

**REVIEW ON THE CAUSES OF POST HARVEST LOSSES OF FRUITS AND VEGETABLES:  
METHODS OF MINIMIZING THEIR EFFECTS ON THE RURAL FARMERS IN NIGERIA****Aliyu Lawal Sokoto, Musa Aliyu, Ahmed Rufa'i Yahaya**Department of Agricultural Science  
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**ABSTRACT**

*Fruits and vegetables are essential components of our daily diets, but they are highly perishable due to their high moisture content and soft tissues. It has been observed that, poor handling, lack of appropriate preservation techniques and inadequate storage facilities and other physiological activities after harvest result to a considerable amount of losses of these fresh farm produce in Nigeria. This paper focused on the reduction of these losses through proper handling, use of adequate preservation techniques and adequate storage to enhance the income of the farmers who make-up over 70% of the work force in the rural areas. This would encourage the farmers to produce maximally, ensure regular supply, attract fruits processing plants, and provide employment opportunities thereby improving the quality of life in the rural areas. It could however be suggested that, government should encourage the farming communities who produce these surplus fruits and vegetables and other food crops by providing storage facilities and adequate but effective marketing channel.*

**1. INTRODUCTION**

Fruits usually refer to the often juicy seed bearing structure of flowering plants that may be eaten as supplementary food or main food. Vegetables, on the other hand, refer to soft edible plant products that may be consumed raw or cooked alone or with meat, fish or other preparation. Fruits and vegetables are the most essential parts of our daily diet (Brash, *et al.*, 1995). They contain minerals and vitamins which safeguard the body against infection. Some supply energy for metabolic activities of the body tissues. They are perishable because of their higher water content (>75%) and low dry matter (<25 %). This, therefore results in their scarcity during off-season due to the difficulty in their storage. However, cereals and grain legumes store for a reasonable length of time, although activities of insects and other damaging agents may limit the length for some. Fruits and vegetables being fresh and perishable are not easily stored (Harvey, 1978; and Kader, 2003).

There have been several calls by various stakeholders for increased crop production but there is virtually no regard for their handling to reduce their losses after harvest. Wastage of fruits and vegetables through post harvest losses at various stages of handling results in reduced income to the farmers who make up the majority of the rural populace in Nigeria. This paper therefore examines the causes of post harvest losses of fruits and vegetables and suggests paying keen attention to the loss reduction of these farm produce after harvest. This could be done through adequate handling, storage, processing and good marketing channels that will bring more income to the farmers, ensure continuity in supply, improve the quality of life of the farmers and through the establishment of fruits processing plants, bring about employment and economic development in the rural areas.

**1.1 Problem Statement**

Majority of the growers of fruits and vegetables in Nigeria are of peasant class adopting various traditional postharvest farm produce protection measures which by implication may have adverse consequences on the market values of the farm produce and, thus affecting the income generation of the peasant farmers. For example lots of these farm produce have been lost due to the high temperature during storage, mechanical injury during harvesting, transportation and packaging, physiological activities of harvested produce, pathogenic attacks. Others pre-harvest factors like irregular water supply, lack of plant nutrients, weeds infestation, etc. Unless measures are strictly taken to curtail these problems the losses caused will continue to paralyze sustainable economic development of the rural farmers in Nigeria.

**1.2 Justification of the Study**

Fruits and vegetables are essential components of our daily diets but they are highly perishable due to their high moisture content and soft tissues. These attributes have made them prone to attacks by different damaging factors. Therefore, there is the need to carry out this review on postharvest losses of fruits and vegetables in order to highlight the most important measures to consider in safeguarding the integrity of the produce for profitable returns.

### 1.3 Objectives of the Study

- To examine the causes of postharvest losses of fruits and vegetables
- To identify and highlight the measures to consider in minimizing the effects of the losses on the rural income and development in Nigeria.

## 2. CAUSES OF POST HARVEST LOSSES OF FRUITS AND VEGETABLES

Losses after harvest of fruits and vegetables are classified according to their causal agents (Harvey, 1978; Brash, *et al.*, 1995) which include pre harvest factors and harvest maturity; losses due to mechanical injury, improper handling during transportation, packaging, storage and marketing; and losses due to pest and diseases.

