Science Journal of Business and Management
2015; 3(5-1): 35-40
Published online October 9, 2015 (http://www.sciencepublishinggroup.com/j/sjbm)
doi: 10.11648/j.sjbm.s.2015030501.18
ISSN: 2331-0626 (Print); ISSN: 2331-0634 (Online)

Products' Quality Preservation and Agricultural Transformation in Nigeria

Essien, B. A[1, *], Essien, J. B.[2], Bello R. S.[3]

[1]Akanu Ibiam Federal Polytechnic, Unwana, Afikpo, Ebonyi State, Nigeria
[2]Department of Basic Sciences, Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria
[3]Department of Agriculture & Bio-Environmental Engineering, Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria

Email address:
basseyessien2004@gmail.com (Essien, B. A)

To cite this article:
Essien, B. A., Essien, J. B., Bello R. S. Products Quality Preservation and Agricultural Transformation in Nigeria. *Science Journal of Business and Management*. Vol. 3, No. 5-1, 2015, pp. 35-40. doi: 10.11648/j.sjbm.s.2015030501.18

Abstract: This paper discussed mechanics of agricultural product deterioration and preservation technologies in the in the era of agricultural transformation in Nigeria from the agribusiness perspective. It also focused on the measures of promoting appropriate preservation technologies in the rural areas in order to reduce product losses. The paper concluded that adoption of simple, effective and appropriate preservation technologies, government involvement in establishing more agro-processing centers/storage facilities and provision of micro credit facilities in the rural areas would ensure food security in Nigeria.

Keywords: Transformation, Food Security, Agri-Business, Technologies, Preservation, Products

1. Introduction

Nigeria is one of the leading countries in the production of agricultural products such as fruits, cassava, yam, cowpea and cocoa (Adewumi, 2008a) as well as fruit, leafy and root vegetables, grain legumes and animal products, of which the bulk of the products is from the SMEs. These agricultural products are highly perishable and records of postharvest losses of these produce are very high with Nigeria having up to 50% (Adewumi, (1998a). It is noted that Nigerian agriculture suffers deterioration losses as much as 50% for vegetables, 30% for roots and tubers, and 20% for grains (FMARD, 2001).

In Nigeria, the highest percentage of the populace lives in the rural areas and is pre-occupied with agriculture at peasant level, where the bulk of the production comes from. Rural communities are the main center of production of agricultural materials, which are the main raw materials for many industries (Adewumi, 2007b). It is therefore reasonable to develop feasible rural communities as industrial center to promote rural development (Adewumi, 2008a). Critical of this rural development is provision of basic infrastructures such as roads, communication network, power and water as well as storage facilities for products undergoing rapid metabolic activities where breakdown leads to product loss. These activities targeted at altering the normal path of growth of these products with the view of extending its shelf-life and inhibiting natural ageing and discoloration are disadvantaged due to process characteristics predominant among the rural farmers. This paper presents an outlook on product deterioration and mechanisms and technological imperatives of Nigerian SMEs in making the sector develop.

2. Products Deterioration Mechanisms

More than one third of the perishable food crops produced in the World are lost after harvest due to poor or lack of preservative and storage methods (Dris, 2004). Most food crop products that are harvested seasonally are perishables and are subsequently subject to ripening, senescence, microbial and pest infestations, water loss, anatomical, morphological and compositional changes. This occurs because of the challenges faced by poor farmers in preservation and storage of these perishables. The development of adequate postharvest treatments for fresh food crop products, and their optimum use are of great necessity and economic importance. Adequate and appropriate postharvest treatments should reduce losses, and preserve perishable food product to meet consumer

demands for constant availability and good quality supply throughout the year, thereby boosting food seasonality. According to Bourne (1977), food must not only be produced, it must be delivered to the ultimate consumer in an acceptable form if it is to fulfill its nutritional destiny.

Agents of agricultural products deterioration

The deterioration of agricultural products is caused by a series of complex chemical/metabolic changes that take place in the products after harvest. The chemical/metabolically changes are brought about by internal agents (such as enzymes -inherent inorganic materials) and external agents (such as micro-organisms).

