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Research Paper

Common Causes and Prevention of Post Harvest Losses in Fruits and Vegetables

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ABSTRACT
The quality of fruits and vegetables is generally impacted by the period of time and storage conditions they are subjected to between harvest and consumption. Careful handling of fresh produce is greatly important as they are living tissue and therefore continue to be physiologically active even after harvest. The respiration rate of fruits and vegetables, together with the various processes applied to them eventually impact the final quality. Nonetheless, a decrease in the quality of fresh produce is harmful as it leads to postharvest losses (consumer unacceptability or waste). Postharvest losses usually stem from bruising, decay, water loss, chilling injury and excessive softening due to improper maturity at harvest. These losses are majorly the resultant effect of improper handling, damaging fruit tissue, insufficient cooling, along with failure to maintain ideal storage temperature, as well as failure to sort and remove low quality items along with inappropriate packaging materials and methods. However, there have been proven actions/ processes performed on fresh items to maintain quality and safety of the harvested fruit in order to extend their shelf-life; these are generally referred to as postharvest treatments.
KEYWORDS: *Postharvest losses; Postharvest preservation; Fruits and Vegetables.*

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I. INTRODUCTION

Commercially and nutritionally, fruits and vegetables constitute an important and indispensable part of food commodity worldwide. In like manner, they play an indispensable role in human nutrition by supplying the necessary growth factors such as essential minerals and vitamins in our daily diet which helps us to keep a good and normal health. Fruits and vegetables are widely distributed in nature, however a major limiting factor that influence their economic value is their relatively short shelf-life brought about by pathogenic attacks. Research has shown that about 20-25% of the harvested fruit gets decayed by pathogens during post-harvest handling both in developed and developing countries (Zhu, 2006; Ara et al, 2012.), although, postharvest losses are often more severe in developing countries, due to inadequate storage and transportation facilities.

Safe consumption of fruit and vegetable is essential for a healthy diet. Although the produce is usually safe on its own while growing, it can however become contaminated throughout the farm-to-fork continuum with harmful microorganisms which includes viruses, bacteria, and parasites, that can in turn cause illness (pathogens) of various sorts. A foodborne illness, which most often is referred to as "food poisoning," can occur through consumption of contaminated foods. The risk of foodborne illness from the consumption of fresh fruits and vegetables is often on the high side because they are generally eaten raw or minimally processed, frequently lacking a kill step (e.g cooking) which destroys pathogens. (Sara et al., 2016)

Fruits and vegetables are made of living tissues which must be kept alive and healthy throughout the value chain process. These thousands of living cells continuously require care and maintenance throughout the handling processes. Biological processes impact the quality of fresh produce and are thus responsible for their deterioration process. Biological factors include rate of respiration, sprouting, rooting, changes in colour, changes in flavour, changes in texture, changes in nutrition, ethylene production, water loss, and pathological

deterioration. While biological processes are innate to fresh fruits and vegetables, the rate of biological processes is affected by environmental factors such as relative humidity, temperature, velocity of the air, and composition of gases in the atmosphere (Kader, 2005, Kiaya, 2014). Hence, harvested produce is continually deteriorating. Recognizing proper handling practices and storage conditions is therefore essential since decreases in quality leads to waste and unacceptability of fresh produce to the consumer.

CAUSES OF POSTHARVEST LOSSES

According to Flores, 2000, postharvest losses in fruits and vegetables has been classified as those from physiological origin and those of technological origin (deterioration by biological or microbiological agents, and mechanical damage.)

Physiological deterioration of fruits and vegetables refers to the aging of products during storage as a result of the natural reactions that takes place in them. In the case where deterioration is brought about by reactions caused by biochemical or chemical agents, there is usually a significant loss of nutritional value of both the intermediate and final products, resulting in undesirability of whole fruit or vegetable. (Flores, 2000)

Technological losses include poor storage conditions, cultural practices, inadequate handling during transportation and unfavourable climate, all of which can accelerate the rate of product decay such as weight loss from product dehydration. (Flores, 2000)

Microbiological deterioration are losses caused by insects, yeasts, bacteria, viruses, moulds, rodents, and other animals. When fruits and vegetables are packed into boxes, crates, baskets, or trucks upon harvesting, they usually become subjected to cross-contamination by spoilage microorganisms from the containers and also from other fruits and vegetables. According to Hodges et al., 2011, biological spoilage stands out as the main cause of postharvest loss in developing countries.

