

Postharvest Loss Assessment of Banana(*Musa spp.*) at Jimma Town Market

Getachew Etana Gemechu¹ Damtew Abewoy² Kedir Jaleto³

1. Jimma Agricultural Research Centers, EIAR ,

2. Wondogenet Agricultural Research Center, EIAR,

3. Mehoni Agricultural Research Centes, EIAR.

Corresponding Author : getuetana2006@gmail.com

Abstract

Postharvest losses of banana in the supply chain with the total loss found to be 26.5% of which more percent of the total loss being at the retail market (64.10%) and wholesale level (35.90%). Mechanical damage followed by improper transport and improper storage were identified as the main causes of banana loss at wholesale level while fruit rotting followed by improper ripening and mechanical damage were identified as the main causes to the loss of banana fruit at retail level. As a result, the current postharvest management system of banana both at wholesale and retail levels is inadequate. The postharvest management of banana has not been given sufficient attention in the area hence, fruit handlers lack information about postharvest handling practices. It was also observed that there is a knowledge gap between the respondents in their experience of proper fruit handling techniques. Therefore, to reduce the level of postharvest losses of banana in Jimma market, focus should be given to postharvest handling practices. The loss can be minimized by awareness creation, education and training about the importance of postharvest losses, adopting better management operations, careful handling and packaging to the supply chain actors.

Keywords: Cause of post harvest losses, Post harvest loss, Post harvest management

DOI: 10.7176/FSQM/119-01

Publication date: September 30th 2022

Introduction

Banana (*Musa spp.*) is a crop of major economic importance in the world which belongs to the family Musaceae and genus *Musa* (Robinson and Saucó, 2010). It represents the world's largest fruit crop with an annual production of 106,714,204 metric tons in 2013 (FAO, 2015). Banana is also the most commonly consumed fruits in the world and of great importance to small-scale farmers in the developing countries of the tropics and subtropics (Frison and Sharrock, 1999; Robinson and Saucó, 2010). About 87% of the entire bananas grown worldwide are produced by small-scale farmers for consumption or sale to local and regional markets (Frison *et al.*, 2004). Banana has multipurpose uses as food, feed, cash source and environmental conservation (Daniel, 1999). It is the most nourishing fruit as it is a good source of potassium, magnesium, copper, manganese, vitamin C and B6 and others (Frison *et al.*, 2004; Wall, 2006). It has been cultivated for several years as a garden plant in Ethiopia.

According to Bezuneh (1975) as cited by Kahessay *et al.*, (2010), Dessert banana is also the major fruit crop that is most widely grown and consumed in Ethiopia. In the south and southwestern parts of the country, it is of great socioeconomic importance in rural communities including food security, income generation and job creation. Banana in Ethiopia covers about 59.64% (53,956.16 hectares) of the total fruit area, about 68.00% (478,251.04 tones) of the total fruits produced, and about 38.30% (2,574,035) of the total fruit producing farmers (CSA, 2014). On the other hand, about 68.72% (37,076.85 hectares) hectares of land covered by banana, about 77.53% (370,784.17 tones) of the banana produced and 22.38% (1,504,207) of the banana producers in Ethiopia are found in the Southern Nations Nationalities and Peoples' National Regional State (SNNPRS) (CSA, 2014). An effort being made by the government of Ethiopia to promote and diversify its agricultural outputs as well as exports at large, the attention given to banana especially in terms of research, extension services, investment endeavors and overall value-chain management. Its production has yet been limited to backyard and small-scale productions with the produce largely supplied to local markets. Large scale banana production in Ethiopia covers only 0.19 % (1,910.97 hectares) of the total area covered by banana and 0.22% (17,924.59 tones) of the total banana produced in Ethiopia (CSA, 2014).

The global share of Ethiopia in banana export was only 0.02% in 2011 (FAO, 2015) which could be described partly to problems associated with postharvest handling to meet quality standards of the export market. A study conducted among producers, wholesalers and retailers of fruits in the fruit market chain revealed that, Losses of horticultural produce are a major problem in the postharvest chain (Debela *et al.*, 2011).

