fruit samples were taken three times for laboratory analysis.

Titratable Acidity (TA) and Total Soluble Solids (TSS) determinations were done following the AOAC (1998). Sweet orange juice was extracted by using juice extractor (Model JEX328) while that of banana, papaya, mango and avocado juices were extracted by using mixer emulsifier (MX-1000). Titrable acidity (TA, %) of all selected fruits were determined by taking 1ml of each fruit juice and adding into a beaker in which three drops of phenolphthalein were added. 0.1M NaOH solution was slowly added to the beaker until the phenolphthalein indicator was changed from color less to pink. The amount of 0.1M NaOH added to the beaker was recorded for each fruit juice. Total soluble sugar (TSS, ^{0}Birx) was registered by dropping a droplet of each juice solution on prism plate of refractometer (TSSA0010). The collected data on these parameters were analyzed using SPSS computer program and the values were compared using a one- sample 2-tailed t-test (Dunnett) at a confidence level of 95%.

RESULTS

About 60% of the respondents interviewed in Jimma town (Fig. 1) sell their mango fruit in an open space and tent like structures. Only 40% of them were observed selling their mango fruit in houses meant for this propose. Similarly, only 20% of the respondents were found selling their avocado in house where as the remaining respondents were selling avocado in open space and tent like structure. 80% of the respondents interviewed were found selling banana in open air hanging the bunch on the support prepared for this purpose.

Most of the fruits sold in Jimma town were brought from distant places using different packing materials and transportation means. 55% of the respondents, who transport fruits to Jimma town, use sacks for packaging fruits where as the remaining 45% of them were using basket and other materials (Fig-2). If fruits were specifically considered, 85% of the respondents interviewed were observed using wooden box to transport banana to Jimma town. The largest proportion

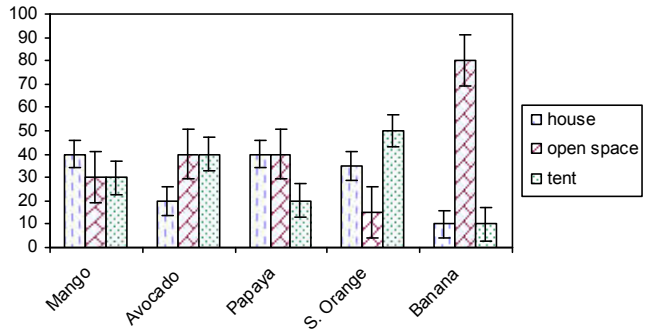

Fig.1. Percentage of respondents selling fruits in different marketing places in Jimma town

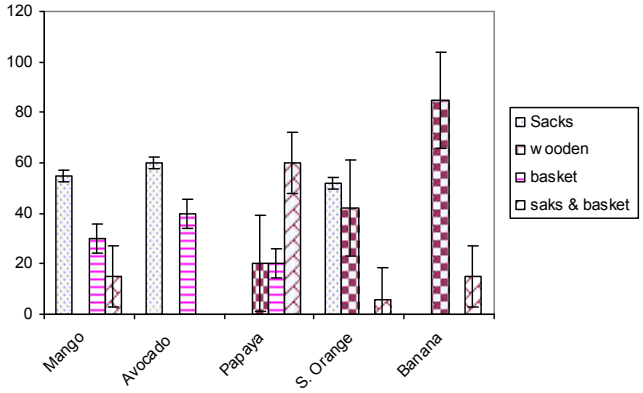

Fig. 2. Percentage of respondents packing fruits using different materials to transport to Jimma town

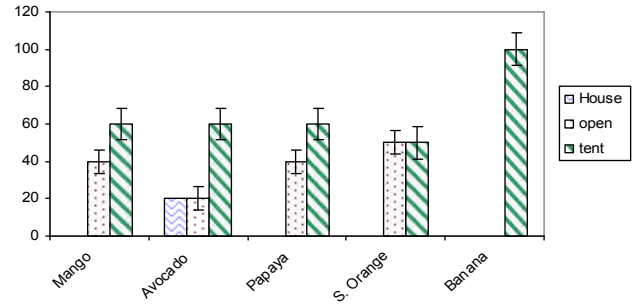

Fig. 3. Percentage of respondents selling fruits at different marketing places in Agaro

