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Problems of food storage and preservation in Nigeria: an overview.

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Summary

Huge losses in quantity, quality and monetary terms do result from poor crop storage in Nigeria. These severe post-harvest losses cannot be tolerated when observed that large deficits exist between supply and demand for major food items in the country.

The paper reviewed the losses due to poor storage. It also surveyed factors responsible for these losses, and some of the efforts made by the Nigerian stored product Research Institute (NSPRI). The author called for a National Storage Scheme for an effective and efficient programme to cut down losses to tolerable levels. The paper also suggested a proper linkage between the storage Research Institute and the farmers through an integrated extension service for adoption of new storage techniques so far developed and yet to be devised.

Résumé

D'énormes pertes quantitatives, qualitatives et monétaires sont dues aux mauvaises conditions de stockage des denrées alimentaires au Nigeria. Ces pertes importantes après récoltes ne peuvent être admises si l'on considère qu'il existe une grande différence entre l'offre et la demande pour la plupart des denrées alimentaires dans le pays.

L'article analyse les pertes dues à un mauvais stockage, de même que les facteurs responsables de ces pertes et quelques uns des efforts entrepris par le «Nigerian Stored Product Research Institute» (NSPRI).

L'auteur fait appel à un système national de stockage pour un programme effectif et efficace pour ramener ces pertes à un niveau acceptable.

Il suggère également une liaison rationnelle entre le «Storage Research Institute» et les fermiers par l'intermédiaire d'un service de diffusion pour les nouvelles techniques de conservation déjà mis au point et d'ores et déjà utilisables.

1. Introduction

The world today is facing serious food crisis. The situation is getting worse with the present population explosion, particularly, in the developing countries in the Continents of Africa and Asia. Nigeria exemplifies this gloomy situation in Africa and indeed in the world. In 1963, Nigeria's population was put at 56 m. But the mid-year population estimate of 1985 was 96.1 million. At present conservative birth rate of 3%, it will double in 23 years time and in 30 years time the population will be 281 million (11).

At the present food production rate (2%), Nigeria cannot feed her estimated 100 million people. Food shortages (table 1) with a «hungry season» have been noted to be perennial in many areas of the country; even after an initial surplus in the boom periods (harvesting periods). Consequently, there are marked seasonal variations in the intake of principal staples and supplementary foods. There is, therefore, wide under feeding and malnutrition, the quality and quantity of diet varying to extents which can be related to local farming techniques and economic pressures (7).

One way in which successive governments have tried to cope with this deficit has been through massive importation of food. For example, rice and maize importation (before their ban on October 1, 1985) topped the list of imports in the first

7 months of 1985. Rice importation alone accounted for 131 million for about 650,000 tonnes between January 1984 and April 1985.

Efforts at the home base at increasing food supply to the populace have been directed towards increasing hectareage and farm in puts. These measures have not proved entirely satisfactory. A look at losses due to improper storage would reveal that several metric tonnes of food produced do not get to Nigerians dining tables. Thus another strategy should involve cutting down post-harvest losses. The objective of this paper, therefore, is to highlight the enormity of post-harvest losses and suggests ways of minimizing them.

1.1. The Need to Store and Preserve Food

Food storage is as old as the history of agriculture. As soon as man settled down to domesticate his crops and animal he also found the need to store what excess he had for future use. In Nigeria, the rural farmers constitute 80% of the entire population and they are responsible for about 90% of the country's agricultural output. These areas lack electricity; thus the rural farmers are faced with serious problems of storage and preservation during harvesting periods, particularly, in seasons when they experience increased yields.

The essence to preserve and store arise from.

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TABLE 1
Nigeria: projected food balance sheet (1,000 Tonnes)

S/NO	Commodity	Years and corresponding surpluses (+) or shortages (-)		
		1975	1980	1985
1	Maize	-200.836	-407.784	-827.889
2	Millet	-705.818	-1503.521	-2946.225
3	Sorghum	-1142.503	-2435.849	-4753.344
4	Rice	+67.46	+311.680	+220.160
5	Wheat	-38.544	-52.778	-101.327
6	Yams	-1271.208	-3749.739	-5621.761
7	Potatoes	-249.073	-280.734	-323.726
8	Cassava	-1316.065	-2882.756	-6220.719
9	Cocoyam	-130.509	-285.859	-250.007
10	Plantain	-222.174	-483.368	-973.537
11	Cowpeas	-4.147	+65.032	+145.180
12	Groundnuts	-55.450	-117.722	-230.730
13	Soya beans	+3.607	+13.217	+28.687
14	Meion Seed	-9.542	-20.218	-41.699
15	Vegetables	-297.084	-561.829	-1168.408
16	Fruits	-42.00	-77.548	-161.675
17	Palm Oil	-265.376	-564.654	-1092.898
18	Poultry	-19.986	-32.472	-67.621
19	Beef	-111.350	-225.117	-461.155
20	Fish	-335.908	-836.224	-1702.000
21	Eggs	-36.365	-62.844	-131.451
22	Milk	-235.848	-472.028	-959.091