The study that was conducted in Ethiopia since 2015 revealed that the average total farm level loss of banana was 15.6% of the total production due to improper transport and storage. The average total post-harvest losses at the wholesale level were estimated to be 22.05% of the total produce handled/purchased for sale

(Woldu *et al.*, 2015). The causes of postharvest losses accounted during banana transport from the farm gate to central markets, 20 % percent of wholesalers purely reported impact and fruit breakage as cause of post-harvest loss while the rest 80% responded the cause to include physiological and other mechanical damages .The average total post-harvest loss at retailer level was estimated to be 8.05% which is small as compared with the other mainly due to the relatively rapid turnover of the produce. The main causes of postharvest losses at the retail level include inappropriate display conditions and handling facilities (Woldu *et al.*, 2015). Different studies had been done in different parts of Ethiopia regarding to postharvest assessment of horticultural crops even banana. Therefore, this study was designed with the objectives of: to assess the extent of post-harvest loss of banana at wholesale and retail level at Jimma market; to assess the major causes of banana fruit loss at wholesaler and retailer level and to assesses the different postharvest handling practices of banana on the existing market level.

Materials and Methods

A survey was conducted to assess the extent of postharvest losses of banana fruits and its causes along the wholesaler and retailer supply chain. The study was conducted at Jimma town, since February ,2017 which is the major consuming town. Jimma is located at about 360 kms south east of Addis Ababa and is the dominant source of banana in the country. Mizan is one of the major sources of banana for jimma town market. Postharvest loss at wholesalers and retailers were surveyed in jimma market by taking a total of 10 wholesalers and, 15 retailers who were randomly selected based on purposive sampling.

Primary data were collected with the aid of structured questionnaire. Based on the present context of banana marketing, two stages were identified to assess the postharvest loss: wholesale and retail levels. Two sets of questionnaires were scheduled and information on postharvest handling and marketing practices were collected from participants at the two levels of the marketing chain. Data regarding losses at wholesale and retail level were also collected separately. And finally, SPSS software was used to analyses the data obtained from the survey and then average means and percentages were used to compute postharvest losses

Result and Discussion

Extent of postharvest losses of Banana

The total postharvest loss of banana at wholesale and retail level were found to be 29.25% (Table.1). The higher proportion of losses (64.10%) was observed at retail level while the wholesale levels' loss was 35.90%. The high percentage loss at the retail could be accounted for the cumulative effect of improper handling from harvest to retail level. The perishable nature of ripe fruits also makes the problem worse at the retail level. The relatively lower magnitude of loss at wholesale level could be explained by the fact that wholesalers are mostly dealing with green fruits. Though the damage is prevalent later at ripening, green fruits are more tolerant to handling problems. Similar to this, lower losses were reported by Wanjari and Ladaniya, (2004) for unripe bananas compared to the ripe ones.

Table 1 . Postharvest losses of Banana at wholesale and Retail level

Supply chain	Loss (%)	Share in total (%)
Wholesale level	10.5	35.90
Retail level	18.75	64.10
Total	29.25	100

Causes of postharvest losses of Banana at wholesale Level

According to response of wholesaler (28.15%), mechanical damage was the main cause for banana loss at wholesale level improper transport, improper storage, improper ripening and improper maturity which were noted by the remaining 22.71%, 19.46%, 17.26% and 12.42% of the respondents, respectively (Figure 1). The processes of fruit handling and packing from harvest through transport and marketing might contribute for mechanical damage to banana at whole sale market. Poor handling, unsuitable containers, improper packaging and transportation are indicated to easily cause bruising, cutting, breaking, impact wounding and other forms of injury leading to fruit deterioration (del Aguila *et al.*, 2010). Similar results were reported by Ilayas *et al.* (2007) stating higher mechanical damage to bananas at whole sale and retail marketing than at harvesting level within the supply chain.

Wholesalers said that, long distance transport followed by poor packaging during transport and improper storage also had their own contribution for loss of banana fruit (figure 1). Transporting banana bunches without cushioning material may expose fruits to mechanical damage resulting in losses (George and Mwangangi, 1994). This is particularly true when fruits are transported for long distance on rough roads, as it was the case in the present assessment. Improper maturity and ripening is one of the factors which perceived by wholesalers to have lower contribution to enhance banana loss. This might be because the wholesalers have limited awareness about the impact of their handling practice, which has their own contribution for banana loss.

