ASSESSMENT OF SOME TRADITIONAL GRAIN STORAGE STRUCTURES IN MUBI SENATORIAL ZONE OF ADAMAWA STATE

M.U. ABBA. A.A. ATIKU.
Department Of Agricultural and
Bio-environmental Engineering Technology
Federal Polytechnic Mubi

Abstract

An assessment of some traditional grain storage structures in Mubi senatorial zone of Adamawa State of Nigeria was undertaken. The result of the findings shows that the common grain storage structures existing in the zones are the mud rhombus, thatched rhombus, underground pit, platforms, earthen pots, cribs respectively. The grain usually stored in unthreshed forms includes millet, sorghum, maize and cowpea. Most of these structures are not moisture proof, rodent proof and are not airtight. Structural defects occur mainly in the roof, walls and columns of the storage structures. The common types of physical defect are cracks, leakage, termite infestation and structural failure of parts. The causes of defects among others include poor strength of materials, inadequate columns, low elevation and pest infestation. In the 57 wards of the five (5) Local Governments in the study area a total of 264 structures were studied (Table.4.). The study revealed that 32.6% of the structures investigated have cracks on their walls, and 15.5% have defect due to collapse of wall lining (Table.5.). The pie-chat (Fig.4.) also revealed that 117.200 marks structures with cracks on the wall, and 55.810 marks structures with defects due to collapse of wall lining. The importance of storage among other are; to keep planting materials from one generation to the other without loss of viability, to ensure steady supply of food throughout the year, since food harvest are seasonal, to stabilize food prices by stock piling when food prices are low and releasing them into market when the prices go up, to encourage farmer's to produce more food since the excess of what they produce will not be lost.

Keywords; *Structure, storage, drying, defects, moisture, grain, termites.*

Introduction

According to a local proverb the definition of a rich person is the one that has stored enough grains to last the year round. Another proverb adds that if one has enough grains in the house then even his foolishness is taken as intelligence. Grain storage is highly important for food security – local and national (Most farm produce begin to undergo deterioration as soon as they are harvested (ShamsuddinTunio, 2010).Agents of spoilage include damage to harvested crops, enzymatic actions, environmental conditions, insects, rodents and microorganisms infestations (RaufNizamani, 2010). The main function of a food storage structure is to control the activities of these agents. It should be noted that in addition to storage structures there are other items that require storage structures on the farm. These include animal feed and fodder, fertilizer, vegetables, milk, machinery, supplies etc. In this seminar paper however, emphasis is on the traditional food storage methods and their storage structures.

Post- harvest facilities or appropriate storage technology has beenthe major problem of Nigerian agriculture for a long time. Nigeria is losing about 2.4 billion tones of food yearly to poor harvest and storage facilities (Olumeko, 1999). The losses were mainly in maize, rice, sorghum, millet, cowpea, groundnut, soya beans, yam, cassava, plantain and fruits. In monetary term, the country is losing a total of N48billion annually on post

harvest losses. It has been observed that different localities in Nigeria have peculiar storage methods depending on the types of crop grown (Adesida, 1998). It has been noted that farmers achieve varying degree of success in applying the basic principles involved in the safe storage of food (Birewar, 1990).In Nigeria the average proportion of food production retained by the farmer's for their own (non-sale)is usually assumed to be 70% (Field Survey 2010). However, there is a high degree of variation reflecting among other factors the size of operational holding, the interaction of consumption pattern with cropping patterns, level of indebtedness and the form of labour payment. Grains kept in farmer's structures are mainly for household consumption; any surplus grain to consumption requirement may be sold within two or three months of harvest. After harvest, grains may be stored temporarily in bulk or in bags for a month or two before being transferred to a structure (Barre and Samuel 1986). The traditional grain storage structures in different parts of Nigeria are made of varying locally available materials. Usually, the type of locally available materials indicates the type of structures. For best success in storing grain in any type of structure, the following are carried out according to (William and Gary, 2002).

Clean grain to remove chaff, weed seeds, and broken kernels.

Handle grain gently to minimize cracked and broken kernels.

Store grain at the recommended moisture.

Aerate stored grain to maintain a cool, uniform,recommended temperature.

Check stored grain frequently and take immediate action to checkmate grain damage.

