History of agriculture

The history of agriculture dates back to the history of the early man. This is grouped into four stages of develop before the advent of modern agriculture. Paleolithic or Stone Age, 2) Mesolithic or middle Stone Age, 3) Neolithic new stone age and 4) Bronze age

1. PALEOLITHIC OR STONE AGE: This is the earliest and longest period of human history which perhaps lasted for more than a million years. During this age, farming per se did not exist nor did the domestication of animal. Going by the historical background in the Bible Genesis 3:23, the LORD God sent man out of the garden of Eden to till the ground from which he was take. Consequently, the harrowing experience outside the comfort zone of the garden of Eden compelled the first man created by God to start wondering from one place to another in search of fruit to sustain his livelihood and that of the family. Therefore, early man in this age used fire, chipped piece of hard stone and rough implements such as crude hand axe and scraper. These were used for hunting and gathering fruit.

2. Mesolithic or middle Stone Age: This was from 12,000 to 6, 000 BC. During this period, men developed and lived with the spear, the bow and fishing net. Wandering in pursuit of game was replaced by primitive farming. Gradual shift from food gathering to food production appeared to have developed independently at different times in different parts of the world

3 Neolithic new Stone Age: This age began at about 6,000 BC. When polished stone tools were developed and used. By trial and error, early man identified those plants of greater value to him and found that the seeds of such plants could be saved and planted to produce more plants, thereby ensuring steady food supply

4) Bronze age: The stone advanced into Bronze Age and later the Iron age, during which better tools were developed to meet the agricultural need of man. Agricultural production evolved with the introduction of other scientific and cultural events. The appearance of plough in 3000 BC was a land

mark in the development of crop cultivation. The replacement of the man-drawn plough by an ox-drawn one was also another major advancement.

DEVELOPMENT OF MODERN AGRICULTURE

Modern agriculture started in England in 18th century. By 1701 precisely, an English farmer called **Jethro Tull** inverted grain drill and horse-hoeing implement which gave rise to better methods of cultivation and ease mechanization through row-crop cultivation..

Investigation on the phenomenon of soil fertility and plant growth was made by **Van Helmont (**1577-1664). He regarded water as the sole nutrient for plants. Another renowned worker was John Woodward. In 1699, he obtained water from various sources and grew spearmint in them. He reasoned that since all these plants have abundant water all should have made equal growth if nothing more was needed. The amount of growth increased with quantity of impurities in the water. He therefore concluded that vegetables are not made up of water alone but some other terrestrial material contributed by the impurities in water.

In search for plant nutrient between 1770 and 1800 many experiments were conducted and facts accumulated on the mode of plant nutrition. The most important contribution at this time was from Joseph Priestly (1775). He found that plant do not affect the air in the same way as animals and that plants actually reversed the effect of animals breathing or respiration on the air thereby keeping the atmosphere pure and wholesome. He discovered oxygen as vital for life but did not discover carbon dioxide, or its necessity in plant nutrition. His work pioneered the understanding of the photosynthetic process. 1779- Jan Ingen – Housz discovered that air purification goes on in light only whilst pollution by plants takes place in darkness. The effect of air on plants and nature and origin of salts in plants was studied by Theodure de Saussure (1782). He grew plants in air or in a known mixture of air and carbon dioxide and measured the gas in air and changes on plant weight. He was thus able to demonstrate the

central facts of plant respiration i.e. absorption of O_2 and releasing of CO_2 in the dark. He further showed that carbon dioxide was absorbed and oxygen released in presence of light. He observed that carbon dioxide in a very small quantity was a vital necessity for plants. If furnished with carbon and oxygen, water is also decomposed and fixed by plants. On comparing the amount of material that can enter through the root under the most farvourable condition, he concluded that the soil furnished only a small part of the food.