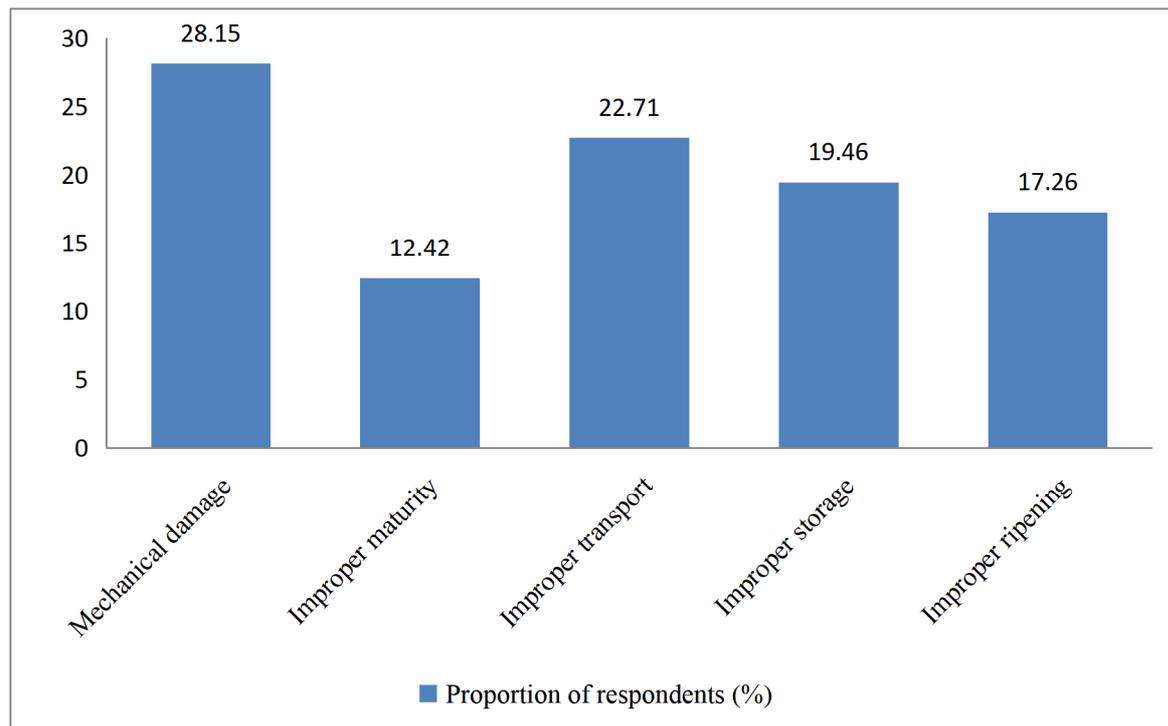


Figure 1. Causes of postharvest losses of banana at wholesale level

Causes of postharvest losses of Banana at retail level

Fruit ripening was mentioned by majority of the retailers (36.75%) as the main cause for banana fruit loss while improper ripening, mechanical damage, improper transport and improper maturity were noted by 28.26%, 15.89%, 10.32% and 8.78% of the retailers, respectively (Figure 2). The possible reason to score high in rotting could be explained by the fact that during handling, fruits are infected with various pathogens which can be established at any time before or after harvest which resulted to cause decay in fruits. Banana pathogens gain entry through injuries happened during harvesting and injuries related to poor handling and transport. During storage, banana fruit deteriorates through the action of spoilage microorganisms, which become activated due to the changing physiological and biochemical state of the fruit (Turner, 2001). As evidenced from this assessment, unsatisfactory sanitation at the ripening and storage environments might also be the source of contamination and quality loss from microbes all of which contribute to the spread of diseases to fruits. Moreover, the storage of fruits in boxes at retail market might result in more losses due to cross-contamination inside the crates. Similarly, poor hygienic conditions in the field and handling and mechanical injuries associated with poor transport and handling were reported to be the main causes for banana rot in Kenya (FAO, 2015). It is therefore, advised to reduce the incidence of physical injury and the risk of contamination of microbes and dust as a means of preventing fruits quality loss.

Improper ripening in banana fruit also leads to an increased susceptibility to physical damage and pathogen attack during storage which increases the risk of fruit spoilage at retail market. Microbial and mechanical damage also interact with the changing physiology of the fruit during ripening and storage will result in great fruit losses (Turner, 2001; Jun-Ping, 2006). The impact of mechanical damage might be increased at retail level because injuries from the previous handling chains will be more prevalent on the ripe banana fruit. The physiological state of the fruit (ripening) by itself also makes the fruit more sensitive to handling damages.