Objective of the study include

- To investigate the various grains storage structures in the study area.
- To proffer solutions to the problems

Materials and method

Study Area

MubiSenetorial zone of Adamawa state Nigeria comprises of, Mubi North, Mubi South, Maiha, Michika, and Madagali Local Government Areas respectively. It borders Borno State to the West and North, Hong LGA to the South and its Eastern boundry belts the Nigeria-Cameroon borders. The area has a tropical wet and dry climate. Dry season last for a minimum of five (5) months (November to march), while the wet season spans between April and October. Mean annual rainfall usually ranges from 700mm to 1,050mm (Adebayo,2004). The structures investigated for this research were randomly selected in the study area. Oral interview with the owners of such structures and physical observation was also conducted. Five structures have been studied in each of the wards in the study area.The statistical method used in the analysis of results are, Bar-chat and Pie-chat.

Importance of storage

Storage is an important aspect of running a farm for the following reasons.

i. To keep planting materials from one generation to the other without loss of viability
ii. To ensure steady supply of food throughout the year, since food harvest are seasonal
iii. To stabilize food prices by stock piling when food prices are low and releasing them into market when the prices go up, and
iv. To encourage farmers to produce more food since the excess of what they produce will not be lost.

Thus, storage is a very important for sustainability of the farming enterprise. In Nigeria, storage is even more important because the storage systems in place are not fully developed. By some estimates, up to 30% of food produced in the country is lost due to poor storage (Onwualu, et al,. 2006)

Traditional Storage Practices

Storage of crops and animal products can be for short or long term. There are many devices which can be used for storage purpose. These include corn cribs, rhombus, silos and refrigerator Onwualuet al (2006). For centuries people have used different methods of food security – local and national. Grains are stored depending on local economic and climatic factors. Grain storage occurs in different stages at field level when shoots are cut and dried before threshing and at field level when grains are kept for several days during threshing season before being taken to farmer's compounds. At every stage care is taken to protect grains against damage. Grain is affected by moisture level, (especially at early stage of harvest), aeration process, sunlight, temperature, microorganisms and various diseases and pest attacks. Women play an important role in grain storage every in Nigeria and they are familiar with different stages and steps of storage process. There are several traditional methods of local storage. A first common method is to build mud/clay jars – which are erected a little above ground to avoid contact with the soil and thus preventing moisture and access by pests, insects and rodents (Hayma 2003).

Requirements for a good Storage Structure

For a storage structure to perform its functions well, it must be design to meet up the following requirement

a. It should keep product cool and dry.
b. It should provide protection from insects, birds, mites and rodents
c. It should have easy inspection facilities.
d. It should have facilities for aeration and fumigation
e. It should be economical
f. It should permit cleaning
g. It should protect the food produce from fire and theft, and
h. It should have good loading and unloading facilities.

Types of Storage Structures

Mud Rhumbus

A mud rhumbus is a cylindrical structure specially made from a mixture of dry grass and clay with either circular or rectangular cross sectional area. It consists of a bin or pillar resting on large stones and covered with a thatched roof . The pillars are about 50cm high. The roof of the structure is usually conical and can be made of thatched, grass or mud. The rhumbus is about 1.5m high by 1m in diameter. On the average, a rhumbus can store 500-2000kg of grains.

A mud rhumbus consists basically of the following;

a. Foundation – floor assembly
b. Shell or wall, and
c. Roof

The construction materials used for the floor, wall and roof include mud, grass, stones, pillars.

Some of the problems identified with the Rhumbus include high risk of fire and theft. There are also the problems of moisture migration, rodents and insects.

Thatched Rhumbus

The thatched rhombus is made of woven grass stems resting on irregular stones and or tree stems. They are usually cylindrical

or circular in share withcapacities ranging from 500kg – 8,000kgs depending on the size. The grains are usually stored in unthreshed forms. They are generally not airtight, moisture and rodent proof. Construction cost is between N2, 000 and N 8,000. They usually have external support ranging from 6 – 16 units depending on the size of the rhombus ((Adejumo and Raji 2007).

Calabashes, gourds, earthenware pots.

These small capacity containers are most commonly used for storing seed and pulse grains, such as cowpeas. Having a small opening, they can be made hermetic, by sealing the walls inside and out with liquid clay and closing the mouth with stiff clay, cow dung, or a wooden (cork?) bung reinforced with cloth.If the grain is dry (less than 12% moisture content) there is usually no problem with this kind of storage.

Storage baskets (cribs) made exclusively of plant materials.