### 2.1 Pre Harvest Factors and Harvest Maturity

Among the pre-harvest factors include the stage of maturity at which the farm produce is harvested. When fruits and vegetables are harvested at immature stage (except Okra) they may ripen erratically and imperfectly, while harvesting at overripe stage increases the susceptibility of the produce to decay and accelerated physiological breakdown (Coursey, *et al.*, 1976; Hironaka, *et al.*, 1980; and Kadar, 2005). Pre-harvest production practices seriously affect the post-harvest returns. Plants need continuous supply of water for photosynthesis and transpiration. Damage can be caused by too much rain or irrigation which can lead to decay, by too little water and by irregular water supply which can, for example, lead to growth cracks. Lack of plant food can affect the quality of fresh produce, causing stunted growth and discolouration of the leaves, abnormal ripening and a range of many effects. Too much fertilizer can harm the development and postharvest condition of the produce. Good crop-husbandry is important for reducing losses. Weeds compete with crops for nutrients and soil moisture (FAO, 1989; Lopez, 2004; and Kader, 2005).

### 2.2 Loss due to Mechanical Injury

The greatest quality losses occur during the distribution and marketing of fruits and vegetables especially the soft textured ones, the losses are mostly from mechanical damage as a result of relatively frequent handling. Mechanical injuries include cuts, bruises, cracking, abrasion, crushing when poorly packed in baskets bags or when transported in rough roads to a distant market. Bananas, tomatoes, pawpaw and pineapple are very susceptible to this type of damage. Mechanical injuries due to cuts and bruises create easy entry point for micro-organisms and expose them to diseases and deterioration. Mechanical injuries occur at any point in the marketing and storage channel from the time of harvest to consumption (Proctor, *et al.*, 1981; Lopez, 2004) especially when handled roughly. Mechanical damage in transit occurs partly because of lack of attention to packaging. In developed countries where presentation of fruits and vegetables in protective packaging is well developed, the produce are usually presented in cushioned containers and container packs where little contact is made among the produce and, therefore there are few damages. This is not so in Nigeria where attention is not paid to how the produce are presented. Tomatoes, mangoes, oranges are packed in baskets and already damaged cartons and then transported in that condition and in unventilated vehicle on rough-roads for long distances. This means that the produce will be at various stages of deterioration by the time it reaches the market. This is commonly seen at the off-loading centres (Lopez, 2004).

### 2.3 Losses due to Poor Storage

Traditionally, very little is done regarding the storage of fruits and vegetables except for few vegetables such as onions that can be stored for about 3 to 4 months (because of their firm texture). Under the tropical ambient environmental conditions, tender and soft tissue crops such as bananas, oranges, tomatoes and leaf vegetables store only for a few days. It should however be noted that, high temperature of the tropical environment results in high respiration rates, increased metabolic activity and tissue break down of these fresh farm produce in storage. The rate of deterioration or perishability of harvested farm produce including fruits and vegetables is generally proportional to the respiration rate (Abaoba, 1979; Kader, 1992). Kader (1992) noted that, the temperature is the environmental factor which mostly influences this deterioration rate. Brash, *et al.* (1995) also observed that, respiration as a metabolic activity is reputed to be related to the rate of deterioration of fresh produce. However, heat build up could result to about 80 to 90% rot of onions in the storage site. Therefore, modern storage involves provision of adequate ventilation through the produce in the store, and reducing temperature of the storage environment through refrigeration to reduce loss due to heat. This technology is not accessible to the resource poor farmers in Nigeria because they cannot afford cold-stores (Lopez, 2004).

#### 2.4 Loss due to Physiological Activities of Harvested Produce

Post harvest losses of fruits and vegetables can also be as a result of physiological activities of the produce after harvest. Detached fruits and vegetable are still living things, they remain metabolically active and the normal endogenous physiological processes of respiration and transpiration proceed through ripening to senescence (Coursey *et. al.*, 1989). Moisture and food reserves are depleted without replacement thereby resulting in wilting and weight loss because of the reduced moisture. Respiration being oxidative break down of complex materials in the plant cells such as starch, sugars and organic acids into simple molecules such as carbon dioxide (CO<sub>2</sub>) and water with the production of heat results in the deterioration of the produce. The tissue break down also allows easy entry of micro organisms which deteriorate the produce further. Endogenous brown spot in an example of a physiological disorder frequently causing high losses in fresh pineapple (Coursey *et. al.*, 1976). Sprouting of onions, Irish potatoes and yams at the end of the dormant period could also lead to increasing metabolic losses. These metabolic processes may be delayed, but not prevented by manipulating the storage condition such as low temperature and moderate relative humidity (RH). High temperature and low relative humidity could cause loss in leaf vegetable as a result of weight and moisture loss (Dixie, 2005).

#### 2.5 Losses due to Pathogenic Attacks

Attacks by micro organisms (fungi, bacteria and to a lesser extent, viruses) is probably the most serious cause of post harvest losses of perishable produce. The pattern of attack is usually an initial infection by non-specific saprophytic organisms causing decay. It should be noted that mechanical damage, physical or physiological changes frequently predispose the produce to pathogenic attacks (Procter *et. al.*, 1989; FAO, 1989).

