



POST-HARVEST LOSSES OF TOMATO CROP (*Lycopersicon esculentum* Mill.)

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ABSTRACT

Tomato production and amount consumed increase with the increase in the population growth. In terms of value and rate of consumption, tomato is reported as one of the leading horticultural crops worldwide. Post-harvest losses in tomato are influenced by factors like; lack of appropriate production techniques, poor or non-application of the pre-harvest recommended treatments, lack of absolute care during harvesting, bulk packaging without cleaning, sorting and grading of the produce, inappropriate storage facilities and method, bad transportation systems, distance of distribution point/market and time taken to reach the final consumer. In the local and global supply chains fruit and vegetables, tomato are gaining importance with increase in consumption at local markets and generating revenues from exports. The supply chain is considered as a large system comprising several organizations together with the relationship between them aimed to improved quality and sufficient food production in an economically and socially sustainable way and reduces postharvest losses of fruit and vegetables. Value chain is the series of activities required in moving a product from origin through the different phases of production to deliver to final consumers. Considering both the supply and value chain as trend and drivers of global food security more especially in the aspect of fruit and vegetable, will alleviate the production constraint and minimize post-harvest losses.

Keywords: Postharvest Losses, Tomato, Value chain, Supply Chain.

INTRODUCTION

Tomato (*lycopersicon esculentum* MILL.) is widely classified as one of the most important cultivated vegetable in the world. The crop duration is relatively short but its produce a maximum yield which makes it more economically attractive. (van Dam et al., 2005). In many part of the world tomato is considered as an industrial and important cash crop because it has high yield and millions hectares of land are used for its cultivation. (Babalola et al., 2010). The crop is growing rapidly with a growing period of 90 – 150 days. The most favourable Daily average growth temperature is between 19 – 25°C with night temperature between 10 – 25°C. The crop is very sensitive to frost and high temperature (Rees et al. 2012). The crop yield decreases with temperature above 25°C more especially when accompanied by high humidity and strong wind. Poor fruit formation and excessive vegetative growth are caused by night temperature above 20°C along with high humidity and low sunshine (Naika et al. 2005; Bergougnux 2013). Pest and diseases attack as well as fruit rotting are associated with high humidity. Thus, a successful tomato production required dry climate (FAO 2013). Tomato grows well on most mineral soils, but preferably deep, well-drained, sandy loam soil with a wide range of pH 5.5 – 6.8, and adequate nutrient supply (Naika et al. 2005), also a well-drained, light loam soil with a pH of 5 – 7 (FAO 2013), attributed with aeration, water holding capacity, and free from salt. Deep ploughing guarantees better root penetration in the case of heavy clay soils (Rees et al. 2012, Naika et al. 2005). Bacteria and fungi are the two major classes of microorganism that causes tomato rot. However, some certain species of plant pathogen like virus and nematode may be responsible for post-harvest disease and losses, but do not cause progressive deterioration of tomatoes (Bartz et al. 2004; Agrios 2005). Bacteria are single celled microbes, they reproduce asexually by fission, which rapidly multiply and spread, especially with a supportive medium like water. A thin layer of water can sustain the brisk movement and growth of the organism on wet or moist materials such as tomato fruits, leaves or packing house machineries (Bartz et al. 2004).

The crop is one of the most commercially viable of all agricultural commodities due to its general popularity and health benefits (Richardson 2013). Tomatoes have significant nutritional value and are an important

source of vitamin A, B and C (Bugel 2003), as well as potassium, iron and calcium (UNCTAD 2012), a source of essential nutrient which have a positive impact on human health such as lycopene, β - carotene and vitamin C (Bergougnux 2013), it is also source of minerals, essential amino acids, sugar and dietary fibres, and plays a vital role in a well-balanced diet of human consumption (Naikaet al. 2005). The fresh tomatoes are not only traded in the market, but also used in the processing industries in soups, as a paste, ketchup's, juices and concentrates (Bergougnux 2013). Tomatoes are eaten in different forms fresh in salad or processed into soups and other products, some other processed product like canned and dried tomato have much economic value when used to prepare different dishes (Naikaet al. 2005). Tomato production and amount consumed mostly increase with the increase in the population growth. In terms of value and rate of consumption, tomato categorically reported worldwide as one of the leading horticultural crops. (Rees et al., 2012). Since the dawn of history fresh fruit and vegetable have been part of the human diet. Fruits like tomato plays a significant role in the life of many consumers, because it is reach in providing required vitamins and minerals and also adding flavor, color, and variety to the diet. (Wills et al., 2007).