Mechanical damage is accrued from inappropriate methods employed in harvesting, packaging, and transporting. These would normally result in tissue wounds, abrasion, breakage, squeezing of the fresh fruits or vegetables. These damages in turn accelerate the susceptibility of the produce to the growth of microorganisms and decay. Proper washing for example, can reduce the microbial load; although its likelihood to further distribute spoilage microorganisms, and moisten the surfaces of the produce to permit growth of microorganisms during holding periods is also high (Alzamora et al., 2000).

Postharvest losses can also result from using low quality seeds and materials. When there is a lack of quality material, farmers utilize whatever materials are available which could be the wrong variety or poor quality (Kitinoja and Kader, 2015)

Meanwhile, fungal contamination has been identified as another important factor in postharvest losses Fungal fruits infection, which is about the most prevalent, may occur during the growing season, harvesting, handling, transport and post-harvest storage and marketing conditions, or after purchasing by the consumer. Overall, fruits contain high levels of sugars and nutrients element and their low pH values make them particularly desirable to fungal decay (Singh and Sharma, 2007).

The high concentration of various sugars, minerals, vitamins, amino acids, and low pH also enhances the successful growth and survival of various parasitic and saprophytic forms of fungi in fruits (Droby, 2006) which has been associated with spoilage fungi classified as either toxigenic or pathogenic (Zhu, 2006). Toxin-producing fungi have been identified and isolated from spoiling fruits by previous researchers (Parvathi and Reddy, 2020), although during refrigeration some moulds may produce mycotoxins (Al-hindi et al, 2011).

On the other hand, however, pathogenic bacteria such as Escherichia coli O157: H7, Aeromonas hydrophila and Listeria monocytogenes, have also been reported to exist in both fresh and minimally processed fruits and vegetable products. These pathogens have been reported to cause infections and allergies (Tafinta et al, 2013).

Saprophytes, such as coryniforms, lactic acid bacteria, spore-formers, coliforms, micrococci, and pseudomonas, derived from the soil, air, and water, have been discovered to be the most prevalent microorganisms present in fresh vegetables. Although, Pseudomonas and the group of Klebsiella-Enterobacter-Serratia from the enterobacteriaceae are the most frequently encountered. Due to the acidity of raw fruits, the primary spoilage organisms are fungi, predominantly moulds and yeasts, such as Sacharomyces cerevisiae, Aspergillus niger, Penicillum spp., Byssochlamys fulva, B. nivea, Clostridium pasteurianum, Coletotrichum gloesporoides, Clostridium perfringes, and Lactobacillus spp. Some psychrotrophic bacteria such as Erwina carotovora, Pseudomonas fluorescens, P. auriginosa, P. luteola, Bacillus species, Cytophaga jhonsonae, Xantomonas campestri, and Vibrio fluvialis, also thrive in vegetable products. (Alzamora et al., 2000).

Postharvest losses can also occur due to social and economic reasons such as lack of policies capable of facilitating and encouraging utilization and administration of human, economic, technical, and scientific resources to prevent the deterioration of commodities; inefficient human, economic, and technical resources for developing programs aimed at prevention and reduction of post-harvest food losses; unknown knowledge of technical and scientific technologies associated with preservation, processing, packaging, transporting, and

distribution of food products; and inefficient commercialization systems, and absent or inefficient government agencies in the production and marketing of commodities, as well as a lack of credit policies that address the needs of the country and participants (Flores, 2000)

Overall, it is estimated that between 49 to 80% of a particular produce/commodity harvested per time goes to consumers while the difference gets lost in the course of the several steps that comprise the harvest-consumption chain. (FAO, 2004)

POSTHARVEST PRESERVATION

Postharvest preservation entails various processes/techniques employed upon harvest in handling and treating food with the core motive of controlling its spoilage by stopping the attack and growth of food borne disease-causing microbes in order to avoid oxidation of fats and in turn maintain the texture, flavour, and nutritional value of the food (Lianou A., et al. 2016).

Proper storage of fruits and vegetables therefore becomes of paramount importance if postharvest losses are to be minimized as only adequate preservation techniques can prevent microorganisms of all kinds from thriving within the fresh produce. Some postharvest techniques that have been employed in preserving fruits and vegetables are discussed below

Sorting: This is carried out for removal of decayed, injured, and sometimes misshapen fruits. It is cost and energy effective as the culls will not need to be handled, cooled, packed or transported. Of paramount importance is the careful and early removal of decaying fruits, as this single step will consequently limit the spread of infection to the healthy fruits during handling, and other processes that follow.