### 3. HOW TO MINIMIZE POST HARVEST LOSSES OF FRUITS AND VEGETABLES

To minimize post harvest losses of fruits and vegetables, there is the need to ensure that the produce is harvested at the right stage of maturity (depending on the use and distance to the markets). The produce should be handled properly and that they get to the consumers or storage on wholesome state. It should be noted that each produce has specific stage of maturity at which it should be harvested. For example, tomatoes for distance market or for storage should be harvested at mature green stage, the one for processing should be harvested at red ripe stage. Bananas and plantains should be harvested at mature-green round full stage for long storage period, oranges and mangoes should be harvested at mature breaker stage when the yellow colour begins to appear, onions should be harvested when the neck is tight, the outer scale leaf dry and brittle in order to reduce neck rot which is the most serious disease of stored onions (Thompson *et. al.*, 1979; FAO, 1989; and Lopez, 2004).

The minimization of post harvest losses of fruits and vegetables involves careful harvesting to prevent bruises and cuts in tomatoes. This will appreciably minimize losses as entry point for pathogens invasion will be reduced. The use of ladder and picking bags for harvesting from trees would minimize mechanical damage that would result if the fruits were allowed to fall down from a height of harvesting.

The post harvest losses of fruits and vegetables can be minimized by proper handling of fruits and vegetables from harvesting through the various marketing and distribution channels, storage and consumption to minimize mechanical damage and therefore reducing post harvest losses. However losses could also be minimized through adequate transportation system and proper packaging. Aworh and Olorunda (1981) and Anazowu-Bello (1987) suggested the use of plywood crates for tomatoes rather than jute bags and baskets. Onions should be packaged in mesh bags to allow in air for ventilation. Bananas and plantains should be packaged in sealed polythene bags after treating them with thiabendazole or benomyl fungicides with or without ethylene absorbent in order to delay ripening and prolong their shelf life.

The modified atmosphere would alter the oxygen-carbon dioxide (CO<sub>2</sub>) balance within the package by reducing oxygen (O<sub>2</sub>) level while increasing the CO<sub>2</sub> concentration. This reduces the respiration and metabolic rates of the produce and thus prolong their shelf (Ndubizu, 1976; Harvey, 1978; and Daker, 2003).

The postharvest losses of fruits and vegetables can be reduced by allowing the farm produce to dissipate their field heat before storage so that they enter the storage environment in a relatively cool state. It should be noted that handling of fruits and vegetable requires that the produce must be wholesome before getting into the store, the storage environment should be cool and ventilated for low temperature and free flow of air. The handling of produce at reduced temperature through the use of refrigeration is one of the most important methods of extending the produce life and reduce the level of post harvest losses. However, use of cold storage has the following limitation; the resource poor

farmers and consumers lack refrigeration facilities, there is no electricity in most rural areas, electricity supply where available is erratic, and many tropical horticultural crops are liable to low temperature injury, e.g. banana, mangoes, tomatoes, peppers etc, do not withstand cold temperature below 7.5<sup>o</sup>c. Therefore, moderately cool temperature reduces metabolic activities of both produce and decay causing pathogens and hence increase the shelf life of fresh produce (Proctor *et al.*, 1981; Dixie, 2005).

Food processing is also another way of reducing losses of farm produce after harvest. In this case, fresh farm produce are converted into less perishable form and this enables the supply of product in one form or another. The processing and preservation into less bulky form for example, tomato puree, tomato ketchup, fruit juice, etc, will reduce transportation cost, reduce storage problems and increase the farmers earning power. Establishment of processing plants near some selected rural areas will encourage the farmers to produce more raw materials for the processing industries (Kader, 2003; Kader, 2005).

Effective control of pests and diseases involves the use of chemicals and heat treatments. Steam treatment and immersions of some fruits and vegetables in hot water for a few minutes (blanching) could kill surface pests and disease pathogens. Farmers have to be educated on the safe use of chemicals in controlling pests and diseases. Phytosanitary practices such as washing and cleaning of harvesting tools, containers, trucks and store house will reduce pathogenic agent build up thereby minimizing micro-organism caused post harvest losses of perishable produce.

#### 4. CONCLUSION

Despite prodigious progress made in increasing food production at the global level, approximately half of the population in the third world does not have access to adequate food supplies. One of the major reasons for this inadequacy is due to food losses occurring in the post harvest and marketing system. Both quantitative and qualitative food losses of extremely variable magnitude occur at all stages in post harvest system from harvesting through handling, storage, processing and marketing to final delivery to the consumer. Evidence has shown that, these losses tend to be highest in those countries where the need for food is highest. Fruits, vegetables and roots crops are much less hardy and are mostly quickly perishable. For which careful handling is required during harvesting and transportation to avoid decay and become unfit for human consumption.