The retailers said that improper handling at wholesale market and taking relatively longer days to sell fruits are the main causes favoring the loss of their fruit in the market (Table 3). It has been revealed from this study that it takes 4 to 5 days, which explained by most of the retailers (53.45%) to finish selling their fruits.

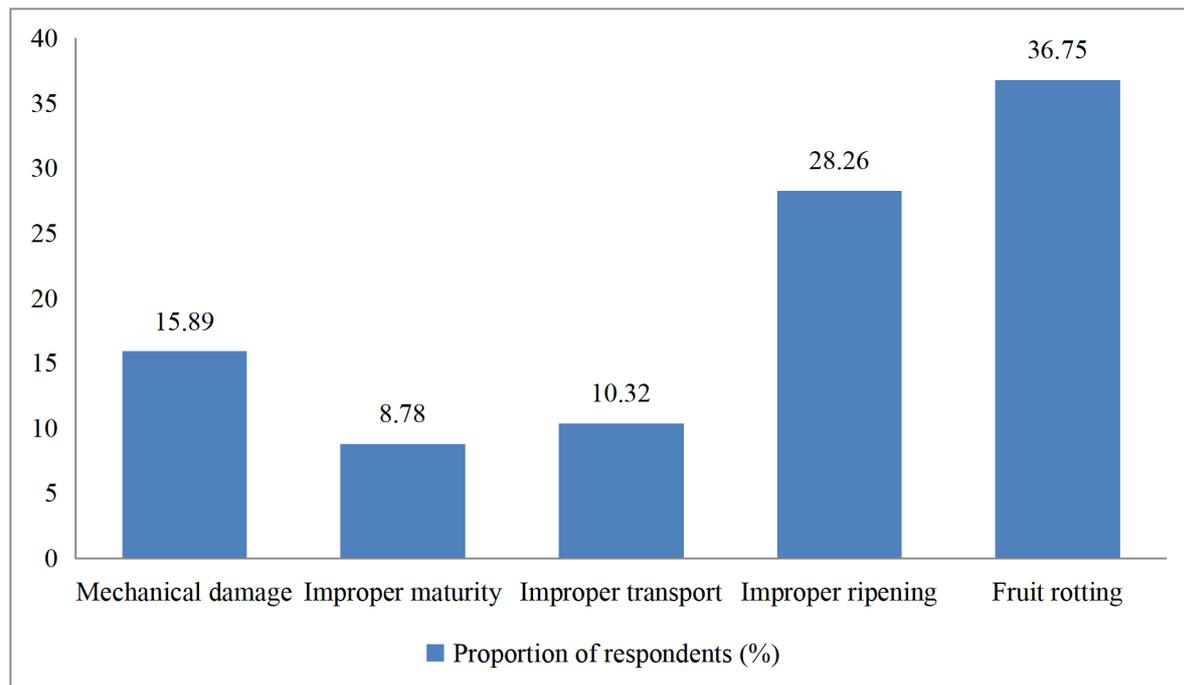


Figure 2. Causes of postharvest losses of banana at retail level

Banana handling practices at Wholesale level

Fruits reaching the wholesale market are off loaded and weighed before entering it to the ripening rooms. It was possible to observe during the assessment that labor handling during unloading was also very rough as they are in hurry just to finish their work. In the ripening room, majority of wholesalers (42.85%) respond that, fruit bunches are stacked horizontally and receive airtight smoke treatment using kerosene burners to initiate the ripening process. There is no temperature and humidity control in the ripening rooms except that rooms are ventilated for some time. They said that, the smoke treatment days vary between 1 to 3 depending on the weather condition, relatively shorter time when temperature is high. Treated fruits are sold to retailers where further ripening is also expected at the retail market. Bananas which are not sold immediately after heat treatment will be de-handled and kept for sale heaped on floor, covered with newspaper (40.5%), or kept on the shelf. Wholesalers (57.74%) responded to finish selling their bananas within 3 to 4 days while it takes 5 to 7 days for the remaining 42.26%. Wooden box was the major means of packaging material to transport banana fruit. For instance, 58.49% of wholesalers were responded as they used wooden box (Table 2).