A. *Enzymatic activities:* Enzymes are complex chemical substance, protein in nature and are found in all living organisms and tissues. They act as means of increasing chemical reactions and are responsible for changes that occur during ripening. For example, pectin is changed to pectic acids in over-ripe fruits. They help to carry on the life activities of respiration, digestion, growth, sprouting of seeds, ripening of fruits. Enzymes are catabolic agent that can destroy as well as build. Enzymes are the agents that are primarily responsible for the decay and decomposition of organic material, putrefaction of meat and fish, rotting of fruits and vegetables. Action of enzymes also causes the cut surface of some vegetables and fruits to turn brown when exposed to air (enzymatic oxidation). Enzymes require moderate temperature for their action. Extremely cold temperature prevents their action temporarily, but once the temperature is allowed to rise, they become active again. They are inactivated also by high temperature.
B. *Micro-organic activities:* Micro-organisms that are responsible for food spoilage include bacteria, yeast and mould. These micro-organisms require favourable condition such as temperature, moisture and most of them require air to grow and multiply.
   a. *Bacteria***:** Bacteria are microscopic organisms whose single cells have neither a membrane enclosed to nucleus nor other membrane enclosed organelles-like mitochondria and chloroplasts. Bacteria are single – celled organisms that grow and multiply best at temperature between 20 and 40°C and 20 to 30 percent moisture content. Examples of bacteria associated with food spoilage are salmonella, lactobacillus, staphylococcus, bacillus and clostridium. Most bacteria are destroyed by high temperatures. Refrigeration also slows down the rate of growth or makes them dormant but once the temperature rise to favourable conditions, they start growing again. Other conditions that inhibit bacteria growth are high concentration of salt, sugar and acids.
   b. *Yeast*: These are aerobic (require oxygen to survive) organism. They grow well in acidic conditions and temperatures between 20 -30°C. They are both useful and harmful in food. A useful role is fermentation in which enzymes produced by yeast cells convert sugar into alcohol and carbon dioxide. Yeasts are undesirable when they ferment fruits, fruit juices, honey etc. they are easily destroyed by temperatures above 60°C. Some common genera of yeast include Saccharomyces, mycodemia, hansenulla etc.
   c. *Moulds*: Moulds are multi-cellular fungi with filaments, which give them a fuzzy appearance when they are growing on food. They appear white, dark or at various colours. They are aerobic and can grow in a wide range of p^H, from quite acidic to fairly alkaline (2.0-8.5). Yeast grows rapidly at temperature of 20 – 30°C and in a moist still atmosphere. Freezing temperatures stop their growth and also are destroyed at high temperature between 71 – 82°C. Since moulds are more adaptable to many condition of acidity, they are involved more in spoilage of preserved products if not properly stored. The most common genera of moulds are Aspergillus, Mucor, Rhizopus, Monilla etc.
C. Abiotic agent (temperature): Nigeria is in tropical region with a very hot climate. High temperatures which are typical of tropical regions encourage rapid rate of spoilage of fruits and vegetables which continue to be metabolically active after harvesting. Temperature control is the single most important factor in food preservation, especially for perishables. The deficiency, abuse or fluctuation of the cold chain (temperature and relative humidity) not only increases the deterioration of the products, but can also trigger problems. High or fluctuating temperature can increase products senescence and decay, and therefore increase losses. It can also increase relative humidity and may cause water fluctuation, especially in packaged, which greatly increases the proliferation of spoilage micro-organisms.
D. *Flora disorders*: Plant disorders that cause spoilage and losses to plant products includes physiological and pathological disorders.
   a. *Physiological disorders*: physiological plant disorders are caused by non-pathological disorders such as poor light, weather damage, water-logging or a lack of nutrients, and effect on the function of the plant system. Physiological disorders are distinguished from plant disorders caused by pathogens, such as a virus or fungus. While the systems of physiological disorders may appear disease – like, they can usually be prevented by alternating environmental conditions. However, once a plant shows symptoms of nutrient deficiency, it is likely that season's yields will be reduced and also a reduction in nutritional quality and quantity levels.
   b. *Pathological disorders*: pathological disorders are caused by pathogens (they are infectious organisms)

that caused spoilage and losses in agricultural products. Organisms that caused infectious disease include fungi, bacteria, virus, protozoa, viroids, nematodes etc. These organisms may be present in the tissues of the produce at harvest or during growth periods leading to deterioration.

E. *Mechanical damage*: Produce of any kind of agricultural products are liable to certain mechanical damage such as bruising, cracking and splitting of the external tissues. Perishable crops are more liable to be damaged due to their sensitivity to the treatments associated with normal harvesting and transportation handling (Bello, 2013).