Source: Computed from (7,8)

- The need to keep excesses not presently required,
- The need to guide against scarcity during unfavourable time and off season periods,
- Proper storage means reduced losses of food and high profit level for producers,
- Proper storage helps to stabilize prices as a result of availability of food items throughout the year,
- Leads to increased food availability for consumption and hence a cut down on import bills on food with a consequent saving of foreign exchange from such importation, and
- Short term storage may be necessary because of distance between centre of production and markets for disposing farm products. From the foregoing, the importance of proper food storage and preservation cannot be overemphasized. How has Nigeria fared in this practice of food production?

2. Food Wastages in Nigeria

Huge losses can result from poor storage of food. The level of losses depend on (i) the storage structure, (ii) method of storage, (iii) the product being stored, (iv) the state of the product under storage and (v) storage environment. Food production process cannot be said to be completed without adequate storage. It is useless spending a lot of labour, time and money in food production only to have them wasted or spoiled. As indicated earlier on, this practice is a ardeous one with the Nigeria rural situations.

Agricultural produce is subject to attack by a wide range of pests and diseases in storage. Some of the identified main pests of cereals while in storage in Nigeria are the flour beetle *Tribolium Castaneum*, confuse beetle *Tribolium confusum* and Angusmoise grain moth *Sitoroga cerealla*. For cowpeas, the main storage pests are the Bruchids *Bruchidus atrolineatus* and *Callosobruchus maculatus*. The larvae and some adults cause the losses through their feeding habits.

Losses due to poor storage have been classed (12) into (i)

weight loss, (ii) quality loss, (iii) food loss, (iv) monetary loss (v) seed loss and loss of goodwill. In this paper I shall address losses in quantity, quality and in monetary terms.

The FAO (1972) estimated a world-wide annual loss of 10% in stored grain (2). However, losses of 30 to 50% have been reported in tropical countries of Africa (12). In short, losses up to 60% have been indicated in some cases for tuber and vegetable crops. In Nigeria, 1.5-2 million tonnes of cereals and grain legumes representing 15-20% of the annual 10 million tonnes produces are lost due to poor storage. As much as 30-50 million tonnes for root and tuber crops like yam. Using 1975 figure, up to 5 million tonnes of 15 million tonnes of yams produced were lost (that is about 33% of the total yams produced that year). Viewed in monetary terms substantial amount is lost through poor storage annually. A 15% grain loss of 1.4 metric tonnes is equivalent to Nigeria N280 million (1).

Losses for vegetables; fruits and animal products are much higher than figures for grains. These are highly perishable products. About 35% of these items; especially in the rural areas are lost in storage. Usually, after harvesting, a short to medium period is required before transportation to the consumers mostly in the urban areas. Some form of storage becomes imperative.

Quality of products is also lost under poor storage. Grains can become mouldy and tastes become tainted. Fruits and vegetable products become unfit for consumption resulting in enormous financial losses. For example, (4) showed that a loss of 4% (115,000 tonnes) occurred in sorghum stored in local granaries in the 1961/62 season due to attacks by insects.

He reported also heavy attacks by the beetles *Tribolium Castaneum* and *Trogoderma granareum* on stored groundnuts. This attack was related to loss in weight of crop and increased free fatty acid (FFA). A rise of 1.5% in FFA on the whole groundnut crop was estimated to have cost Nigeria N250,000 *per annum*.

Animal products do suffer losses due to improper storage. Considerable damages are done to dried fish and meat by *Dermestes maculatus* whose larvae can cause hollow in them during storage. Nigeria produced 3.5 million tonnes of fish between 1980 and 1984 but lost nearly half of it to poor storage. About 45% of fish caught in 1983 was lost due to poor preservation, handling and storage, particularly in the artisanal sector, that is, fish caught by the use of simple gear such as hooks, nets and non-sophisticated fishing methods. This sector provided 98% of Nigeria domestic production between 1973 and 1983. Figures from the fisheries department show production to fall from 777,208 in 1983 to 511,472 tonnes in 1984. In 1983 alone, about 45% of the 505, 139 tonnes fish output in the artisan sector was lost which was valued at about N112.7 million. A better preservation and storage method could have saved about 75% of Nigeria's total catch which could enhanced Nigeria's low daily protein intake.

Losses of food items will continue to widen the food supply demand deficit in Nigeria if not arrested. It is pertinent here to highlight some of the major factors affecting food storage in Nigeria.

