Traditional Methods of Preservation and Storage of Farm Produce in Africa

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Abstract: Food preservation and storage methods in sub-Saharan Africa are poorly conceived, carried out and inadequate. This has resulted in enormous food losses in storage as a result of deterioration by microorganisms, rot and rodents. Africa is blessed with various types of food produce and also possesses diverse indigenous knowledge systems for their preservation and storage. These have been used by most cultures over time to preserve their produce after harvest. Advanced food preservation techniques which include methods such as canning, pickling, drying and freeze-drying; irradiation, pasteurization, smoking, and the addition of chemical additives or spices etc. are used globally but these methods are usually not affordable or practicable for the resource-poor natives. Traditionally, Long-term methods like fermentation and drying have been used for fruits and vegetables, while short term methods used include storing in buckets and in clay pots; and also blanching. For grains, storage in cribs and silos is practiced. Traditional ways of storing yam include keeping them fresh in barns, on platforms or in the ground. However for cassava, being a highly perishable crop, methods like re-burying in trenches; applying a thick coat of soft clay or mud; or keeping small quantities in water have been used for short-term storage. Improved methods of preservation and storage available for cassava include the field clamp method; storage in boxes or in plastic film bags with various lining materials. Generally, the non-adoption of new methods by the people slows down improvements that have been made through research. Collaborations incorporating the plus aspects of the present methods with research into new ways of food preservation and storage are advocated in other to save more food for the future.

[Ofor, Marian Onomerhievurhoyen. **Traditional Methods of Preservation and Storage of Farm Produce in Africa.** New York Science Journal 2011;4(3):58-62]. (ISSN: 1554-0200). http://www.sciencepub.net/newyork.

Key Words: Food losses, harvest, deterioration, traditional methods, short-term, long-term.

1. Introduction

Postharvest losses ranging from 30 to 50 percent occur in tropical areas, especially in sub-Saharan Africa where farmers use the indigenous or traditional methods for food preservation and storage, according to FAO surveys. Preservation and storage is therefore important to extend the shelf-life of crop products and ensure their supply over extended period of time for fresh market or for processing.

Advanced food preservation techniques which include methods such as canning, pickling, drying and freeze-drying; irradiation, pasteurization, smoking, and the addition of chemical additives etc. are used in advanced countries but these are unavailable to our resource-poor farmers.

Traditional Methods of Food Preservation and Storage

According to Coursey (1982), non-grain, perishable staples are estimated to provide the dietary base for between 500-700 million people across the tropics. Recent FAO statistics indicate a higher relative importance of perishables in the tropics than in the temperate world. Coursey and Haynes (1970), states that the most important are the root crops-cassava, yams; the various aroids, sweet potatoes and white potatoes. Fruits and vegetables also feature greatly in the diets of people in sub-Saharan Africa.

This paper aims at x-raying the indigenous knowledge systems with which African rural farmers preserve and store the abundance of food crops available in the continent. Improvements, modernization or changes that have taken place in some of the local methods have also been highlighted with a view to securing the harvest.

2. Fruits and Vegetables

i Fermentation: Fermentation is a cheap and energy efficient means of preserving perishable raw materials. When harvested, fruit and vegetables undergo rapid deterioration, especially in the humid tropics where the prevailing environmental conditions accelerate the process of decomposition.

According to FAO (2003), during the fermentation of raw vegetables, lactic acid bacteria develop, transforming the natural sugars present and

the added sugar into acid. The characteristic flavour and texture of fermented vegetables is produced by the action of lactic acid bacteria. It is a technique that has been employed for generations to preserve food for consumption at a later date and to improve food security.

According to FAO (1998a), several examples abound from around the world of the role fermented foods have played in preserving food to enhance food security. About 60% of the fermented foods of Sudan are famine or survival foods. Many of the fermented foods have been developed in Western Sudan in the Kordofan and Darfur regions, which are traditional famine areas. The strong link between fermented foods and food shortages is revealed by the fact that when a family becomes rich a number of fermented foods are no longer prepared. The techniques used are very effective methods of food preservation. The products can be preserved for years through the double action of fermentation itself (which produces anti-microbial acids) and sun-drying.

Sudan is probably the hottest and driest country in Africa. Through the years, women have made full use of this free solar energy. Shade temperatures in the summer reach 45-50^{o}C and the hot sands outside the shade reach more than 70^{o}C. According to Dirar (1992), dried and fermented foods together with the seeds and fruits that can be gathered from the wild have saved lives especially those of children in the past and in the present in times of shortage. During the 1983-85 famine, relief workers found that people had survived by producing specific traditional fermented food products, especially Kawal (Arthur, 1986).

ii Drying: Africans live under climatic conditions that constitute major problems for the preservation of food hence they prefer fresh fruits and vegetables. However, in areas where irrigation is not possible; production and availability of fresh products are limited to the rainy season (Fabre and Mihailov, 1985). During the dry season they have to eat products preserved in various ways. Drying is a prominent means of preserving surplus food products for the off-season. Drying can be in the form of the ordinary sun-drying which involves spreading the food material on the bare grounds, road sides or on roof tops. Although this method is cheap, problems associated with it include no control over the drying process, possible contamination of the product by dirt, rodents, animals, infestation by insects or moulds; and exposure of the product to rain and wind, which causes repeated wetting and redrying (Makwaia, 1985). All of these often result in a poor quality dried product.

