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Investigation into the Post Harvest Losses of White Yam (*Dioscorea rotundata*) During Storage in Yam Barn and Platform Structures

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ABSTRACT

Yam is one of the preferred staple foods in West Africa. The annual vegetative cycle of yam necessitates a long period of storage to make it available all year round. The major problems in yam tuber storage are sprouting, respiration and transpiration which cause weight and quality losses. In this work, the effects of storage conditions and storage period on the nutritional and other qualities of stored yam tuber were investigated. Storage structures used were yam barn and platform. A total of 20 yam tubers (Dioscorea rotundata) locally called "Gambari" variety with 10 tubers in each storage structure were used. Parameters evaluated were temperature and relative humidity within the storage structure, signs of deterioration of the tuber such as sprouting, weight loss and rotting and some nutritional parameters were also evaluated. The temperature and relative humidity were measured three times a day at 6:00am, 2pm and 6pm. The results showed that average temperature and relative humidity in the barn were slightly higher than that of the platform. These differences were statistically significant, in the three month storage period. Tubers stored in the barn has highest sprouting index and weight loss while at the end of the three months storage period, the tubers in platform showed less weight loss compared to the barn. The difference in sprouting and weight loss between the structures was statistically significant. Also, tubers stored in the barn had the highest percentage of rotten tubers compared to the tubers stored in platform.

Key words: White Yam, Post-Harvest Losses, Yam barn, Platform, Storage Methods

INTRODUCTION

Yam, a tropical crop in the genus *Dioscorea*, has as many as 600 species out of which six are economically important staple species. These are *Dioscorea rotundata* (White yam) *Dioscorea alata* (Water yam), *Dioscorea bulbifera* (Aerial yam) *Dioscorea esculentus* (Chinese yam) and *Dioscorea dumetorium* (triofoliate). Out of these, *Dioscorea rotundata* (white yam) is the most common specie in Nigeria. Yams are grown in the coastal region of rain forest, wood savanna and southern savanna habitats [1].

It is in the class of root and tubers that is the staple food of West Africans which provides about 200 calories of energy per capital daily. In Nigeria, in many yam producing areas, it is said that "Yam is food and food is yam"

In Nigeria, yams are generally consumed in many different forms as food for man while it can also be used as animal feed. This use is reportedly limited only for economic reasons [2-3]. Yams are essentially for consumption and are eaten, chewed or swallowed, but boiling and pounding are preferred methods of eating yams [3].

In yam growing areas of Nigeria, yams are converted to flour and utilized in different form. Yams are regarded as the traditionally most acceptable source of flour over other crops like cassava, cocoyam and plantain [4]. The researcher further observed that the conversion of yam tuber to flour is recommended as a suitable and convenient method of storing the crop to prevent postharvest losses encountered during storage. However, the production level of yam in Nigeria is substantially low and cannot meet the growing demand at its present usage level.

Successful storage of yams requires the use of healthy and sound tubers, proper curing if possible combined with fungicide treatment. There should also be adequate ventilation to remove heat generated by respiration of sprouts and rotted tubers that develop. Monitoring the presence of rodents and protection from direct sunlight and rain is also necessary. Yams can be best stored in a cool, dry and well ventilated surrounding [5]. Yam storage structures came in different shapes and sizes depending on the ability of the farmer, locality and cultural practices. The construction materials are usually wood, ropes, palm fronds, guinea corn stalks, and mud [6-7].

The most common problems faced by farmers are post-harvest losses. Wastage occurs because the apparent surplus during the harvest season cannot be consumed within a short period. However, few months after the harvest there is always a diminishing availability of yam produce. Therefore, it becomes imperative that the existing yam tubers are stored in structures for later use [8] as cited in [5]. Lack of improved and affordable yam storage facilities have left most yam farmers at the mercy of marketers and middlemen, who would usually purchase their produce at relatively cheaper prices. Farmers would usually run at a loss at the end of the farming season, making this situation a great disincentive to yam farmers in Nigeria and the Sub-Saharan Africa at large. If this problem is not tackled appropriately, soon, most farmers would quit yam cultivation and shift their focus to other food crops. This without doubt, would greatly affect the country food security as far as yam production is concerned.

According to [9], there are several traditional low-cost storage methods and structures for yam tubers. The most common of them include leaving the tubers in the ground until it is needed. They can also be stored under tree shades, yam barns, underground structures such as pits, ditches and mud structures. [5] and [10] also reported that there are well ventilated weather-proof, insect and rodent proof strong shelters for storage of yam tubers; however, the cost of these structures discourages farmers, who are the major producers of yams, from adopting such improved storage structures.