3. Process Conditions and Mechanism

Several process technologies have been adopted for the purposes of improving product quality and extension of their shelve lives. Principles and methods of so far employed ranges from traditional management practices to more sophisticated automated systems for large scale product handling. These basic principles and methods achieves one or several of the following conditions:

Temperature control: Cold temperature inhibits growth and high temperatures destroy the spoilage agents and inactivate or destroy enzymes. At household level, this is achieved by the use of a refrigerator or boiling/heating. This method depends on the quality of the produce and the temperature of storage, which should be far below enough the actual freezing temperature of the produce for long preservation.

Dehydration or moisture removal: Dehydration usually implies the use of controlled conditions of heating, with the forced circulation of air or artificial drying as compared with the use of sun drying. As well as much moisture as possible must be removed from products, to make the product unfavorable for spoilage organisms to grow or multiply during storage and enzyme activity is controlled (Anonymous 2013).

Creating unfavourable environment: This method is achieved by the use of chemical substances such as salt, acids, sugar, smoke and other approved activities. These are used either singly or in combination to lengthen the shelf-life of perishable food items. For instance, salting or curing draws moisture from the produce through a process of osmosis, and smoking deposits a number of pyrolysis products onto the foods, including the phenols, syringol, gualacol and catachol (Msagali, 2012). These compounds aid in the drying and preservation of foods. This principle is used in preparation of jam, juice, syrups, sauces, pickles and lye.

Air removal: This is achieved during processing when jars containing the food to be preserved are boiled. The water vapour produced during boiling pushes the air out since jars lids partly unscrewed during the boiling. Since the microorganisms are destroyed during the boiling process and air is pushed out, the preserved food can remain good for a long time.

These four control factors results in various processing technologies such as:

Drying: Drying is the oldest method of preserving food. Dried foods keep well because the moisture content is too low for spoilage organism to grow. Drying will never replace canning and freezing because these methods do a better job of retaining the taste, appearance and nutritive value of fresh produce (Ikejiofor and Nwagugu, 2012). But drying is an excellent way to preserve foods that can add variety to meals and provide delicious, nutritious snacks.

Storage: Storage is a means of retarding deterioration and spoilage of agricultural products by manipulating the environment in and around the stored products to as many unfavourable conditions of sufficient severity as necessary to terminate or drastically reduce the continued activities of the spoilage agents, thereby maintaining quality of the product with respect to appearance, odour, taste, texture and vitamin nutrient contents for a specific period (Ikejiofor and Nwagugu, 2012), and processing means to improve or maintain quality by changing the form or character of an agricultural product.

Processing: For effective product handling and transportation of agricultural material plays vital role in final product quality. Processing helps in reducing bulk products being transported to the market and also reduces the transportation costs, obviates storage problems and increase farmers' earning power (Aboaba, 1971). Productions of various agricultural products are seasonal and harvest takes place at certain times of the year. It is therefore necessary to process and store for different length of time in order to provide consumers with uniform and quality product supply.

Preservation: When the availability of food is more than the present use, it is preserved for future consumption, and preservation is done on foods that are perishables for future use. Preservation helps the foods to be available in off-season and in any place. Delay in the use of fresh food alters its freshness, its palatability and its nutritive value hence, such food is preserved and use for long time. Therefore, all food preservation methods are based on the general principles of preventing or retarding the causes of spoilage- microbial decomposition, enzymatic and non-enzymatic chemical reactions and damage from mechanical causes, insects and rodents etc. Therefore, the general principles of preservation include:

1. Prevention or delay of microbial decomposition:
   a. By keeping out microorganisms (asepsis)
   b. By removal of microorganisms through titration
   c. By hindering the growth and activity of microorganisms e.g. by low temperature, drying, anaerobic condition or chemicals.
   d. By killing the microorganisms using heat treatment or radiation.
2. Prevention or delay of self-decomposition of food:
   a. By delay of chemical reaction e.g. by prevention of oxidation by means of an antioxidant.

b. By destruction or inactivation of food enzymes e.g. by blanching.
3. Prevention of damages caused by insect, animals and mechanical causes.

Types of preservation methods:

a. Temporary preservation: in this method, growth of microorganisms is only retarded or inhibited for a short time.
b. Permanent preservation: in this method, the growth of spoilage organisms are completely destroyed by different means.

4. Traditional Technologies for Preserving Agricultural Products

Root and tuber:

1. Re-burying the roots in the pits/trenches, covered with plant materials and soil.
2. Pilling the roots/tubers in heaps and keeping them moist by watering them daily and/or heaping them under shade.
3. Applying a thick coating of soft clay or mud on the root/tuber.
4. Keeping small quantities of cassava in water, especially where it is going to be used in 'fofo' processing.
5. Yam tuber(s) are mixed with wood ash, heaping them and covering them with thin layer of soil and possibly topped with dry grass as a form of mulch. This can be done on the floor or on shelves in shade or huts of stores.