Drying has also been improved through the use of solar dryers built specifically to trap solar energy in custom-built units, for the sole purpose of drying food materials in a safe and hygienic environment. Some of the fruits and vegetables successfully dried in parts of North and West Africa include Bananas, Pineapples, Eggplant, Tomatoes, Okra, Peppers, Onion, Amaranthus, Cassava leaves, Corchorus leaves etc (Makwaia, 1985; Taiwo, 1985).

Short-term methods of preserving leafy vegetables could also include storage in buckets and in clay pots at ambient temperatures.

iii Storage in Buckets: According to Okon *et al*. (2004), pumpkin and amaranth leaves can be bunched up and dipped in a bucket of water, with the tips of the stems steeped in the water. Waterleaf and bush okra are not dipped but rather sprinkled with water. The leaves are then covered with a thin polythene sheet, tied to the bucket and kept in a cool place. Daily, the polythene sheet is removed temporarily and water sprinkled on the leaves. This method keeps the leafy vegetables fresh for about 6 days.

iv Storage in Clay Pots: In this method, clay pots of convenient sizes are washed clean and placed on a firm support. At the bottom of the pot is placed a layer of sterilized (boiled) wet jute bag and wire gauze on top of it. On top of the wire gauze, the washed vegetable leaves are placed and covered with another layer of wire gauze and a second jute bag. This bag is kept moist at all times. In the event of transporting the vegetables to long distance markets, bunches of the leaves are wrapped in a clean or sterilized wet jute bag that is kept wet. Alternatively, the vegetable leaves can be placed in vegetable baskets made from raffia or other flexible plant material with smooth surface, with the inside completely lined with wet jute bags.

v Blanching: Fruits, fresh vegetables and root vegetable pieces can be immersed in a bath containing hot water (or boiling water) for 1 – 10 minutes at 91 – 99^{0}C, to reduce microbial levels, and partially reduce enzymatic activity that could lead to deterioration. This process can be termed as scalding or blanching. The heating time will depend on the type of vegetable product processed (FAO, 2003). Before freezing, vegetables can be cooked briefly in boiling water, a process known as blanching, to inactivate enzymes altogether and reduce discoloration and nutrient loss. Also before drying, some leafy vegetables like *Gnetum* spp. are briefly blanched to suppress enzymatic activities and loss of colour. Blanching of vegetables, as a pre-processing technique before solar drying, was found to result in better nutrient retention, especially carotene, better palatability and appearance when done under laboratory conditions (Bustrillos, 1985).

3. GRAINS

i Cribs: The storage of husked and unhusked maize is a common practice among subsistence farmers in sub-Saharan Africa. According to David (1998), a number of variations are used but the two essential requirements for successful open storage in cribs are that drying takes place while the crop is being stored; and that the farmer is able to control insect attack at the same time.

In many parts of sub-Saharan Africa for example, one finds farmers hanging bunches of unhusked bunches of maize or corn (*Zea mays* L.) on poles set in the ground, on the branches of trees, and in the roofs of cooking or living shelters. Sometimes, farmers remove the husks and pile the cobs loosely in open weave baskets, granaries or in covered crib granaries. The latter containers partly protect the grains from rain and also allow air to pass over the grain and help it dry better. In humid wetter areas, it is better and more advisable to put the crops in a crib-type storage container (David, 1998). Furthermore, he explained that in many countries of sub-Saharan Africa, the traditional storage crib is either round or rectangular; and is built approximately ½ meter off the ground, with walls made out of mud and/or palm leaves. This type of storage unit is easy and cheap to make, but the storage losses due to insects and rodents are often as high as 40% (Taylor-Davis, 2005).

In some areas, the maize and other grains are put in earthen pots and spread with crushed neem leaves or crushed dry capsicum pepper fruits to ensure they are preserved for the next season and for market.

Silos: The silo and dryer must have good roof over them to protect them from the rain. To be sure of good quality storage of harvested crop products, it is important to understand the proper way to use the silo and dryer. To use them correctly is not complicated but simply needs care and attention at the right times. The traditional silo is built with mud. The mud silo needs protection against rain. A simple and inexpensive method of protection is to construct a thatch cone in the shape of an inverted "V" and put it on the silo. If the cone hangs over and down, it will also protect against the sun's rays (David, 1998).

4. ROOTS AND TUBERS

The principal root and tuber crops of the tropics are cassava (*Manihot esculenta* Crantz), yam (*Dioscorea* spp.), sweet potato (*Ipomoea batatas* L.), potato (*Solanum* spp.) and edible aroids (*Colocasia* spp. and *Xanthosoma sagittifolium*). The potential of these crops is particularly high in the humid tropics and those sub-humid tropics, which are not suitable for cereal production.

a. Yam

i Barn storage of fresh yam tubers: Barns are commonly used for the storage of yams in Nigeria. The barn is usually built on an open ground but is usually shaded to protect the yams from the scorching effect of the sun. There are many variations in the type of structure but basically, it consists of walls of vertical poles cut from the bush or planks bought from the market, if left unbarked, will take root when set on the ground (Ezeike, 1995).