BACKGROUND OF THE REVIEW

HARVESTING OF TOMATO

Tomato can be harvested with hand by gentle twisting of each fruit from the vine without tearing or pulling, and mostly in the morning hour, when the temperature is cool, for that will allow the farmer to supply fresh fruit to market. After harvest, tomatoes should not be left in the sun's rays for a long period of time as this will affect the product quality. (Rees et al., 2012). During harvesting the ripening conditions (while green or when they are red) and the end use of the tomato have to be considered by the farmer to enable him to maintain the nutritional value of the product and reduce the rate of losses either by damage or deterioration. The fruit is at high risk of post-harvest losses due to its water content and when the fruit is over-matured. Therefore, it is necessary and important for farmers to consider harvesting time and post-harvest treatment of tomato, because these will help to reduce the rate of post-harvest damage. (van Dam et al., 2005).

POST-HARVEST LOSSES

Food losses occurring during post-harvest and marketing system pose a great set back to the availability of fresh food particularly in some developing countries, because roughly half of the inhabitants in the third world experience shortage of food supplies, even though significant progress has been made in increasing food production worldwide. It has been reported that, post-harvest losses of tomato, citrus fruit, banana and sweet potatoes as high as 50%. The global post-harvest losses figure has been estimated to be 25% or 28 – 42% while for less industrialized countries it is 15 – 60% or 15 – 50%. This result shows that almost half of the food produced never reaches the final consumers due to post-harvest losses leading to labour waste and retard the economic status. (Rehman et al., 2002). In the tomato supply chain research was conducted at Cambodia on post-harvest losses in both traditional and modern supply chains and it was found that there were 23% losses in the in traditional supply chain compared with 22.5% in modern supply chain. However the modern chain had more severe quality requirements which offered a higher price than the traditional chain. Immaturity, insect pests and disease are pre-harvest factors that cause spoilage and increase rates of farmer's losses, while physical injury, rotting, weight loss, and over ripening are losses encountered during subsequent handling. In the traditional chain an attempt has been made to improved individual handling techniques in the case of improved packaging, pre-cooling and sanitizing treatment to ensure decreased in post-harvest losses. Tomato injury which accelerates the rate of deterioration at the whole sale and retail stages can be minimized with the use of 20kg capacity plastic crates with a recommended thickness, low density polyethylene bagging and 20kg capacity baboon basket lined with newsprint. In the modern chain an attempt was also made under simulated supermarket conditions (15°C) using a modified atmosphere packaging (MAP) comparing low density polyethylene (LDPE) and 11µm-thick film overwrap. Tomato fruit ripening and weight loss where relatively inhabited to that in the surrounding (24 - 33°C, 65 - 92%RH). Hence based on this result it is essential to apply the introduced handling techniques (improved packaging, pre-cooling, and

sanitizing treatment) to minimize post-harvest losses in the tomato supply chains. (Buntong et al., 2013).

Basically among perishable products like fruit and vegetables of which tomatoes are typical, post-harvest losses occur between harvest and consumption in developing and lower income countries and are higher with an estimate of 50% losses. In the local and global supply chains fruit and vegetables more especially tomato are gaining importance with increase in consumption at local markets and generating revenues from exports. Hence a supply chain may be considered as a large system comprising several organizations together with the relationship between them and if followed critically and orderly it improved quality and sufficient food production in an economically and socially sustainable way and reduces post-harvest food losses worldwide. While the series of activities required in moving a product from origin through the different phases of production to deliver to final consumers and to be disposed of after used is termed as the value chain. Considering both the supply and value chain as trend and drivers of global food security more especially in the aspect of fruit and vegetable, will alleviate the production constraint worldwide and minimize post-harvest losses. Figure 1 below show a schematic example of a supply chain for fruits and vegetables with its subsequent activities and effect on the product economic value and use of energy. (Aramyan and van Gogh, 2014)