There is therefore the need to promote less expensive, improved storage structures using local materials for small holder yam farmers. This approach will not only increase the income of yam producers but also ensure an all-year round availability of yams, which is critical in achieving sustainable food security in the country.

MATERIALS AND METHODS

The yam tubers used for this study were white yam (*Dioscorea rotundata*) is locally called Gambari. This is one of the most commonly cultivated species among the farmers in the study area. The tubers used were brought from Emure Ile market. Wet and dry bulb thermometer and weighing balance were also used.

Methods

The storage structures used for this study were barn and platform structures.

Barn construction

The barn was constructed with vertical poles from *Gliricidia Sepium* species. Holes of 30cm depth and space 30cm apart were dug along the perimeter of the 2.7m by 1.7m barn for the support of the main vertical poles of average diameter (thickness) of 5cm were used as main vertical members. The main members were held together by smaller diameter (thickness) poles placed horizontally along the height of main members, one above the other and tied using cordage. Plate 1 shows the experiment arrangement of yam in the yam barn.

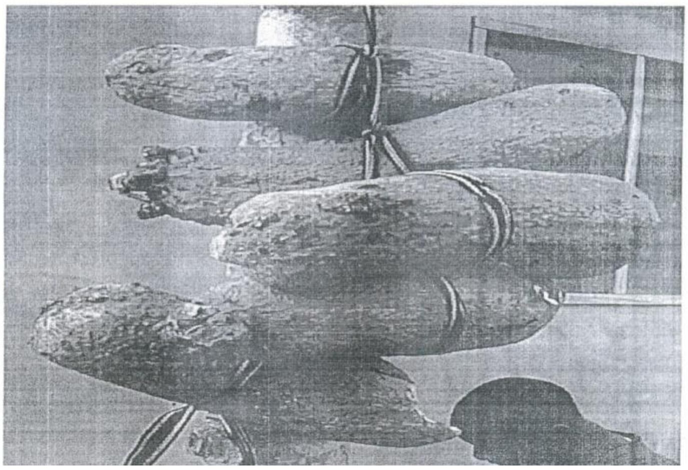

Plate 1: Experimental Arrangement of Yam in the Yam Barn

Platform construction

For the construction of the platform, a plank of 70cm long with thickness of 8cm was placed on two blocks of 2.25cm high within the already specified premises above. The place was fumigated and also rodenticide were used against rodent. Plate 2 shows the experimental arrangement of yam on the platform

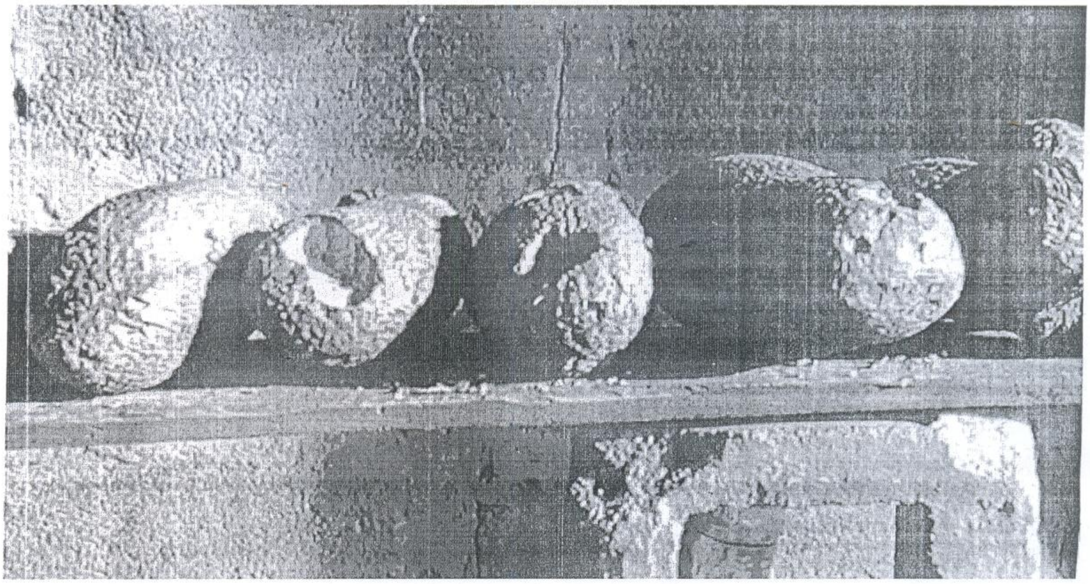

Plate 2: Experimental Arrangement of Yam on the Platform.

Experimental Site

An open space for yam barn and for platform within the premises of the Department of Agricultural Technology, Rufus Giwa Polytechnic, Owo, was selected to stimulate the traditional practices whereby farmers prefer elevated sites under shade with adequate drainage and unobstructed ventilation for the storage of yam tubers.