According to FAO (1998b), it is considered that this will reduce the risk of attack by termites or rotting of the timber at ground level. The grown timber will provide shade on sprouting. The maximum storage life of the different cultivars of yam differs from one to the other. However, the mean for all of them is six months. Barns are effective for yam storage during the dry season but once the rainy season starts, tubers stored in barns tend to deteriorate rapidly, with the constantly moist environment enhancing the rotting of the tuber and the frame work of the barn.

ii Platform Storage: Traditional raised platform is built with forked sticks about 1m high, crossed with bamboo and other hard sticks cut from the surrounding bushes. This is usually done in the field. The tubers may be placed vertically or horizontally but it is important that no tuber is placed on top of the other. As with barn storage, shading, ventilation and regular inspection are essential in platform storage (FAO, 1998b). Also, like barn storage, outdoor platform storage is discontinued when the rainy season begins. Sometimes indoor platform storage is used.

iii Ground Storage of Yam: Yam tubers can be stored, piled up on a carpet of dried mulches in a heap. This normally happens under a tree providing shade and the heap is covered with maize or millet stalks or similar materials (FAO, 1990). The shade made by the tree balances out the temperature fluctuations occurring throughout the day, providing protection against the overheating of the produce. This traditional storage method in poorly ventilated structures cannot allow the produce to be checked regularly. This promotes the spread of rot which means that storage duration is strictly limited. The stored produce is also damaged by rodents which can hide themselves very well in the heaps.

b. Cassava

Cassava roots are much more perishable than other major root and tuber crops due to its high water content – 62% (FAO, 1998). Some traditional storage methods for fresh Cassava includes re-burying the roots in trenches covered with plant material and soil; piling the roots in heaps and keeping them moist by watering them daily; applying a thick coating of soft

clay or mud and keeping small quantities of cassava in water.

Some low-cost methods for improving storage and extending the shelf life of fresh cassava roots by at least two weeks have been developed (Crentsil *et al*. 1995). All of these storage methods favour curing conditions in an environment with high humidity and temperature, in order to slow down the rates of physiological and microbiological deterioration. However, to be successful they all require careful harvesting and selection of the roots prior to storage, since curing is not effective if root damage is extensive.

i The field clamp: Storage was successful in field clamps, similar to those used for potato storage, for up to eight weeks. The clamp consists of a layer of straw laid on a dry floor covered by a heap of 300-500 kg of roots followed by a layer of straw and a final layer of soil. Openings are left at the bottom of the heap to provide some ventilation. This storage method was found to be difficult to manage where seasonal variations in climate made it difficult to either limit or increase ventilation and, during a wet season, to ensure that the floor of the clamp remained dry. It also had a high labour requirement.

ii Storage in boxes lined with moist sawdust or wood shavings: The method involves putting alternate layers of sawdust and cassava roots, starting and finishing with a layer of sawdust. As an alternative to sawdust, wood shavings, peat or any other suitable packing material can be used. However, the packing material must be moist but not wet. Physiological deterioration occurred if the material was too dry and microbial decay accelerated when it was too wet. In Uganda this storage method is being tested in combination with the lining of the box with plastic (Nahdy and Odong, 1995). Study have indicated that 75% of the roots remained acceptable after four weeks in store, provided the roots were packed immediately on the day of harvest. However, with a delay of only one day, only 50% of the roots were rated as acceptable.

iii Storage in plastic bags or plastic film wraps: This is the most practical and promising method of storing cassava roots intended for the urban markets. A number of studies have shown that cassava roots treated with an appropriate fungicide and kept in an airtight plastic bag or a plastic film wrap can be stored for two to three weeks. At present, thiabendazole which is widely used to treat potatoes is the safest and most appropriate fungicide to be used. Most of the chemicals remain in the thick peel of the root. Only 1 mg/kg of residue was found in the parenchymal tissue, which is substantially below the limit of 5 mg/kg set for potato (Cooke *et al.* 1988). The highest proportion of HCN is found in the peels and the cortex layer immediately beneath the peels (Hahn, 1984). It is for this reason the cassava root is always peeled before being processed or consumed. Processing involves dipping of the cassava roots in a 0.4% w/w solution of thiabendazole for 10 seconds and storing in plastic bags. It has been successfully tested in Ghana (Crentsil *et al.* 1995) where it was found that household bleach (0.95% active chlorine) was as effective as thiabendazole if sound cassava roots were not stored for much longer that seven days. In addition, transport of the produce over rough roads seemed not to be detrimental to the keeping quality of the roots, suggesting that the technology could be effective for commercial operations.

Conclusion:

The traditional methods of food preservation and storage are much favoured by the people and they use it to save food for future use. However, their techniques are poorly conceived and require improvement to reduce the food losses which hitherto make the traditional methods lose their importance of keeping food safe and for a long period of time. Research into the traditional methods is necessary; to ensure that the methods are cheap and cost effective, to boost food production for the worlds teeming population.

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11/6/2011