At 1834, J.B. Boussingault carried out series of field experiment on his farm. These were the first of its kind. Boussingault therefore, pioneered the research method on which the new agriculture science was to be developed. Boussingault's work covered a wide range of agricultural practices and dealt with the cultivation of crops, soil studies and animal nutrition. Liebiy (1840) published a book titled "Chemistry in its Application in Agriculture and physiology" in which he presented the law of minimum. This law stated that if one crop nutrient is missing or deficient, plant growth will be poor, even if the other elements are abundant. This law is still valid today.

Relationship between Agriculture and other Sciences

The development of modern agriculture, benefited from advances in other science such as botany, engineering, plant physiology, chemistry etc. A lot of early work in chemistry led to our present understanding of plant nutrient requirements and later, the production of fertilizers. Advances in botany and physiology further enhanced our knowledge of forms and functions in crop plants. Early developments in engineering also facilitated the development of farm tool and machineries that reduce or eliminate the physical exertion in agriculture. This encouraged the establishment and maintenance of large scale farms. Further advances in biochemistry and toxicology led to the chemical control of weeds. Thus, modern day agriculture is an embodiment of all aspect of science and technology. Further advancement of the profession still requires the continuous application of innovations in science and technology.

Center of origin of cultivated crops

Centre of origin are the region of the world where crops are believed to have existed naturally without being introduced there for the purposes of cultivation. Center of diversity is the region of the world where the greatest variability in crop species is believed to have occurred. A centre of diversity can also be center of origin.

Primary center of diversity: These are centres where maximum diversity occurs and where the crop is believed to have been first cultivated or domesticated.

Secondary centers are area of diversity to which plant have migrated from a primary centers

The lists of some of the plants that are supposed to have originated from various Centres are as follows:

1. **Southwest Asia**:-Barley, carrot, date palm, grapes, melon and wheat.
2. **Mediterranean**:- alfalafa, cabbage, clover, hops, lettuce and Olive.
3. **Ethiopia**:- barley, castor, coffee (arabica), finger millet, walnut, okra and sorghum.
4. **Central Asia**:- apples, foxtail millet and hemp.
5. **South East Asia**:- bamboo, banana, chinese yam, citrus, coconut and sugar cane.
6. **Indo-Burmese**:-cocoyam, cotton, garden egg, jute, mango, pigeon pea and rice.
7. **Chinese**:- onions orange, small bamboo & soybean.
8. **West central Africa**:- banboo, ground nut, coffee (robusta), kola., cowpea, sorghum, oil palm, red rice and yam.
9. **Central America and Mexico**:- Guava, kidney bean, maize, red pepper, sisal and cotton.
10. **Ecuador and Peru**:- Avocado pear, potato, paw-paw, cotton, sweet potato tobacco and tomato
11. **Brazil and Paraguay**:- cashew, cassava, cocoa, Ground nut, pine apple & rubber.

Importance of origin of crops

1. Breeders used it to identify diverse forms of the species with useful traits or characters for crop improvement.

2. Used by crop protectionist in designing biological control e.g. cassava meal bug

ECOLOGY AND VEGETATION OF NIGERIA

Ecology:- study of organism in relation to their environment. Ecological system or Ecosystem:- refers to the collection of organism that interact or have the potential to interact with physical environment they live. Agricultural activities in any given environment depend on ecology of the region. The components of ecology are climate and soil.

Climate component that interact to produce weather are as follows:

Temperature:-in the tropics, it ranges between 15 and 34 oC. With this crop can be grown throughout the year from January to December. However, temperate regions, temperate determine when agricultural activities commence.

Rainfall: Adequate moisture is essential for plant growth. Over most part of West Africa, the climate is dominated by two air masses namely: a) north-easterly hamattan or dry continental tropical air which originated over Sahara desert and

b) The humid oceanic air brought in by south west winds. These two air masses converge at the Inter-Tropical Convergence (ITC). These zone characterized by

1. Low dense clouds
2. Heavy rains
3. Violent thunderstorms.

A larger part of the agricultural areas of West Africa falls within the ITC zone The Southwest winds bring rain to a zone of 500 -550 km wide on either side of the ITC midline. The ITC follows seasonal variations

depending on the apparent position of the sun, thus the occurrence of the alternating wet and dry season periods over most of the areas covered by West Africa. Another type rain of importance in West Africa is the convectional rain. This type of rain is characteristics of the coastal areas, which coincide strictly with the equatorial zone of West African sub-region. Convectional rainfall results from evaporation and precipitation phenomena.