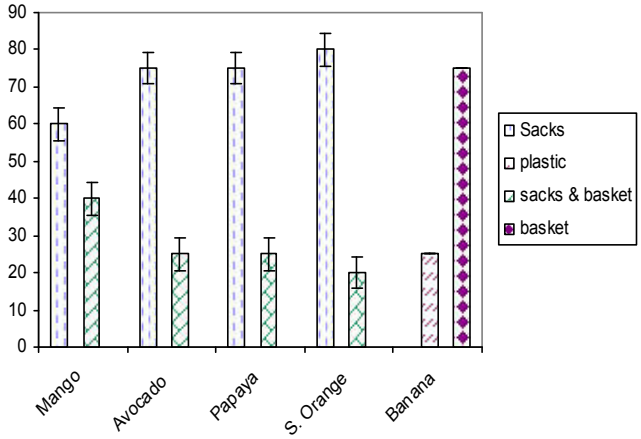

Fig. 4. Percentage of respondents packing fruits using different materials to transport to Agaro town

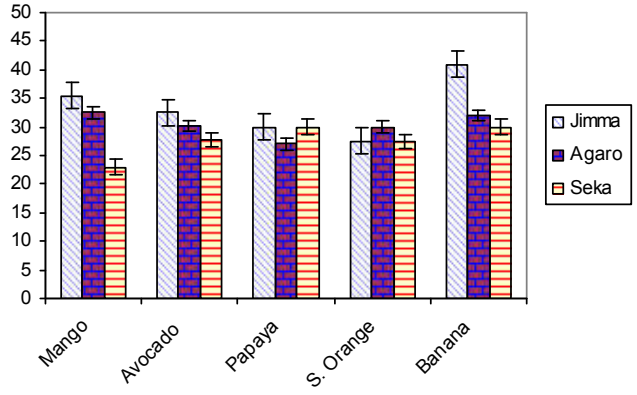

Fig 5. Percentage loss of fruits in Jimma, Agaro, and Seka

respondent) no one was observed using house for selling fruits (Fig. 3). For packing and transporting fruits to Agaro town, people were observed using sacks and plastic materials. As can be seen from the result, most of the respondents have been observed using sacks as packaging materials to transport mango, avocado, papaya and sweet orange (Fig. 4). Banana, on the other hand, was packed and transported by either basket or plastic. In this specific area none of them were observed using wooden box and basket (except for banana) as packaging materials to transport all the other fruits under investigation. As opposed to the transport system to Jimma town, most of the respondents who transport their fruit to Agaro were observed hiring daily laborers and only few of them were seen using animals and tracks. From the survey result of this town, as compared to the other fruits large amount of mango (30%) was lost during transportation.

Table 1.Percentage of respondents using different packing materials to transport fruits to Seka chekorsa town

Fruits	Respondents using different packing materials (%)			
	Sack	Basket	Plastic	Sack + Basket (%)
Mango	20	-	-	80
Avocado	50	50	-	-
Papaya	75	-	25	-
Sweet orange	40	60	-	-
Banana	-	40	40	20

Table 2. Minimum TSS (^{o}Brix) and maximum TA (%) of selected fruit

Fruits	TSS (^{o}Brix)		TA (%)	
	Minimum Content	Average value obtained	Maximum content	Average value obtained
Avocado	10	3.30	2.0	1.87
Banana	17	15.62	3.0	3.19
Mango	14	9.41	4.0	2.16
Papaya	8	6.92	1.0	2.11
Sweet Orange	11	5.80	13.0	3.73

Sources: (Kader, 2001; Rotter, 2009; and own data)

Table 3. TSS (^{o}Brix) and TA (%) of selected fruit tested in relation to standard value

Location	Selected fruits									
	Mango Sig (2-tailed)		Avocado Sig (2-tailed)		Banana Sig (2-tailed)		Papaya Sig (2-tailed)		Sweet orange Sig (2-tailed)	
	TA (%)	TSS	TA (%)	TSS	TA (%)	TSS	TA (%)	TSS	TA (%)	TSS
Jimma	0.000**	0.000**	0.338^{NS}	0.000**	0.076^{NS}	0.591^{NS}	0.000**	0.012*	0.000**	0.000**
Agaro	0.008**	0.000**	0.576^{NS}	0.001**	0.081^{NS}	0.000**	0.005**	0.000**	0.000**	0.001**
Seka	0.007**	0.000**	0.775^{NS}	0.017*	0.480^{NS}	0.431^{NS}	0.004**	0.000**	0.000**	0.000**