Experimentation

The experimentation consists of monitoring the temperature and relative humidity of the storage environment, the weight losses and the rate of sprouting in the tubers. Temperature and relative humidity were monitored using wet and dry bulb thermometer. Three readings at 8.00am, 2.00pm and 6.00pm were taken every week and the difference between subsequent weights represent the weekly loss. Weights were measured with digital and 5kg capacity weighing balance. The sprout were removed weekly and weighted.

During the weekly weighing periods, the tubers were also observed for physical defects such as rat and insect attack. The experiment was carried out for a period of 12 weeks between May and July, 2015.

RESULTS AND DISCUSSION

Results

The results of the experiment with the storage structures under conditions are presented in figure 1, 2, 3, 4 and 5 while table 1 and 2 shows the performance of the structures.

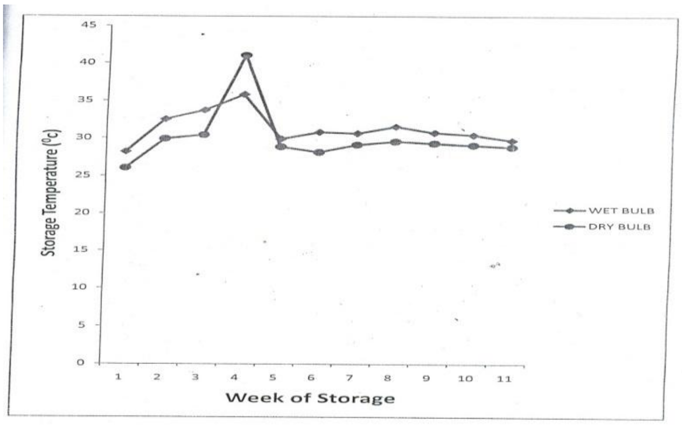

Fig. 1 Graph of Weeks of storage versus storage Temperature for Yam Barn

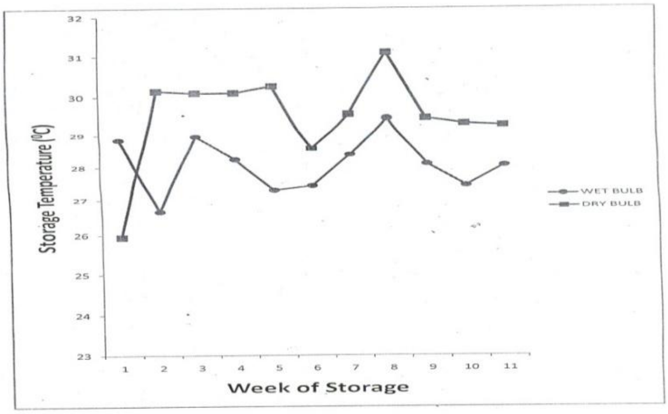

Fig. 2 Graph of Weeks of Storage versus Storage Temperature for Platform

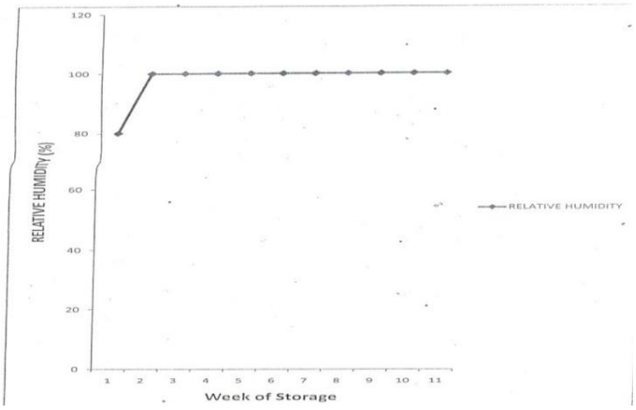

Fig. 3 Graph of Relative Humidity versus Week of Storage for Platform

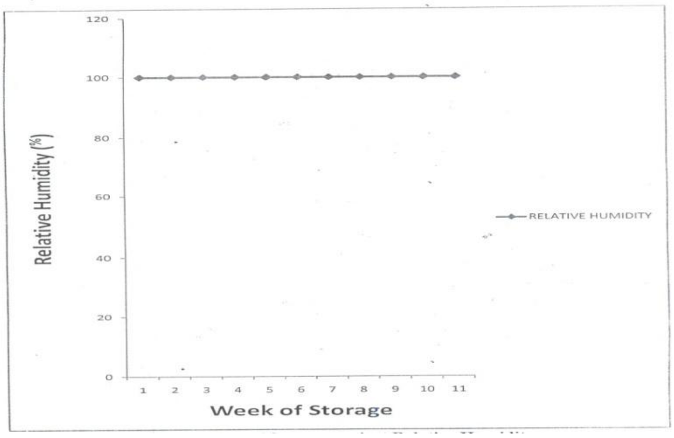

Fig. 4 Graph of Weeks of Storage against Relative Humidity Yam barn

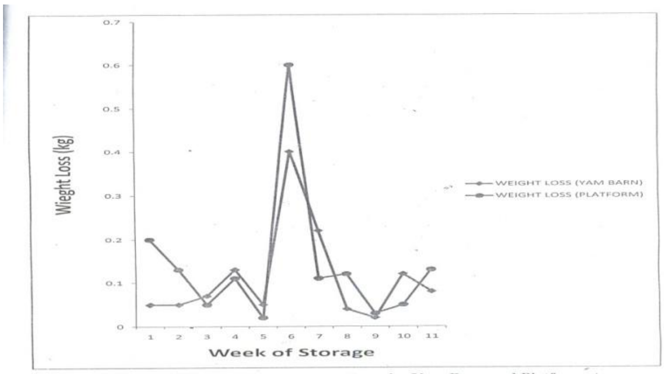

Fig. 5 Graph of Average Weekly Weight Loss for Yam Barn and Platform

Table -1 Numbering Yam Sprouting in Yam Barn

Weeks	Number of Sprouts	Sprout Index
1	5	0.5
2	----	----
3	----	----
4	4	0.4
5	----	----
6	----	----
7	6	0.6
8	5	0.5
9	6	0.6
10	----	----
11	4	0.4

Table -2 Numbering Yam Sprouting in Platform

Weeks	No of Sprouts	Sprout Index
1	3	0.3
2	----	----
3	----	----
4	2	0.2
5	----	----
6	----	----
7	3	0.3
8	----	----
9	----	----
10	----	----
11	1	0.1

Discussion

Figures 1 and 2 describe the temperature pattern in both barn and platform structures. The wet and dry bulb temperatures taken shows that dry bulb maximum temperature of 45 °C in the 4^{th} week and minimum temperature of 27 °C during the first week for yam barn storage were recorded. For the same storage structure, the wet bulb temperature gives maximum and minimum temperatures of 37 °C and 28 °C respectively.

Similarly, in case of the platform storage variations in temperature were noticed. However, maximum and minimum dry bulb temperature recorded were 31.4 °C and 25.9 °C respectively while the wet bulb maximum and minimum temperatures observed were 29.5 °C and 26.6 °C respectively and these occurs in the 8^{th} week and first two weeks of the observations. Generally, observations show that temperatures under platform storage is lower than that of the yam barn storage because of the shade provided. This observation is also in line with the findings of Mijinyawa and Alaba [8].