Altitude:-is strictly a component of climate, nevertheless it affects the local weather of an area. The higher the altitude the cooler it gets thus, high altitude areas provide opportunity for crops like tea and coffee Arabica. Majority of agricultural crops of Nigeria can be profitably cultivated at low to medium altitude (0 – 2000 m above sea level) eg yam, cocoyams, maize, cowpea, plantains, cassava, cacao, oil palm, ruber and robusta coffee.

Photoperiod (day length):- is the length of daylight in every 24 hours. Photoperiodic variation is not pronounced in the major crop production areas of Nigeria. Although a few indigenous West Africa crops (e.g. pigeon peas, sorghum, cowpea, okra and millet) show clear photoperiodic response. Because of the variation in the day length crops are grouped into either- photo- neutral, long and short –day types.

Humidity:- measure the degree of moisture in the air within the atmosphere. Most Nigeria crops and animals adapted to the high humidity of the rainy months and the relatively low humidity of the harmattan season.

Soil : is another factor responsible for diversity of an ecosystem.

Agricultural ecological zones of Nigeria

Nigeria is one of the luckiest countries in the world which had all the vegetational belts (Fig 1) . They are:

1. Mangrove:-These are swampy discontinuous forest areas along the Atlantic coastal of Nigeria. They are most prominently noticeable at the deltas where the brivers empty into the Atlantic Ocean. Some of

these mangrove forest are salty and can only support salt-tolerant mangrove plant species e.g. raffia palms, obeche etc. The major agricultural activity of this vegetation zone lumbering and fishing

2. Rain forest: it is a discontinuous forest zone along the coast following the mangrove forest. The major agricultural activities include- timber, cocoa, kola, coffee, plantain banana, rubber oil palm coconut while arable crops are cassava, yams, cocoyam, maize etc.

3. Derived savannah: As the name implies, it was formerly forest but because of the activities of man (fire, overgrazing crop cultivation over time etc), the vegetation changed to savanna. common crops are yam, cassava, cereals-Maize, rice sweet potato, mango citrus guava, avocado etc.