Table 2. Banana fruit handling practices at wholesale market

Handling practices	Proportion of respondents (%)	
Packing materials to transport	Carton	10.23
	Wooden box	58.49
	Sacks	18.12
	Basket	6.2
	No packing	6.96
Ways of Ripening	Electric ampole +Kerosene	22.41
	Kerosene burners	42.85
	Covering with leafy materials	13.56
	Cover with madaberia (shera)	21.18
Days to finish selling	3-4 days	57.74
	5-7days	42.26
Days to ripening	1-3 days	48.7
	1 day	21.36
	2 days	29.94

Banana handling practices at retail level

Retailers use different types of packaging materials to transport and store banana. Majority of retailers (57.65%) use wooden boxes to transport their banana followed by baskets which accounts 25.4% of retailers are used this kind of materials and some retailers (2.58%) use no packaging to transport banana fruits (Table 3). Most of the

retailers (51.88%) use shera (madaberia) and leafy materials (20.96%) for ripening of their bananas. Most of the retailers (65.40%), it takes 2 to 3 days for ripening of banana fruits while it takes 1 to 3 days for 34.60% retailers. It takes 4 to 5 days for most of the retailers (53.45%) to finish banana selling followed by 7days and 2 to 3 days with 28.12% and 18.43% of retailers respectively.

Table 3. Banana handling practices at retail market

Handling practices	Proportion of respondents (%)	
Packing materials to transport	Carton	
	Wooden box	57.65
	Sacks	14.23
	Basket	25.54
Ways of Ripening	No packaging	2.58
	Electric Ampole+kerosene	9.75
	Traditional kerosene	17.41
	Covering with leafy materials	20.96
Days to finish fruit selling	Cover with shera(Madaberia)	51.88
	2-3 days	18.43
	4-5 days	53.45
	7 days	28.12
Days to ripening	1-2 day	34.60
	2-3 days	65.40

Training taken at wholesale and retail level

According to the respondents, 30% of wholesalers are taken training before they engaged to this job by governmental organizations while only 6.67% of retailers are taken training before they engaged to be retailers for banana marketing (figure 3). Both wholesalers and retailers wanted any training and support regarding to postharvest harvest handling of horticultural crops particularly for banana.