3. Factors Affecting Food in Storage.

Some of the factors identified as causes for these losses are:

- (i) Chemical and physical changes resulting from high microbial growth, insect activities which are highly favoured by the environmental conditions of temperature, relative humidity and moisture. Rodents also pose serious problem in storage especially where grains are stored in sacks.
- (ii) Mishandling while in transit. Proper care is not taken while moving produce from farm sites to stores or between one town and another.

This causes physical injury to the products which predisposes them to fungi and bacterial attack. This hastens the rotting process of vegetables, fruits and tubers; particularly.

- (iii) Use of poor storage containers and stores. Because of the low level of technology in Nigeria, local farmers depend on the use of simple storage structures like raised platform, thatched Cribs, rhumbu, earthen pot, bin for grain; barns for yams and no special storage facilities for easily perishable products like fruits, vegetables and meat in the fresh state. Silos are essentially used by large commercial concerns, government agencies involved in mass purchase from local farmers.
- (iv) Poor state at maturity and physical condition at harvesting. Harvesting is mostly done at an advanced stage of ripening, even after some damages had been done by insects and rodents.
- (v) Inappropriate storage moisture content, and
- (vi) Poor farming practices, for example, fertilizer application. In most cases in Nigeria, fertilizer application is not based on soil test values. It has been shown by (5) that high N application reduces storage life, while high doses of P and K fertilizers improved storage life of white yam (*Dioscorea rotundata*) between 3-3.5 months after harvesting.

4. Minimizing Losses

Since most of the rural producers are poor and illiterates, sophisticated methods like cold storage, irradiation cannot be meaningfully utilised here. Hence methods which can be easily adopted by these small rural producers are being advocated. Emphasis is on preventing factors which can lead to serious loss and medium technology easily adoptable in terms of cultural compatibility, economic viability and technological operatability.

These can be summarised as follows:

- (i) Processing of farm products into forms that can keep for long and proper package thereafter,
- (ii) proper storage practices, for example, adequate drying,
- (iii) good sanitary conditions of the storage environment, e.g. cleaning, proper sacking etc.,
- (iv) development by breeders of varieties which have relative low moisture content,
- (v) Harvesting at mature green stage for highly perishables like tomato, pepper, banana etc.

At the Nigerian stored products Research Institute (NSPRI) some simple methods easily adoptable have been developed (6). These include: (i) Storage of tubers; e.g. cassava. Freshly harvested cassava with a little of the attached stem embedded in moist saw-dust in baskets, boxes, cartons were

found to keep for as long as 10-12 weeks; against a normal storage life of 2-3 days under uncontrolled Nigerian environmental conditions.

ii) storage of fruits: Packaging in slatted boxes and perforated cartons with dufaylite paper cells (10) reduced losses in orange in transit to less than 1%. Those without dufaylite cells had 3-5% while those transported naked had 20-25% losses at their destination. Storage of the oranges in these structures in a cool shed were observed to preserve them for 3-4 weeks with less than 10% spoilage in Southern Nigeria, while storing them in unprotected heaps, as is the common practice, caused 40-50% within 2 weeks.

A method which is a possible alternative to conventional refrigerator that could revolutionised storage of perishable farm products has also been developed. This is the Evaporated Coolant System (ECS). It is developed to reduce the temperature in the storage chamber. Two models have been constructed and tested by NSPRI. The first model is a rectangular double-walled structure made of burnt bricks on a solid foundation and it carries a heat insulating roof. The space between the double wall, the cooling medium, is filled with river bed sand that is constantly kept moist with water. The inner chamber which forms the storage chamber is divided into shelves or compartments for fruits and vegetable placements.

The second model consists of two burnt clay pots, one placed inside the other and the space in between is filled with river bed sand that is constantly kept wet. The smaller pot is coated externally with cement to prevent inside seepage of water. Cooling is effected through heat transfer to the wet river bed sand.

A temperature drop of 8-12°C below ambient has been achieved in the ECS chambers. Storage trials conducted for mangoes, pineapples, tomatoes and leaf vegetable have been found to be effective. Unfortunately, these results have not been well publicized and the idea sold to the rural producers. Thus, (9) advocated for the launching of a National Storage Scheme (NSS) aimed at co-ordinating and monitoring the effective use of many storage facilities in many parts of the country and also formulate new guidelines of achieving good storage conditions and structures for farmers; particularly, at the rural level.

5. Conclusion

Considering huge losses resulting from poor storage and the need to meet the ever widening gap between food supply and demand, the need to pursue a vigorous food storage programme need not be over-emphasized. Efforts at doing this should involve research institutes, universities, government and the organised private sector and of course, the rural farmers. New methods of proper storage should be communicated through good extension services to the farmers for adoption.

A reduction in post-harvest losses would increase available food for the Nigerian masses. There is the need to develop simple storage methods for crops like yam, apart from the expensive cold-storage technique and the barn method which under tropical conditions result in severe losses.

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