Post Harvest Losses and Changes in Quality of Vegetables from Retail to Consumer: A Case Study of Tomato and Cabbage Farming in Endebess Sub County, Kenya

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Abstract- Tomato is an important vegetable crop in Kenya. It is widely grown for home consumption and for sale. The demand for fresh tomato is high both for domestic use and markets. However, tomato post-harvest losses are a threat to the harvested tomatoes. The purpose of the study is establishing the effect influence of Packagingon tomatoes from Retail to Consumer: A Case Study of Tomato and Cabbage Farming in Endebess Sub County, Kenya. Descriptive design was used to operationalize research methodology. From this study, it was concluded that poor packaging methods and facilities affects the quality and hence losses in the market. It was recommended that the county government should establish cooling centers in every ward to cushion farmers from incurring losses before transporting their produce to the market. The county government too should build large coolants in the market places to handle the produce once it reaches the markets. In so doing, the post-harvest losses will be mitigated. The study further recommends that farmers should avoid lining their crates with papers to increase aeration in the crates while transporting the produce. The study also recommends that farmers should grade their produce thoroughly by separating the infected tomatoes and cabbages from healthy ones, separate in terms of size and ripening level to reduce on the post-harvest rots.

I. INTRODUCTION

Tomato (*Solanum lycopersicum* L.) belongs to the family *solanaceae* and it is an annual sub-tropical fruit vegetable crop. The crop originated from South America and was introduced to Europe in the 16th Century and later to East Africa by colonial settlers in early 1900 (Wamache, 2015). In Kenya, tomato plays a vital role in meeting domestic and nutritional food requirements, generation of income, foreign exchange earnings and creation of employment (Sigei*et al*., 2014).

Postharvest handling is a set of operations undertaken from the time of harvest up to the time just before consumption or just before processing. According to FAO (2004), in developing countries postharvest losses of fruits and vegetables are more serious than those in well developed countries. Postharvest losses of fruits and vegetables are estimated 5-20% in developed country and 20-50% in developing countries (Mashav 2010). The perishability of the product, which is very high for fruits and vegetables; the bulkiness of the product, which adds to transportation inconveniences, storage and labor cost; the quality of the products such as color, freshness, smell etc. (Mbuk et al. 2011).

Postharvest handling procedures are not fully recognized in less developed countries until 1989 (FAO 1989). Surveys have revealed that a substantial portion of the harvest is wasted in the region annually due to improper harvesting and postharvest practices, disease, pest and lack of facilities and technology to extend their storage life. This continues to cause heavy losses in revenue to the growers, wholesalers, retailers and exporters and inconvenience to the consumers and lowers export potential of these commodities (Damunupola 2011). The middlemen/brokers collect the produce from the farm and bring it to the wholesale market using cow driven carts. In Myanmar, handling practices are unsystematic and postharvest technology is

insufficient, except water washing and cleaning the harvested produce.

Consumption of vegetables is important for preventing non- communicable diseases (NCD) including malnutrition and obesity related disorders (FAO, 2010; Kitinoja, 2010; Keatinge et al., 2011). Nevertheless, accessibility to a vegetable rich diet remains a challenge. This is primarily a problem in the developing world. In Kenya and in other developing countries, addressing the problem of food and nutrition security remains a key priority. At least 2 – 3 billion people are estimated to be suffering from malnutrition across the globe, while 925 million people suffer from hunger, representing almost 16% of the population of developing countries (FAO, 2009; FAO, 2010).

Kenya is among the Africa's leading producer of tomato and is ranked 6th in Africa with a total production of 397,007 tones (FAO, 2012). HCDA 2013 stated that the major tomato production area in Kenya is Kirinyaga County producing 14 % of the total produce. Other major tomato producing Counties in Kenya Kajiado (9 %), TaitaTaveta (7 %), Meru (6 %), Bungoma and Kiambu (5 %), Migori and Makueni (4 %), Homa bay and Nakuru(3 %) and Machakos (2 %).Tomato production in Kenya accounts for 14 % of the total vegetable produce and 6.72 % of the total horticultural crops (Gok, 2012). The crop is grown either on open field or under greenhouse technology. Open field production account for 95 % while greenhouse technology accounts for 5 % of the total tomato production (Seminis, 2017).

Postharvest losses of cabbage at retail purchasing were 21.21% on average. The estimated volume of this loss is around 21 950 t. Based on the average individual requirement of at least 2000 kcal (8374 kJ) per day (Story & Stang, 2015), the total volume of these physical losses at national level could meet the daily dietary energy needs of at least 84 200 people for a whole month. In addition, the cabbage lost could meet the daily vitamin C (75 - 90 mg/day) needs of at least 72 629 individuals for a whole year (Story & Stang, 2005; Marcoe *et al.*, 2006; Maillot *et al.*, 2007).

II. PACKING OPERATIONS

Trimming the outer leaves (wrapper leaves) of cabbages are trimmed off except for 3-4 wrapper leaves to protect the head from injuries during handling and transport (Bautista and Acedo 1987). However, wrapper leaves could not fully protect the head from too much force due to impact or compression, which usually results in head bursting.