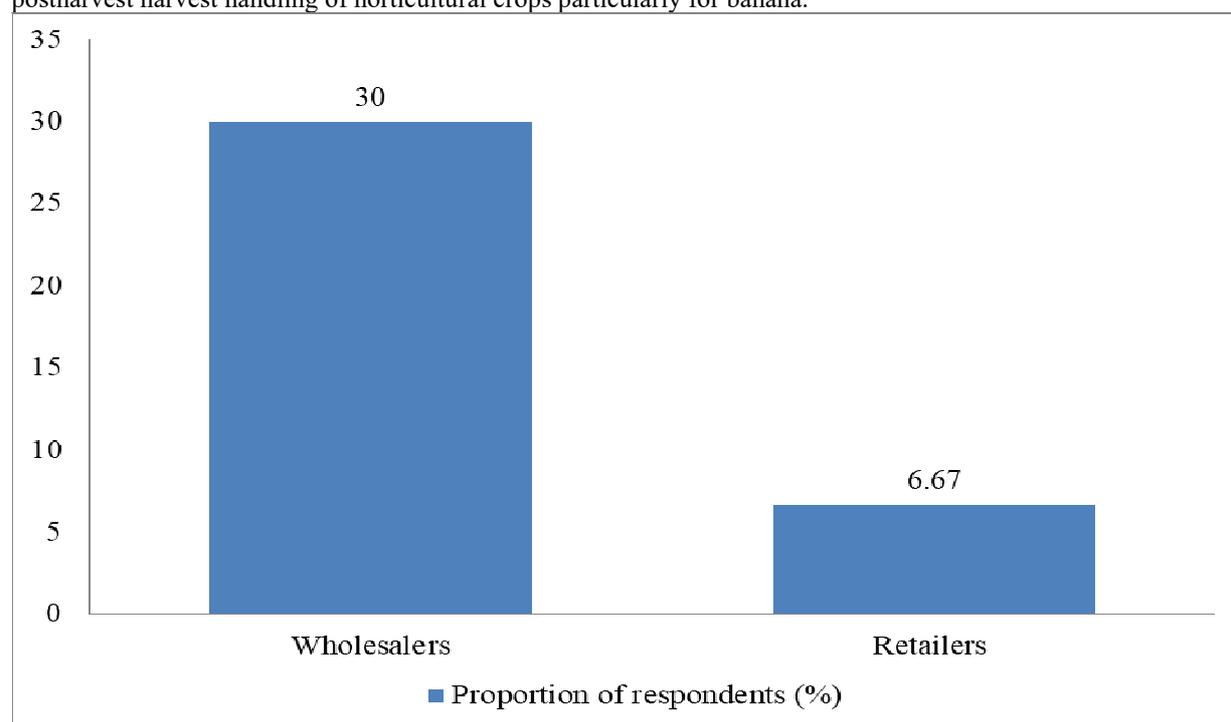


Figure 3. Wholesalers and retailers who were taken training so far

Summary and Conclusions

Banana (*Musa spp.*) is a crop of major economic importance in the world which belongs to the family Musaceae and genus *Musa*. Banana has multipurpose uses as food, feed, cash source and environmental conservation. It plays a very essential role in human nutrition and diet. It is the most nourishing fruit as it is a good source of potassium, magnesium, copper, manganese, vitamin C and B6. Banana is also a good source of energy, low in protein and fat content and has several medicinal properties. Its attractive texture and flavor make banana popular by the consumers. Almost all types of bananas produced in Ethiopia are consumed fresh and play an

important role in feeding the low income families as well as providing a source of income to them. The fact that it produces fruit throughout the year adds to its importance as a cash crop in the growing region

The study estimated postharvest losses of banana in the supply chain with the total loss found to be 26.5% of which more percent of the total loss being at the retail market (64.10%) and wholesale level (35.90%). Mechanical damage followed by improper transport and improper storage were identified as the main causes of banana loss at wholesale level while fruit rotting followed by improper ripening and mechanical damage were identified as the main causes to the loss of banana fruit at retail level. Despite the fact that poor postharvest handling during harvesting, transportation and marketing could have contributed more to the injuries noted, the respondent's perception for these factors to influence the loss was lower.

Based on the results and observations made during the survey, it seems that the current postharvest management system of banana both at wholesale and retail levels is inadequate. The postharvest management of banana has not been given sufficient attention in the area hence, fruit handlers lack information about postharvest handling practices. It was also observed that there is a knowledge gap between the respondents in their experience of proper fruit handling techniques. Therefore, in order to reduce the level of postharvest losses of banana in jimma market, focus should be given to postharvest handling practices. The loss can be minimized by awareness creation, education and training about the importance of postharvest losses, adopting better management operations, careful handling and packaging to the supply chain actors.