All these practices are simply attempt to limit moisture loss from the roots/tubers so that at least they can extend the storage life of the root/tubers by only few days.

5. Improved Low-Cost Storage Methods for Fresh Cassava

1. Store in field clamps and in boxes with moist saw-dust or wood shavings.
2. Storage in plastic bags or plastic film wraps: this is one of the most practical promising method of storing cassava roots intended for the urban markets. Cassava roots treated with an appropriate fungicide and kept in an air-tight plastic bag or a plastic film wrap can be stored for 2-3 weeks. Improved higher-cost technologies include refrigeration, deep freezing, waxing, controlled atmosphere and chemical treatments.
3. Construction of structure capable of controlling weather (weather proofing), provide better shading and ventilation. Open-sided shelves store where roots/tubers are placed in single layer on shelve instead of being tied to the frame is preferable.

All the storage methods investigated favoured curing conditions in a high humidity and high temperature environment in order to slow down the rates of physiological and micro-biological deterioration. However, to be successful, they all require careful harvesting and selection of this root prior to storage, since curing is not effective if root damage is extensive. However, the technologies used in traditional and improved method of preservation of agricultural products are summarized in Table 1.

Table 1. *Technologies used in traditional and improved preservation of agricultural products.*

Description	Traditional methods	Improved methods
Roots and tuber produce	Hanging, Pit storage.	Improve barn, oven/solar drying/processing into dried chips or various products e.g. Garri, flour etc.
Grains	Hanging, Storage in pots, gourd, calabash, pit, platform, heap and baskets.	Silo storage, sack, Rhombus, improve crib, ware houses.
Fruits	Underground storage, high altitude cooling.	Freezing, canning, oven drying, controlled atmosphere, processing into purce, sauce, chutney, pickles, concentrates, jams, beverage, nectar etc.
Vegetables	Blanching, high altitude cooling, storage in pot, basket or bucket, underground storage.	Drying/processing, refrigeration, evaporative cooling and controlled atmosphere.
Meat	Smoking, sun drying, salting.	Freezing, canning, oven drying.

Sources: Ajisegiri, 2002; Okon *et al*, 2004

6. Measures of Promoting Effective Preservation Technologies

1. Adoption of effective preservation technologies by farmers in order to reduce losses through spoilage.
2. Sitting of more storage structures in different locations close to farming regions.
3. Establishment of industries that are involved in the processing of agricultural product in rural farming areas.
4. Government (Federal, State and Local) should provide basic infrastructures such as (road, electricity, water etc.) to support the industrialization of feasible rural areas with high production of agricultural produce.
5. Manufacture of indigenous machinery for processing of agricultural materials into primary and secondary products.
6. Appropriate and adequate farming system technologies should be adopted by the farmers in order to know when to plant, harvest and how to harvest and handle.
7. Lack of government to invest in agriculture, increase allocation to at least 10% of national budget.
8. Innovations in science and technology are both pre-condition and a part of agricultural transformation. Farmers' needs technology applicable to their

diversified agro-ecological condition to counter erratic humidity that leads to building up of pest and diseases during harvesting and storage.

7. Nigeria Food Security Outlook

Promotion of appropriate technologies will be achieved through the adoption of improved, simple and affordable methods of preserving agricultural products in order to reduce postharvest losses thereby ensuring food security in Nigeria. (Food security and sustainability in agriculture have become burning issues in the country (Abubakar, 2010). According to IFPRI (2002), food security ensures physical and economic access to sufficient safe and nutritive food to meet daily dietary needs and food preferences for active and healthy life. However, food security, both in terms of availability and access to food, poses a challenge to the rapidly growing population in environments of dwindling land and water resources (Choudburg, 2010).

Farm gardens and orchards producing fruits and vegetables (perishables) have emerged as a major economic activity in many places, but the challenge of preserving and storing these important products still remain untouched especially in the rural areas where the bulk of production is experienced. A number of major challenges facing the agricultural sector reflected through low productivity, and is worsened by poor preservative and storage methods, which have led to food insecurity in Nigeria (World Bank, 1996). Achieving food security in its totality, the challenges faced by the farmers in preserving and storing must be tackled. One way by which this could be achieved is through integrated farm development through agribusiness.