Estimates of production losses in developing countries are hard to judge, but some authorities put losses of sweet potatoes, plantain, tomatoes, bananas and citrus fruits to as high as 90% or half of what is grown.

#### 5. RECOMMENDATIONS

- Post harvest losses of fruits and vegetables as well as other farm produce should be minimized through availability and efficient use of storage facilities and the creation of processing industries to encourage farmers to produce more fruit, root and vegetable crops. The government will provide the enabling environment and support for this to happen.
- Adequate marketing and distribution channels should be designed and deployed with active supervision of the government to ensure regular food supply even during produce off-season.
- Government should intervene by encouraging agricultural cooperative societies to establish bulk cold stores and storage units at selected rural areas to serve as raw materials depots for the agro-based processing plants.
- Government should also provide incentives in form of loan facilities to farmer's cooperatives and private entrepreneurs who are interested in crop production, storage and crop processing business.

#### 6. REFERENCES

- Abooba, F.O. (1979). Storing and Processing of Major Food Crops in Nigeria Rain Forest Zones. In Anazodo, U.G.H and Odigboh, E.U, (Eds). *Proceedings of a Symposium on Appropriate Approaches for Accelerated Food Production in the Rain Forest Zones of Nigeria*. Sept, 1979.
- Anazonwu-Bello, J.H. (1987). Small Scale Food Processing and Distribution in Nigeria. Paper Presented at the Social Science Council of Nigeria Workshop for Research Directors on Small Scale, Food Processing and Distribution Industries in Nigeria held at the University of Benin, 7 – 8<sup>th</sup> May, 1987.
- Aworh, O.C. and Olorundo, A.O. (1981). Effect of Packaging Methods on the Post Harvest Losses of Perishable Fruits and Vegetables in the Nigerian Marketing System. Paper Presented at the 6<sup>th</sup> African Horticultural Symposium, University of Ibadan, 19-26 July, 1981.

- Brash, D.W.; Charles, C.M.; Wright, S. and Bycraft, B.I. (1985). Shelf Life of Stored Asparagus is Strongly Related to Post-Harvest Respiratory Activity. *Post Harvest Biology and Technology*, 5 (1 x 2), 77-81.
- Coursey, D.G.; Burden, O.J. and Rickardi, J.E. (1976). Reduction Advances in Research on Post Harvest Handling of Tropical and Sub-Tropical Fruits. *Acta Horticulture*, 57: 135-143.
- Dixie, G. (2005) (PDF). Horticultural Marketing. FAO, *Horticultural review* 12: 197-223., Rome.
- FAO, (1989). Prevention of postharvest food losses, fruits, vegetables and root crops – A training manual (3) FAO Training Series 17/2, Rome.
- Harvey, J.M. (1987). Reduction of Losses in Fresh Market Fruits and Vegetables. *Annual Review of Phytopathology*, 16, 321-341.
- Hironaka, K.; Okumura, T.; Ishbashi, K.; Kaoze, H. and Kato, S. (1980). Studies on Frozen Vegetables III. Changes in Texture of Vegetables Resulting from Freezing Damage. *Refrigeration Reito*, 55 (633), 593-598.
- Kader, A.A. (1992). Post Harvest Biology and Technology: An Overview in A.A. Kader (ed.). *Post Harvest Technology of Horticultural Crops*. Division of Agricultural and Natural Resources, University of California Publications, 3311: 15-20.
- Kader, A.A. (2003). A perspective on postharvest horticulture (1979-2003). *Hort Science* 38 (5), 1004-1008.
- Kader, A.A. (2005) (PDF). Increasing food availability by reducing postharvest losses of fresh produce. Division of Agricultural and Natural Resources, University of California Publications, 288-291.
- Lopez, A. (2004). Manual for the preparation and sale of fruits and vegetables from the farm to the market. FAO, Rome.
- Ndubizu, T.O.C. (1976). Delaying ripening in Harvested Nigerian Green Plantain. *Journal of Agricultural Sciences*, 87, 573-575.
- Proctor, F.J., Goodliffe, P. and Coursey, D.G. (1981). Post Harvest Losses of Vegetables and their Control in the Tropics. In Spedding C.K.W. (ed). *Vegetable Productivity: The Role of Vegetables in Feeding People and Livestock*. Proceeding of a Symposium of the Institute of Biologists, No 25. The Royal Geographical Society, London, 27-28 Sept, 1979. Macmillan Publishers Ltd, London, 1981, 268pp.
- Thomson, A.K.; Booth, R.H. and Proctor, F.J. (1972). Onion Storage in the Tropics. *Tropical Science* XIV(I): 19-34.