Furthermore, throughout the period of storage, the relative humidity (R.H) is 100% in the yam barn while in the platform it varies within the first two weeks (80% minimum), after which it rises to 100% and remain constant throughout the period of storage as revealed in figure 3 and 4.

Weight Loss

The weekly rate and cumulative weight losses observed in the stored yam tubers is represented in figure 5. The values of the weekly weight losses were higher in the platform than the barn.

Weight loss in stored yam tubers is attributed to three factors. These are moisture loss through transpiration, respiration and sprouting which exhaust the food stored in the yam. Among these factors, moisture loss is reported to have contributed the highest percentage to weight loss. Figure 5 shows that highest losses occur between fifth and sixth weeks.

Sprouting:

The weekly and cumulative data of sprouts in the yam tubers stored in the two structures are presented in Tables 1 and 2. The yam sprouting in platform was lower than the barn. Sprouting is promoted by humid environment and high temperatures. The higher relative humidity and temperature within the yam tubers stored on the barn are the major factors responsible for the higher sprouting in the barn than the platform.

Physical Observation

Shrinkage and rotting of yam tubers was one of the physical parameters considered in the study. Shrinkage was noticeable in the tubers stored in the platform. At the 7th week of storage, rotting was initiated in four tubers and by the end of the 11th week, the four tubers had completely rotted within the platform. There was no incidence of shrinkage and rotting among the yam tubers stored in the yam barn throughout the period of the experiment.

CONCLUSION

In this study, an assessment of storage practices of yam was carried out. The major storage facilities available to farmers are traditional storage which includes platform and barn in storing agricultural produce (yam). The study reveals that if all factors remain constant platform storage fair well then the barn storage.

It was also revealed that lack of capital, inadequate facilities, climatic factors, pest and diseases are the major problem of storage.

Recommendation

On the basis of the findings of this study, these recommendations are made.

The Government should educate the farmers about improved methods of storing their yam. If these recommendations are implemented the storage losses in post harvesting in yam will be ameliorated.

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