8. Nigeria Agribusiness Outlook

Agri-based SMEs can be found everywhere in the society, which include agribusiness farm firm, crop and animal production, processing, marketing (Onwumere, 2008) and have played significant roles in the economic development of Nigeria. This dynamic role of SMEs as the engine room of development forms the bulk of businesses activities in a growing economy like that of Nigeria (Emesowum *et al*, 2013). The small and medium scale industries are seen as a key to Nigeria's growth and alleviation of poverty and reduction of unemployment in the country (Aremu and Adeyemi, 2011). SMEs have been acknowledged to have huge potentials for sustainable development, contributor to the Gross Domestic Product (GDP), especially when incentives, policies, programmes, financial and extension services are supported.

In many parts of Nigeria, it is dominated by diverse small and medium scale agribusiness enterprises (SMEs) like fruit processors, crop and livestock production enterprises. These enterprises produce bulk of commodities consumed in homes, industries and for export where available. Despite the high demands and popularity of these SMEs, its total production is grossly inadequate. This is because most entrepreneurs use obsolete tools and equipment and poor or non- preservative methods in preservation. World Bank survey (2000) however, showed that poor performance of SMEs in Nigeria was as a result of the public policy structure that did not provide the right incentives for growth.

9. Conclusion and Recommendation

The climax of farming is the harvest of the good quantity, quality products. In order to reduce post-harvest losses of products, adequate preservation technologies should be adopted by the farmers. Moreover, government should established more agro-processing centers/storage facilities in rural areas with high capacity production of agricultural produce, and basic infrastructures should be provided in areas where the bulk of the produce comes from, so that food security should be assured. Also, to achieve this, policies that would enhance the access to micro credit facilities through other government and non-governmental organization apart from the Nigerian banks by these enterprises should be advocated for with little or without interest rate. And SMEs should be encouraged to form cooperative groups within their catchment areas, so as to place them more favourably in capital acquisition while strengthening extension services in the area. The neglect of these major factors will militate against agricultural transformation and rural agricultural development in Nigeria.

References

[1] Aboaba, P. O. (1971): Developing Nations Needs tropical Processes. Food Engineering 43: (66) Pg 73-75

[2] Adewumi, B. A. (2008a): Fruit Production and Processing. Option for Rural Industrialization and Poverty Alleviation in Nigeria. Book Project of the Alexander Vom Itumboldt Foundation Pg 43-53

[3] Adewumi, B. A. (2008b): Collaborative Research in the Development of food machinery for Africa. Proceeding of the conference on collaboration Research for Technical development organized by Makerere University, Kampala, Uganda Pg. 10.

[4] Ajisegiri, S. A. (2002): Post-harvest Technology Development in Nigeria. Aluelemhgbe publication. Pp 57-68.

[5] Aremu, M. A. and S. L. Adeyemi (2011): Small and medium scale enterprises as a survival strategy for employment generation in Nigeria. Journal of sustainable development. Vol. 4 no. 1.

[6] Bello R. S., 2013: Fruits and Vegetable Technologies: Management Options. *Createspace Charl US.* ISBN-13: 978-149-047-910-197-8 https://www.createspace.com/4329868 June 2013 (218 pages)

[7] Emesowum, C. E.; J. A. Mbanasor and S. A. Olayimola (2013): Analysis of factors affecting performance of agribusiness-SMEs in Imo State, Nigeria: policy issues for agricultural transformation. Proc. of the 47th Annual Conf. of agricultural society of Nigeria, Ibadan 2013. Pp 518-521.

[8] FMARD (2001): Federal Ministry of Agriculture and Rural Development. New Agricultural Policy Thrust. http/www.fao.org/docrep/004/AC301e03.htm15/org

[9] Ikejiofor, M. C. and Nwagwu, N. I. (2012): Promoting Appropriate Technologies for Preservation of Agricultural Production to ensure Food Security in Nigeria. Proc. of Int'l Agric Conf. ANSUIAC 2012. 6-9th May, 2012. Pp 348-352.

[10] Kazembe, H. W. (2005): Approach to Successful Development of Low-Cost fruit Extractor Technologies. A case study of Improve Livelihood in Malawi. A paper presented at Tropentag conf., Stuttgart-Hoherhein, Germany.

[11] Onwumere, J. (2008): Policy issues in enhancing the output of Agribusiness of small and medium scale. Piggery enterprises (AGRI-SMEs) in Abia State. Journal of Agricultural Extension. Vol. 12 (2).

[12] Okon, P. B.; Uko, A. E. and Amalu, U. C. (2004): Handling and Storage of Leafy Vegetables. Postharvest Management LEISA, India. Vol. 16 Pp 28.