** Highly significantly different (P<0.01), * significantly different (P <0.05), NS- Non significantly difference (P >0.05)

of papaya, on the other hand, was transported to this town being packed in sacks. People use different means of transportation for transporting fruits to Jimma town. As the survey result indicated most of the respondents transport their fruits to Jimma town using tracks. Though it varies from fruits to fruits, animals were rarely used for this purpose around this area. Investigations of fruit losses at different chains in Jimma town indicated that there were variations from fruits to fruits. The survey result indicated that there was high postharvest loss of mango (35.5%) during transportation and banana (40.0%) during marketing than that of the other fruits. Postharvest loss of sweet orange during transportation was relatively low (27.5%). At Agaro town, more than 60% of the respondents were found selling their fruits in tent like structures. Avocado, mango, papaya and sweet orange were also observed being sold in open space. Almost all respondent use tents for displaying and selling banana fruits. In this specific area, except for Avocado (only 20 % of the High banana loss (38.5%) on the other hand was observed during marketing and storage. In contrast to the situation in Jimma town, the percentage loss of sweet orange was found to be higher at marketing and storage places. In the Seka chekorsa town, all the respondents were observed using open space to sell all the fruits during marketing. None of them were seen using house and tent like structures to sell the fruits. More than 50% of the respondent use sack as a packing material (table 1). From the survey result it was observed that people were not experienced in using wooden box as a packing material and none of them were found using it. About 40% of the interviewed people were observed using plastic to pack banana fruits. In addition to this, all of the respondents in the area were hiring laborer for transporting all fruits from producer to the consumers. There were no any other means of transportation method used. In Seka Chekorsa the highest percentage loss for all fruits was observed during marketing as the fruits were sold in the open space being exposed to sun

light. Comparing the postharvest losses of the selected fruits in the three study sites, the highest postharvest loss of mango (35.5%) and banana (40.7%) were observed at Jimma town as compared to Seka Chekorsa and Agaro. If fruits were considered the highest postharvest loss 41% was registered for banana at Jimma town where as the lowest loss was recorded for sweet orange at Seka Chekorsa town. Chemical analysis was made for those fruits physically considered as unfit for consumption. The statistical analysis for TA (%) and TSS (^{o}Brix) for these fruits showed highly significantly differences ($P < 0.01$) from the standard values except TA for avocado and banana (Table 2 & 3).

DISCUSSION

Largest percentage loss of mango in Jimma town was observed during transportation because the fruits travel longer distance to reach Jimma town on a bumper road. In addition to the nature of the road, the packing material used to transport mango to the town was also contributing to this amount of loss. Banana fruits, on the other hand, were mainly affected due to poor marketing structure. They were sold in an open space being displayed in a very hot condition that increases the deteriorations after harvest. Fresh fruits and vegetables are highly susceptible to mechanical injury owing to their tender texture and high moisture content. If are exposed to undesirable environmental conditions like high temperatures during transportation and marketing soften in tissue and bruise easily, causing rapid microbial deterioration. Owing to the lack of natural defense mechanisms in the tissue, the microorganisms spread rapidly causing fruits and vegetables unfit for consumption. In Agaro and Seka Chekorsa less postharvest losses of fruits were observed because the fruits took shorter distance to reach the marketing sites. From the chemical analysis result except for avocado, the average TSS values for the other fruits were significantly lower than the minimum standard values for each fruits (table -3). TSS values normally increases during ripening mainly due to increased rates of respiration, transpiration and other metabolic activities resulting in breakdown of cell structure and complex substances (Gul *et al*., 1990). How ever, in this experiment the values were found to be lower because of the further hydrolysis created due to poor handling of the fruits (Rathore *et al*., 2010). The deviations in TSS and TA values from the standard value of each fruits indicate that the fruits are not fit for consumption. This is to mean that postharvest loss of these fruits is not only physical losses like color and appearance but also is a chemical loss created due to the abnormal metabolism that took place in the fruits affected by microorganisms.

Conclusion

The type of infrastructure and the length of the distance to the final markets play a critical role in the distribution and marketing of fruits and vegetables. In this specific zone, poor postharvest handling during transportation and marketing were therefore identified as the main factors resulting in increased postharvest losses of the fruits under investigation. Poor roads, inappropriate means of transport combined with a badly arrangement of packing materials and poor marketing structures aggravated the postharvest losses of the fruits in the zone. Since postharvest behavior and postharvest management of these produces have not been given sufficient attention in this zone, farmers remained producing fruits and vegetables on small plots of land. Therefore, in order to reduce the levels of postharvest losses in the area and to rapidly transfer the produce from producers to consumers, a close integration of producer, wholesaler, retailer and consumer becomes necessary. Such highly integrated marketing channel serves to prevent traders from being left with unsold, perishable produces. It was also observed that there is knowledge gaps between the respondents interviewed in their experience of using packing materials. This therefore calls for public awareness campaigns that must be implemented to increase their knowledge of using suitable packing materials.

Acknowledgements

The authors would like to thank Jimma University College of Agriculture and Veterinary Medicine for providing us sufficient fund to do the research. Our sincere appreciation also goes to the officials of the three towns who let us collect data and the respondents who gave us their time to respond to the questions we prepared.

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