4. Southern guinea savannah: Tall grasses, ground nut, cotton yam, cassava, ginger, legumes, cereal etc.

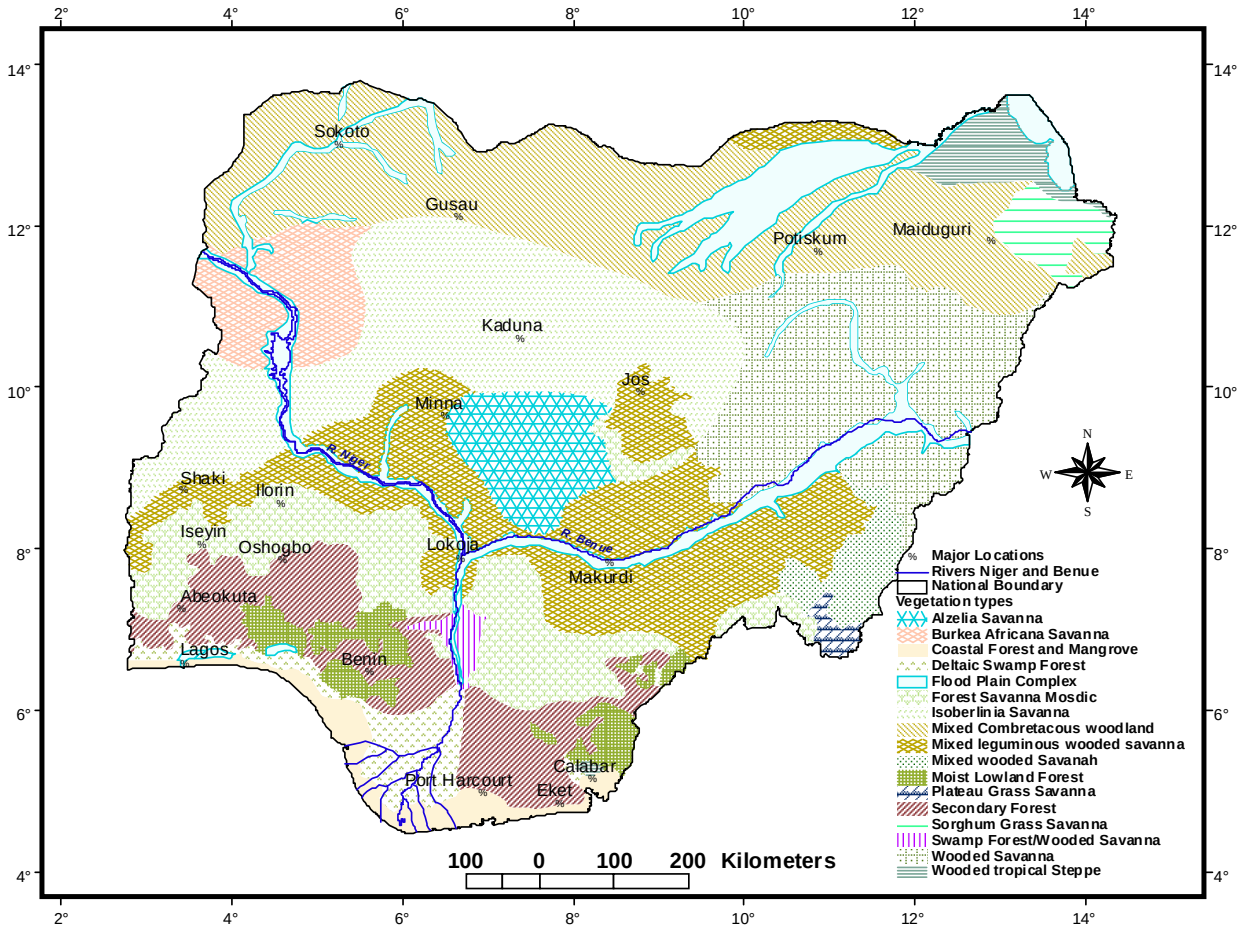
5. Northern guinea savannah:-in 4 above.

6. Sudan savannah:- Few drought, fire resistant trees and shrubs, extensive grassland, millet, cotton, ground nut, tomatoes, watermelon etc.

7. Sahel savannah:- Short cereals, pulses, maize, bambara ground nut tomatoes, onions etc.

8. Montane forest:- tea, coffee, vegetables etc.

Every crop species has optimum sets of conditions for growth. As a general rule crops are not profitable unless they are adapted to the region to which they are produced. The map below gives graphic description of vegetation in Nigeria



Crop distribution

Going from the very wet mangrove to the rainforest in the south to the drier North, the diversity of the natural vegetation decrease, such that less tree and more shrubs and mainly grass predominate. Crop diversity also follows the same trend as the natural vegetation. The high rainfall agro-ecologies in the south is dominated by tree crops (cocoa, rubber, oil palm, citrus, mango and kola), tuber crops(yam, cassava, cocoyam and sweet potato), cereals (maize, rice and sorghum)grain legumes (soybean, pigeon peas and cowpea) and vegetable crops. As one moves from the rainforest to the derived savanna, tree crops thin out. The major economic crops in the derived savanna and southern guinea are tuber (yam, cassava, sweet potatoes) and cereals (maize, sorghum, rice. As one proceeds to the drier north, with about three months of annual rainfall, tuber crops cannot be grown under rainfed agriculture because of their long growth cycle. Thus, the crops that thrive in the dry Sudan and Sahel savanna are early maturing cereals (sorghum and millet), legumes and vegetables.

The rainfall distribution and the quantity determine the crops cropping systems that can be grown in an environment. As rainfall diminishes from the south to the north, the total amount of solar radiation also increases because of less overcast skies. Every crop species has optimum set of condition for growth i.e. each crop has its own set of environmental condition under which it grows optimally.