Drying: This technique is about the oldest way of preserving fresh produce. Technically, it can either be an alternative to freezing, refrigerating or canning, or even compliment these methods. Drying can be carried out by using the warm heat of the sun (the earliest method used), an oven, or a dehydrator using the right combination of warm temperatures, low humidity and air current. In drying, warm temperatures cause the moisture to evaporate. Low humidity allows moisture to move quickly from the food to the air and the air current speeds up drying by moving the surrounding moist air away from the food. Once dried, the produce is then carefully stored away in air tight containers or a dry place.

The basic concept of drying has to do with the removal of moisture from the produce so as to prevent the growth of bacteria, yeast and mould and thus prevent the vegetable from spoiling or rotting. The process also slows down the action of enzymes (naturally occurring substances which cause foods to ripen), although it doesn't completely inactivate them. Because drying removes moisture, the produce then becomes smaller and lighter in weight and whenever the dried product is ready to be consumed, water is added back, eventually returning it to its original form.

For vegetables, drying time is crucial to tenderness. As the drying time increases, the vegetable begins to lose its flavour and the quality of the product becomes poorer. Drying time can be hastened by drying small, uniformly cut pieces. Because they contain less acid than fruits, vegetables are dried until they are brittle. At this stage, only 10 percent moisture remains and no microorganisms can grow.

It is advisable that vegetables be dried almost immediately after harvesting. They can be washed in cool water to remove soil and chemical residues, and then cut into pieces uniform in size so they can dry at the same rate.

Waxing: Waxing of fruits or vegetables has become a common post-harvest practice. Food grade waxes which helps to reduce water loss during handling and marketing are used to replace some of the natural waxes removed during the harvesting and sorting procedures. These waxes seal tiny scratches and injuries on the surface of fruits and vegetables, improves their overall appearance as well as prolongs the storage life of fruits and vegetables. It must always be ensured that the wax coatings are allowed to thoroughly dry prior to packing (Dhatt and Mahajan 2007).

Packaging: In most developing countries, fresh fruits and vegetables are generally packed and transported in bamboo baskets, plastic crates, plastic bags, or nylon sacks, and this is often done in an unpackaged form.

Packaging is basically the act of putting a produce inside a container along with packing materials to cushion the produce as well as prevent movement so as to protect the product. According to Simson and Straus 2010, the following are the core/important general requirements and functions of food packaging materials/containers: (i) they must be non-toxic and compatible with the specific foods; (ii) sanitary protection; (iii) moisture and fat protection; (iv) gas and odour protection; (v) light protection; (vi) resistance to impact; (vii) transparency; (viii) ease of opening; (ix) pouring features; (x) reseal features; (xi) ease of disposal; (xii) size, shape, weight limitations; (xiii) appearance, printability; (xiv) low cost and (xv) special features.

Furthermore, packaging must satisfy three basic objectives which are (i) contain product and facilitate handling and marketing by standardizing the number of units or weight inside the package. (ii) Protect product from injuries (impact, compression, abrasion and wounds) and adverse environmental conditions (temperature,

relative humidity) during transport, storage and marketing. (iii) Provide information to buyers, such as variety, weight, number of units, selection or quality grade, producer's name, country and area of origin. Semipermeable materials make it possible to generate special atmospheres inside packages, thus helping to maintain produce freshness. The three major types of packaging usually carried out are (1) consumer units or pre-packaging, (2) transport packaging and (3) unit load packaging or pallets (FAO 2004).

Packaging plays a very important role in protecting fresh produce as it • provides protection from dust; • reduces microbial contamination from consumer contact and the surrounding environment •helps in maintaining the freshness of produce; •increases the sale of fresh produce; and consequently • extends its postharvest shelf life.

Altogether, the proper application of any chosen postharvest technology, is expected to result in extended postharvest shelf life, retainance of fresh quality and reduction of losses.

II. CONCLUSION

Fruit and vegetables are important sources of a wide range of vital micronutrients, phytochemicals and fibre, and there is now strong evidence that fruit and vegetable consumption can prevent a number of chronic non-communicable diseases, including cardiovascular diseases (CVD), diabetes, obesity, cancer and respiratory conditions (Robertson et al. 2004). The primary cellwall of fruit generally divided into the cellulose, hemicellulose and pectin is composed of approximately 10% proteins and 90% polysaccharides. Numerous cell wall degrading enzymes can be secreted by pathogens to breach and use the plant cell walls as nutrient sources eventually reducing post-harvest life and finally leading to inedible and undesirable quality of fruits and vegetables. Hence, the need for adequate storage and preservation procedures in order to reduce postharvest losses to the barest minimum.