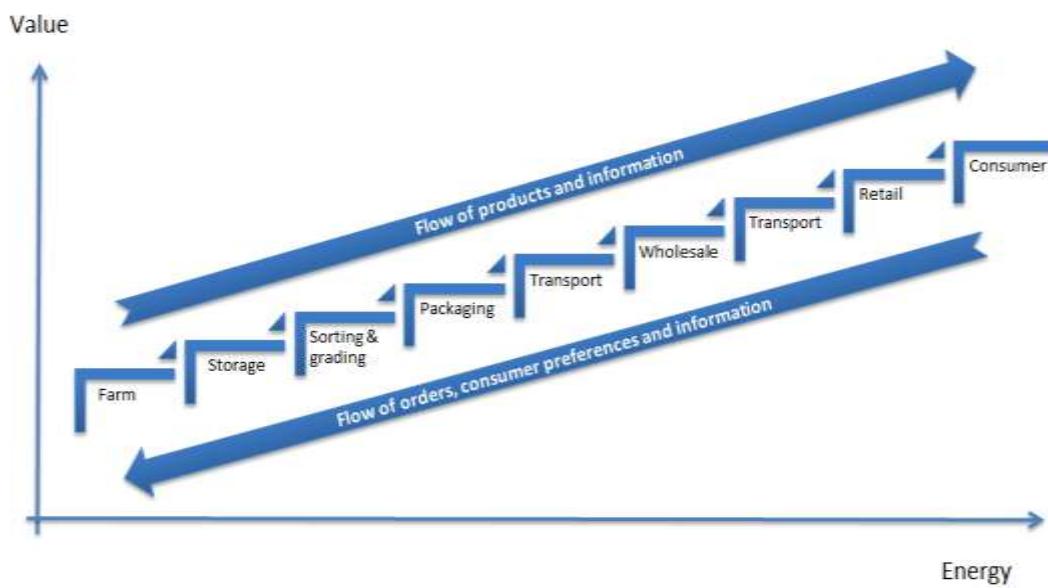


Figure 1: Steps and additional effect in the supply chain (value and energy wise).

Source: Aramyan and van Gogh, 2014

POST-HARVEST HANDLING OF TOMATO

Inappropriate post-harvest handling, storage, and shipping conditions are some of the factors that highly affect the fresh tomato, for optimum product quality it is necessary to adopt appropriate pre-harvest and post-harvest handling in tomato farming system which will warrant a profitable marketing. (Rees et al., 2012). Management of handling conditions and controlling the storage environment are important factors in reducing post-harvest losses. The rate of deterioration in post-harvest increases with the effect of exposure to high temperature which is one of the most important environmental factors. (Wills et al., 2007). Post-harvest losses in tomato are mostly influenced by factors which include; lack of appropriate production techniques in the farming system (selection of varieties with short shelf life, poor control measures for insect pests and disease infestation and abiotic stresses), poor or non-application of the pre-harvest recommended treatments, lack of consideration of time factors, stages to follow, and absolute care during harvesting, bulk packaging without cleaning, sorting and grading of the produce, inappropriate storage facilities and method, bad transportation systems, distance of distribution point/market and time taken before reaching the final consumer. Because of the great losses encountered by tomato growers, processors and dealers really lead to low returns, and the country also experience earning setback in terms of foreign exchange. (Rehman et al., 2002).

TOMATO CONTAINER

Tomato picking containers include nylon, net bags or plastic buckets, the containers needs to hold only tomato that are matured, ripe and free from damage. The picked tomato in the picking container should be emptied in to the larger container positioned at the collection area and must not be more than 25kg because of frequent transportation to the sorting area on the farm, physical damage or bruises due to over loading must be avoided

to ensure quality product. (van Dam et al., 2005). Tomato containers like plastic crates, polythene bag and lined bamboo basket when used during tomato harvest carefully reduced post-harvest losses. (Buntong et al., 2013). Harvesting containers in the field must be easily handled and workable which include; baskets, plastic field boxes (Figure 2), buckets, carts, wooden crates (Figure 3) and polythene bags. Even with the use of a good container care must be taken in handling both the container and the content in a systematic and recommended manner to ensure the product quality (FAO 2003).



Figure 2: plastic field box.