In humid countries, where grain cannot be dried adequately prior to storage and needs to be kept well ventilated during the storage period, traditional granaries (cribs) are usually constructed entirely out of locally available plant materials: timber, reeds, bamboo, etc. Under prevailing climatic conditions most plant material rot fairly quickly, and most cribs have to be replaced every two or three years - although bamboo structures may last up to 15 years, with careful maintenance.Basically similar to the outdoor type of platform described above, in all its variations, the traditional crib differs in always having a roof and wall(s). It may even be elevated at least one meter above ground level, with a fire maintained underneath to assist drying of the contents and, allegedly, to reduce insect infestation. However, such cribs (especially the larger ones) are more commonly raised only 40 to 50 cm above ground level.Access to the interior of a crib is gained usually over the wall. This may involve raising the roof, but some cribs have a gap between the top of the wall and the roof to facilitate entry. Relatively few cribs have sealable gaps in the wall or floor for the removal of grain.

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JarsThese are large clay receptacles whose shape and capacity vary from place to place. The upper part is narrow and is closed with a flat stone or a clay lid: which is sealed in position with clay or other suitable material. Generally kept in dwellings, they serve equally for storing seeds and legumes. So that they may remain in good serviceable condition, they should not be exposed to the sun and should not be either porous or cracked.

Earthen Pot.The earthen pot storage is found in very few villages in Madagali and Mubi South.. It is made of burnt clay. The shape and sizes differ with the locality. They have capacity of between 5 – 20kg of threshed or shelled cereals. The grains stored in this pot are used mainly for seedlings. The grain crops stored includes cowpea, maize and sorghum. The main defects are that, it is fragile, small in capacity and absorbs moisture from the ground where it is place. Damages on seed include mould growth, and spouting, change in colour, odour and taste.

Underground Pit

This is commonly found in Madagali Local Government Area where the water table is low. The pit, which may be round or square in cross section, is 1 – 3m deep and 1 – 3 m in diameter or square. The underground pit is usually lined with straw. The pit and the straw mat are padded with 40 – 60cm of corn husk. Also a layer of husk padding or insulation is provided at the bottom of the pit. The common types of grain stored are millet, sorghum and cowpea; they are stored in threshed form.The capacity ranges from 1000kg – 6000kg and above. After loading the grains into the pit, tree stems are placed across the pit then covered with polyethylene or metal sheet.

The Underground pit, has a woven grass stem lining used for storingmillet.Then a layer of husk before finally layers of sand or laterite is used to cover it. The duration of storage could be between 1 and 5 years without opening and usually, once opened; all the content must be emptied. The same site can be used for up to 12 years with annual re-digging.

The location of the defect is usually in the wall lining, which may be eaten up by termite, and the structure is not rodent proof. Maintenance is usually done by cleaning and replacement of the wall lining. Maintenance cost is dependent on the locality and availability of material.

The damages or loses in stored grains includes change in colour, odour and taste. It is believed that these grains have low viability. Grains stored in this structure are protected against insect attack because of reduced oxygen level. Causes of grain damage/loss include microbial organisms, structural failure and changes in the chemical composition of grains. Approximate percentage loss of quantity and economic values are 10 – 20% and 5 – 10 % respectively. The underground pit is easy and cheap to construct and requires minimum materials, but however great difficulty is experienced in emptying and cleaning the structure.

Bags or Sacks.

Putting grains in sacks or bags is an old method of storage. Storage sacks are made of wooden jute, hemp, sisal, local grasses and cotton. Sacks are relatively expensive as they do not often last for more than two seasons. Sacks can be stored in a farmers house, no special building or container is needed. Farmers in the village can decide to build a shed to hold all the grain belonging to all the village farmers. Grains stored in fibre sacks are easily attacked by insects, rodents, moulds. Farmers should be encouraged to dry their grains well before storage. The grains should be inspected regularly. The environment should be water proof and well dried.

In many countries, the extent of losses after harvest has not been fully assessed. Those assessment that have been made indicate a serious wastage. Assessment of loss of quality and quantity of produce should be undertaken on the farm, in traders stores and at centralstorage depots as well as in processing plants and the export chain. An effective storage policy must reflect and be integrated with the overall agricultural programme. This has not being catered for presently.