According to Kader (2006)cabbages and cauliflower, washing is not advisable since it could favor bacterial soft rot if they are not properly dried. The inner edible part is kept clean by the wrapper leaves. Most leafy vegetables are washed in clean water to remove dirt and other debris and surface contaminants. This is especially important during rainy weather as the produce is often contaminated with soil.

According to Bautista and Acedo (1987) sorting is done to separate poor produce from good produce, and further classify the good produce based on other quality parameters, such as size. Systematic grading coupled with appropriate packaging and storage will extend postharvest shelf life, wholesomeness, freshness, and quality, and will substantially reduce losses and marketing cost. Most vegetables are usually sorted/ graded based on maturity, size, shape, color, weight, and freedom from defects such as insect, disease, and mechanical damage. Cabbage and cauliflower are graded usually based on size that means the diameter of the head.

According to Kader (2006) developing countries, implementation of grade standards as well as safety standards for leafy vegetables and other fresh horticultural produce faces formidable difficulties that contribute to the lingering problem of high postharvest losses. Grade standards, if enforced properly, are essential tools of quality assurance during marketing. They provide a common language for trade among farmers, handlers, processors, and marketers, maintain orderly marketing and equity in the market-place, and protect consumers from inedible and poor quality produce.

Bautista and Acedo(1987) opine that proper packing is essential to maintain the freshness of leafy vegetables. Packaging should be designed to prevent

deterioration of product quality, in addition to serving as a handling unit. As protection, packages should prevent or reduce physical injury to the produce during transit and handling, provide ventilation to hasten cooling and escape of heat caused by respiration, and reduce water loss from the produce (Gast 1991). Some packages promote sale of the produce.

III. RESEARCH METHODOLOGY

According to (Bryman and Bell, 2015), a research design is a strategy for data collection and analysis to generate answers to the research problem. This study will employ a descriptive survey design. In this study the target population was 300 framers in Endebess Sub County and 3 sub county agricultural officers.. The study adopted a 30% of the total population being 90 respondents. This was supported by Mugenda and Mugenda (2011) who states a 30% of the study population is sufficient for data.Data collection instrument that were used in the study included questionnaires observation schedules and oral interviews.Content validity of the research instruments was established through consulting experts who advised on development of appropriate questions for questionnaires, interview guide and the observation schedule. Quantitative data gathered from closed ended questions was post-coded first and organized into similar themes as per the research questions. It was analyzed, tabulated and presented by using descriptive statistics. To integrate qualitative data gathered from open ended questions, tallying of similar responses of each item were done. Frequency counts were made of all respondents making similar responses. Results of data gathered from closed ended and open items were presented in frequency tables, percentages, means, tabulations and graphs and explanation of the findings made based on themes. The information from the interview schedules was subjected to content analysis to describe, decode, translate, and develop understanding through a detailed description of the situation and presented in themes alongside the quantitative analysis

IV. RESULTS

- Packaging

The study sought to establish the packaging materials used before the fresh produce is taken to the market. Figure 3 shows the farmers' responses. The responses of the farmers were recorded in table 1.

Table 1: Packaging materials

Type of material	Tomatoes	Cabbages
Sacks	0%	100%
Cartons	89%	11%
Wooden Crates	100%	0%
Plastic Crates	86%	14%

Table 1show that all tomato farmers 100% use wooden crates in packaging their tomatoes while all farmers of cabbages use sacks in packing their cabbages to the market. 86% and 89% of the tomato farmers use plastic crates and carton respectively. Only 11% and 14% of the cabbage farmers use cartons and plastics crates respectively implying the low level use of proper packing methods hence, losses in the transportation value chain to the market. The study further sought to find out whether the farmers use layers in the packaging of tomatoes and cabbages. Results indicated that 100% of the farmers do not use layers in separating the packing of goods to the market. This could be one of the reasons of post-harvest of tomatoes and cabbages.

- Damage rate due to Packaging, Transportation and Storage

The study wanted to establish the approximate losses points in respect to packaging, transportation and storage. Their responses were recorded in the figure below.

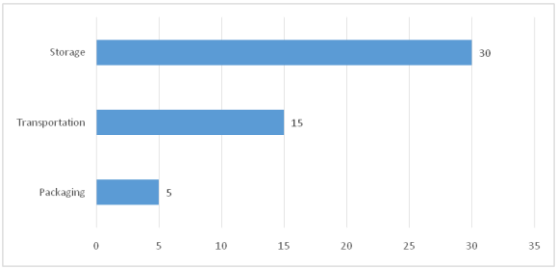

Figure 2: Damage rates between packaging, transportation and storage

From figure 2, it was observed that major losses 30% are incurred during storage stage of post-harvest losses, 15% during transportation while 5% during packing. This was a clear manifestation that much as post-harvest losses are incurred throughout the value chain, major losses are incurred during storage as the goods await the markets.

CONCLUSION

From the findings of the study, it is concluded that poor packaging methods and facilities, leads to postharvest losses as the vegetables reach the market

RECOMMENDATIONS

This study recommends that:
From the study findings, it was recommended that the county government should establish cooling centers in every ward to cushion farmers from incurring losses before transporting their produce to the market. The county government too should build large coolants in the market places to handle the produce once it reaches the markets. In so doing, the post-harvest losses will be mitigated.

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