Source (FAO 2003)



Figure 3: Wooden crates.

Source (FAO 2003)

SORTING, CLEANING AND GRADING OF TOMATO

For sorting, cleaning and grading of tomato several machine may be used. Sorting canals are long water containers in the reception area which are used for efficient sorting and cleaning of tomato. They have numerous advantages during handling operation. The dried tomato coming out of the sorting canal should cautiously be placed in containers for onward distribution. Grading refers to the arrangement of tomato based on their consistent sizes, economic value, physical and quality characteristic. If sorting, cleaning (washing) and grading where observed critically during post-harvest handling that guarantee a quality product, create customers and producers confidence and maximize profits. (van Dam et al., 2005). Post-harvest product handling is one of the main courses of post-harvest losses, such as absence of sorting and grading in the post-harvest chain, low technological level in post-harvest handling, use of outdated equipment and creating inefficiency are major contributing factors that

lead to increase in post-harvest losses during handling. (Aramyan and van Gogh, 2014).

TOMATO PACKAGING MATERIALS

Good tomato packaging protects it against natural predators, pathogens, moisture loss, bruising, crushing and deformation. The quality of tomato, aesthetic value and market price will be affected if poorly package. Tomato packaging depends on its end use like fresh tomato, dried tomato to processed tomato. Packaging is necessary for handling, transporting and storing tomato. Some of the common packaging materials include: large green leaves, clay pots, baskets, wooden crates, cardboard crates, card board boxes, glass jars, plastic bottles, tins etc. (van Dam et al., 2005). Post-harvest handling losses occur if the packaging is not suited for long term storage or long distance transportation. The used of local materials with no good design in traditional packaging causes a lot of product loss during handling, storage and transportation. (Aramyan and van Gogh, 2014). The main quality of modern packaging material is that during handling, stacking, and transportation the packaging materials should posses' sufficient mechanical strength to protect the product against other external forces and reactions. Some of the packaging materials used include; fibered board boxes (cartons), wooden crates, pallet boxes and shipping containers, flexible sacks, plastic crates and baskets (FAO 2003). Tomatoes are fragile fruits, if not handled and transported cautiously they easily perish and their taste, flavour and nutritional value will be affected. Therefore, it is recommended for tomato growers to send them to the market immediately after harvesting so that they will maintain the product quality and guarantee a profit marketing for the farmer. (van Dam et al., 2005).

SUMMARY

The major factors influencing post-harvest losses include; poor pre-harvest measures where most of the farmers are ignorant of the new technology and they find it very difficult to adopt and effect changes on their normal system of farming. Some of this new farming technology involve the use of new improved varieties with maximum shelf life,

consistency in the used of fertilizers as to improve soil nutrient content as recommended by the producers and/or specialist and control of insect pest and disease is also another major challenge faced by tomato growers because of it nature and durability. Hence there is need of campaign and awareness to the tomato producers for the new technological system of farming to enable a sufficient and quality tomato, in same vain to minimize rate of post-harvest losses worldwide.

Another factor is that most of the tomato farmers at local level does not give consideration on harvesting time and possible stages in the harvesting period as such much losses where encountered. Because tomato does not all ripe at same time that means there is need for schedules for harvesting, and if followed critically it retard the rate of tomato losses at harvesting stage. Main while post-harvest handling practice is also one of the most sensitive area and if manage properly, certainly bounty of tomato losses will be reduce. Some of the handling processes involve collection of the tomato at farm, sorting, cleaning, grading, packaging with recommended packaging materials that will ensure aesthetic value, safe transportation and free storage hazard, also guarantee profitable marketing.

In the local and global supply chains fruit and vegetables more especially tomato are gaining importance with increase in consumption at local markets and generating revenues from exports. The supply chain may be considered as a large system comprising several organizations together with the relationship between them and if followed critically and orderly it improved quality and sufficient food production in an economically and socially sustainable way and reduces post-harvest food losses worldwide. While the series of activities required in moving a product from origin through the different phases of production to deliver to final consumers and to be disposed of after used is termed as the value chain. Considering both the supply and value chain as trend and drivers of global food security more especially in the aspect of fruit and vegetable, will alleviate the production constraint worldwide and minimize post-harvest losses.

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