Source; (Field survey 2012Field survey 2012)

Fig;2

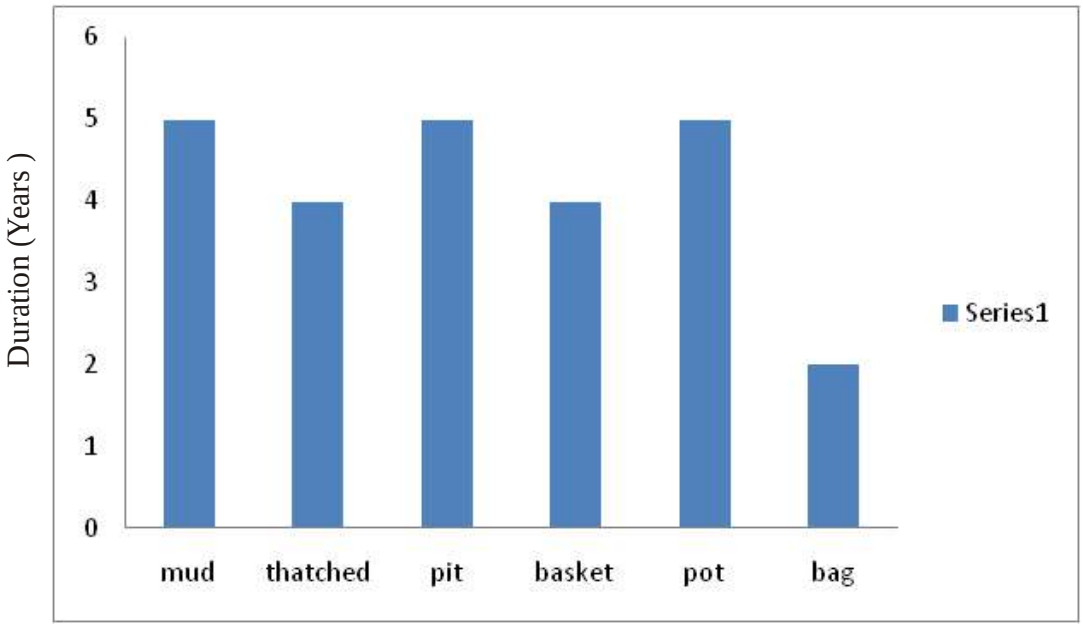
Source;(Field survey 2012)

Table 1;.Information on Storage facilities under study.

Structure	Address/Location	Number of structures investigated	Duration(yrs)	Capacity(kg)	Use of structure
Mud Rhombus	Michika	78	5	1000	Store maize
Thatched Rhombus	Mubi North.	42	4	1000	Store sorghum
Underground Pit	Madagali.	48	5	800	Store sorghum
Storage Basket	Maiha.	48	4	60	Cowpea/Millet.
Earth Pot	Mubi South/Madagali	48	5	20	Cowpea/Millet.
Bags or Sacks	Mubi North.			100	All grains.

Source (Field Survey 2012)

Fig;3.



Source; (Field survey 2012)

Table;2. Capacity and duration of Storage.

Structure	Capacity (kg)	Duration of Storage.(yrs)
Mud Rhombus	500-2000	2-10
Thatched Rhombus.	500-8000	1-4
Underground pit.	1000-6000	1-5
Storage Basket.	50-100	1-15
Earthen Pot.	5-20	1-10
Bags or Sacks.	50-200	1-2

Source; Ademoju and Raji 2007.

Table;3. Assessment of Storage facilities under study.

Structure	Advantage	Problem	Causes	Recommendation
Mud Rhombus	Low co st of maintenance	Leakage of roofs, cracks on the wall.	Poor strength of material, structural failure	Repairs, replacement of structural parts
Thatched rhombus	Made from locally available materials	Leakage on roofs, walls.	Structural failure.	Replacement of structural parts.
Underground storage pit	Low cost of construction.	Collapse of wall lining.	Termites.	Replacement, fill structure to capacity.
Earthen pot.	Stores seedlings.	Fragile.	Moisture migration.	Use moisture barrier.
Bags or sacks.	No speci al building or container needed.	Attack by insect/mould rodents.	Grain not properly dried.	Dry grain well before storage.
Basket.	Serves for both storage and drying	Structural parts rot fairly quickly under prevailing condition.	Bacterial attack.	Replacement of structure.