References

- Adeoye, I.B., Odeleye, O.M.O., Babalola, S.O. and Afolayan, S.O., 2009. Economic Analysis of Tomato Losses in Ibadan Metropolis, Oyo State, Nigeria. *African Journal of Basic & Applied Sciences*, 1 (5-6): 87-92.
- Anthony, S., Abeywickrama, K. and Wilson Wijeratnam, S., 2003. The effect of spraying essential oils of *Cymbopogon nardus*, *Cymbopogon flexuosus* and *Ocimum basilicum* postharvest diseases and storage life of Embul banana. *Journal of Horticultural Science and Biotechnology*, 78(6): 780-5.
- Azene, M., 2015. Post-harvest loss assessment and management of banana (*Musa spp.*) fruit. PhD Dissertation.
- Bathan, B.M. and Lanican, F. A. (2010). Factors Affecting Performance of Banana Farms in Oriental Mindoro, Philippines. *J.ISSAAS*, Vol. 16(1):110-120
- CFC (Common Fund for Commodities), 2004. Development of organic banana production and export in Sudan and Ethiopia to the Middle East and Europe. FC/CC/34/FISGB/10. Appraisal Report, Addis Ababa, Ethiopia
- CSA (Central Statistical Agency of Ethiopia). (2014). Agricultural Sample Survey. Report on Area and Production of Major Crops. Volume I, VII and VIII. Statistical Bulletin 578. Addis Ababa, Ethiopia
- Daniel Shamebo, D., 1999. Banana in the southern region of Ethiopia (SRE). In: Picq, C., Fouré, E. and Frison, E.A. (eds.), *Bananas and Food Security*, INIBAP, Montpellier, France. pp. 119-128.
- Debela, A., Daba, G., Bane, D. and Tolessa, K., 2011. Identification of major cause of Post-harvest losses among selected fruits in Jimma zone for proffering veritable solutions. *International Journal of Current Research*. Vol. 3.
- del Aguila, J.S., Heiffig-del Aguila, L.S., Sasaki, F.F., Tsumanuma, G.M., Ongarelli, M.G., Spoto, M.H.F., Jacomino, A.P., Ortega, E.M.M. and Kluge, R.A., 2010. Postharvest modifications of mechanically injured bananas. *Revista Iberoamericana de Tecnología Postcosecha*, 10(2): 73-85.
- Ethiopian Horticulture Development Agency, 2012. Annual Report. Addis Ababa, Ethiopia
- FAO (Food and Agriculture Organization of the United Nations), 2015. Production status.
- Frison, E.A., Escalant, J.V. and Sharrock, S., 2004. The global *Musa* genomic consortium: A boost for banana improvement. In: Jain, S.M. and Swennen, R. (Eds.), *Banana Improvement: Cellular, Molecular Biology, and Induced Mutations*. 24-28 September 2001. Leuven, Belgium.
- Frison, E.A. and Sharrock, S.L., 1999. The economic, nutritional and social importance of bananas in the world. In: Picq, C., Fouré, E. and Frison, E.A. (eds.), *Bananas and Food Security*, J. INIBAP, Montpellier, France. pp. 21-35
- George, J.B. and Mwangangi, B.M., 1993. Some factors affecting banana storage and ripening: a case study of banana handling and ripening in Kenya. In *International Symposium on Postharvest Treatment of Horticultural Crops* 368 (pp. 628-633).
- Getachew, D., 2004. Prevention of post-harvest food losses fruits, vegetables and root crops a training manual. Agriculture and Consumer Protection.
- Ilyas, M.B., Ghazanfar, M.U., Khan, M.A., Khan, C.A. and Bhatti, M.A.R., 2007. Postharvest losses in apple and banana during transport and storage. *Pakistan Journal of Agricultural Sciences*, 44(3), 534-539.
- Kahesaye, B., Puskur, R., Worku, T., Hoekstra, D. and Azage, T., 2010. Innovation in banana value chain development in Metema district, northwestern Ethiopia: Improving productivity and market success (IPMS) project experiences. *Acta Horticulture*, 879: Produced by Economic and Social Development
- Robinson, J.C. and Saucó, V.G., 2010. *Bananas and Plantains*. 2nd Edition. CAB International, UK

- Salvador, A., Arnal, L., Manterde, A. and Cuquerella, J., 2007. Reduction of chilling injury symptoms in persimmon fruit cv. 'RojoBrillante by 1-MCP, *Postharvest Biology and Technology* 33:285-281
- Tomek, W. G., and Robinson, K. L., 1990. *Agricultural Product Prices* (3rd ed.,). Cornell University Press, New York, pp. 107-108
- Turner, D.W., 2001. Bananas and plantains. In: Mitra SK. (ed.). *Postharvest physiology and storage of tropical and subtropical fruits*. CABI Publishing, UK, pp. 45-77.
- Wanjari, V. and Ladaniya, M.S., 2004. Marketing of banana in selected districts of India. *Tropical Agricultural Research and Extension*, pp.126-133.
- Woldu .Z, Mohammed .A, Belew .D, Shumeta. Z. and Bekele, A., 2015. Assessment of Banana Production and Marketing in Ethiopia. *International Journal of Sciences: Basic and Applied Research (IJSBAR)* Volume 24(3), pp. 283-307
- Woldu .Z, Mohammed .A, Belew .D, Shumeta. Z and Bekele. A .2015. Assessment of Banana Postharvest Handling Practices and Losses in Ethiopia. *Journal of Biology, Agriculture and Healthcare* .Vol.5(17)
- Zhuang, J.P., Su, J., Li, X.P. and Chen, W.X., 2006. Cloning and expression analysis of beta-galactosidase gene related to softening of banana (*Musa sp.*) fruit. *Zhi wu sheng li yu fen zi sheng wu xue xue bao* or *Journal of plant physiology and molecular biology*, 32(4), pp.411-419.