REFERENCES

[1]. Alzamora, S.E., Tapia, M.S., and López-Malo, A. (2000) Minimally Processed Fruits and Vegetables: Fundamental Aspect and Applications. Aspen Pub. Co., Inc., Maryland, US, 277-286.

[2]. Ara I, Rizwana H., Al-Othman MR. and Bakir MA (2012) Studies of actinomycetes for biological control of Colletotrichum musae pathogen during post-harvest anthracnose of banana. African Journal of Microbiology Research Vol. 6(17), pp. 3879-3886.

[3]. Dhatt AS, Mahajan BVC (2007) Horticulture post-harvest technology harvesting, handling and storage of horticultural crops. Punjab Horticultural Postharvest Technology Centre, Punjab Agricultural University Campus, Ludhiana

[4]. Droby.S (2006) Improving quality and safety of fresh fruits and vegetables after harvest by the use of biocontrol agents and natural materials. Acta Horticulture., 709: 45-51

[5]. FAO (2004) Manual for the preparation and sale of fruits and vegetables: from fi eld to market, FAO agricultural services bulletin no. 151. Food and Agriculture Organization of the United Nations, Rome

[6]. Flores Gutiérrez., A.A. (2000). Manejo Postcosecha de Frutas y Hortalizas en Venezuela. Experiencias y Recomendaciones. 2nd edit. UNELLEZ, San Carlos, Cojedes, Venezuela, 86-102.Agricultural Science 2010;149:37-45

[7]. Hodges RJ, Buzby JC, Bennett B. (2011). Postharvest losses and waste in developed and developing countries: opportunities to improve resource use. Journal of Agricultural Science 149 37-45.

[8]. Kader, A.A. (2005). Increasing food availability by reducing postharvest losses of fresh produce. Acta Hort. (ISHS) 682 2169-2176

[9]. Kiaya. V (2014) Post harvest losses and strategies to reduce them. *Action Contre La Faim (ACF)*. Retrieved from http://www.academia.edu/download/45278162/POST_HARVEST_LOSSES.pdf

[10]. Kitinoja L. and A.A. Kader. (2015). Measuring postharvest losses of fresh fruits and vegetables in developing countries.

[11]. Lianou A., Panagou E., and Nychas G.E (2016) Stability and shelf-life of food pg 3-44

[12]. Pavathi D and Reddy VK (2020). Studies on Postharvest diseases of vegetables and fruits of three markets in Warangal town, Telangana State, India J. Indian bot. Soc. Vol. 99 (1&2) 2020: 37

[13]. Robertson A, Tirado C, Lobstein T, Jermini M, Knai C, Jensen J, Ferro-Luzzi A, James WPT (2004) Food and health in Europe: a new basis for action, European series, no. 96. WHO Regional Publications, Copenhagen

[14]. Sara, B. D. et al (2016). Safe Handling and Storing of Raw Fruits and Vegetables

[15]. Simson SP, Straus MC (2010) Post-harvest technology of horticultural crops. Oxford Book Company/Mehra Offset Press, DelhiAl-Hindi, R.R., Al-Najada, A.R. and Mohamed, S.A. (2011) Isolation and identification of some fruit spoilage fungi: Screening of plant cell wall degrading enzymes. Afr.J. Microbiol. Res., 5(4): 443-448.

[16]. Singh D, Sharma RR (2007). Postharvest diseases of fruit and vegetables and their management. In: Prasad, D. (Ed.), Sustainable Pest Management. Daya Publishing House, New Delhi, India.

[17]. Tafinta IY. Shehu K, Abdulganiyyu H, Rabe AM, and Usman A (2013) Isolation and Identification of Fungi Associated with the Spoilage of Sweet Orange (*Citrus Sinensis*) Nigerian Journal of Basic and Applied Science, 21(3): 193-196

[18]. Zhu SJ (2006). Non-chemical approaches to decay control in postharvest fruit. In: Noureddine, B., Norio, S. (Eds.), Advances in Postharvest Technologies for Horticultural Crops. Research Signpost, Trivandrum, India, pp. 297–313.