Source; (Field survey 2012)

Table 4; Number of storage structures investigated in the study area

Local Govt.	Number of wards	Mud Rhumbus	Thatched Rhumbus	Bags	Underground pit	Earthen pot	Storage basket	Total
Michika	16	13	13	13	13	13	13	78
Mubi North	11	7	7	7	7	7	7	42
Mubi South	10	8	8	8	8	8	8	48
Maiha	10	8	8	8	8	8	8	48
Madagali	10	8	8	8	8	8	8	48
Total	57	44	44	44	44	44	44	264

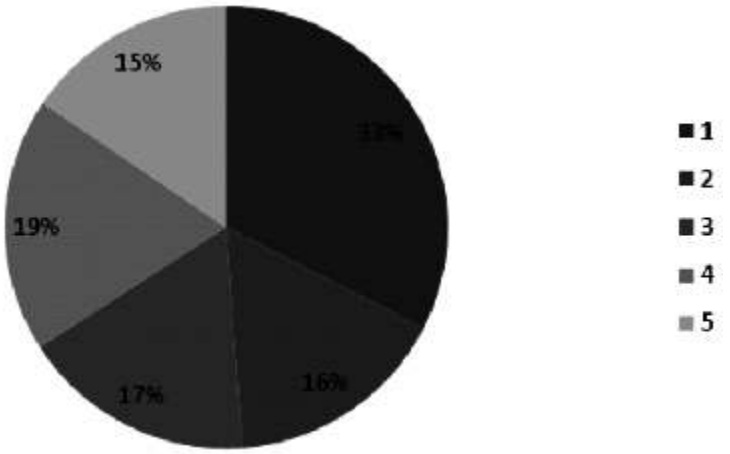
Source(Field survey 2012)

Table5;Assessment of defects on the storage structures in the study area

Local Govt.	Number of wards	Number of structures studied	Number of structures with defects	Types of defects observed	Percentage of defects(%)	Percentage of defects in degrees
Michika	16	78	42	Cracks on walls	32.6%	117.20^0
Mubi North	11	42	21	Leakage of roofs	16.3%	58.60^0
Mubi South	10	48	22	Attack by insect/mould	17%	61.39^0
Maiha	10	48	24	Fragile	18.6%%	66.97^0
Madagali	10	48	20	Collapse of wall lining.	15.5%	55.81^0
Total	57	264	129		100%	360^0

Source;(Field survey 2012)

Fig;4



Source(Field survey 2012)

Key; 1----Cracks on walls
2---Leakage of roofs.
3---Insect attack.
4---Fragile structures.
5---Collapse of wall lining.

Table 6: Required Moisture Content for Different Storage Periods for Grains

. Storage period	Required moisture content	Potential problems
2 to 3 weeks	14 . 18 %	Molds, discoloration, respiration loss
8 to 12 months	12- 13 %	Insect damage
More than 1 year	9 % or less	Loss of viability

Source: Adejumo and Raji (2007)

Result and discussion

The result on assessment of some traditional grain storage methods (Table3) in Mubi senatorial zone of Adamawa state shows that the common grain storage structures existing in the study area are Mud rhombus, thatched rhombus, underground pit, earthen pot, baskets, sacks or bags. The grain crop produced by the farmers in the study area include sorghum, maize, millet and cowpea(Table 1.). Farm produce are stored for as long as the storage structure can bear. The duration of the structures studied is between 4-5yeaes (Fig.3). Adejumo and Raji(2007) have shown that standard local storage structures have strength to last from 1-15years depending on the type. (Table.2.), they have also shown therequired Moisture Content for Different Storage Periods for grains(Table.6.).The type of structure used for storage depends on the type of grain produced by the farmer (Table, 1). The survey revealed that Mud rhombus and the thatched rhombus (Fig,1and Fig,2) have common physical defects such as cracks on the wall and leakage on the roof due to poor strength of material and structural failure. Termites activities also causes wall lining in underground pit to collapse. Mould growth was also observed on the earthen pot due to moisture migration which makes the structure fragile. Insects attack was also observed in grains stored in sacks or bags due to grains that were not properly dried before storage. In the 57 wards of the five (5) Local Governments in the study area a total of 264 structures were studied (Table.4.). The study revealed that 32.6% of the structures investigated have cracks on their walls, and 15.5% have defect due to collapse of wall lining (Table.5.). The pie-chat (Fig.4.) also revealed that 117.200 marks structures with cracks on the wall, and 55.810 marks structures with defects due to collapse of wall lining.

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