CROPPING SYSTEMS

Man depends on crops for his food, clothing, feed for his livestock and for other uses.

Crop production basically aims at increasing the dry matter accumulation of crops as well as crop yields. This is achieved by manipulation of the genetic makeup of plants and through environmental manipulations.

Cropping systems on the other hand seeks to increase the benefits derived from crop production by efficient utilization of both natural and socioeconomic resources.

Natural resources include: land, solar radiation, water and soil.

Socio-economic resources are labour, credit, power sources, and market demand.

What is a system?

A system can be defined as an **arrangement of components** that are **interrelated**, and **interact** among themselves **according to some process** and **transforms inputs into outputs.**

Cropping systems

This can be defined as the **cropping pattern** used on a farm and **their interactions** with **farm resources**, other **farm enterprises** and available **technology that determine their makeup**.

Cropping pattern alone does not fully define a cropping system as it is only a component.

What is Cropping pattern?

This is the **yearly sequence** and **spatial arrangement** of crops or crops and fallow on a given area.

Cropping pattern therefore deals with the questions of:

- How crops follow one another in a year on a farm
- How the farmer arrange the crops within a given space on the farm.

It therefore follows that in cropping pattern answer questions like :

- Does the farmer grow just one or more crop at a given time within a year?
- If two or more crops are grown are they planted at the same time or another brought in at a stage in the growth cycle or after harvest of the first?
- Does he grow one crop year after year?
- Do the crops follow one another in a definite sequence? Etc.

Cropping pattern in space can either be:

a) Monocropping or

b) Intercropping

Mono cropping

This is also referred to as sole cropping and it defines growing of just one crop at a time from planting to harvest. This is not a common practice in the tropics amongst majority of farmers that are small holder. Sole crops of horticultural crops like tomato, pineapple and some times of maize, oil palm and others are however common.

Multiple cropping

This is a cropping situation where more than one crop is grown on a farm in a year. Multiple cropping can be in time or both in time and in spatial arrangement. Hence we have:

a) **Sequential cropping** – multiple cropping in **time**

b) **Intercropping-** Multiple cropping in **time** and in **space**

Intercropping can be:

a) **Mixed**

b) **Row**

c) **Relay**

d) **Strip**

 # Do you know some merits and demerits of sole and intercropping?

 # Can you distinguish between sequential cropping and intercropping?

Monoculture: This is the repetitive growing of the same crop on the same land that is the same crop is grown after harvesting same. This is common with low land rice.

GENERAL ROLE OF EXTENSION IN CROP PRODUCTION

The extension service is an organization set up by the government, commercial organization or groups of individuals with the primary aim of disseminating information to the target audience.

In indigenous or traditional agriculture farmers are engaged in several production practices and use several input that limit their output. Scientists from time to time come up with improved practices and input such as new methods of cultivation, soil conservation, planting, crop maintenance, harvesting and storing of crops and marketing of agricultural products; as well as information on techniques of applying fertilizers, insecticides an fungicides to the crops and enhance the output and increase farmer's efficiency. Farmer and such researchers stay miles apart, thus to pass across this new ideas for the benefits of farmers trained workers are needed.

Extension workers are specially trained for this purpose. They acquire skills in communication; they also acquire knowledge on human behaviour as it relates to effective discharge of their duty.

The bases of agricultural extension

Agricultural extension services and agricultural extension programmes have developed with the idea of helping farmers to help themselves in the identification and solution of their farm and home problems; especially in a predominantly subsistence rural agriculture where small scale farmers are less able to deal effectively with their individual problems.

The objectives of agricultural extension services are:

1) It gives assistance to rural people involved in agriculture to acquire knowledge, skills and abilities that will enable them produce, distribute, process and market agricultural products more effectively.

2) It increases the efficiency of agricultural production through the dissemination of scientific information and the application of new technology of production.

3) By assisting farmers to utilize agricultural services provided by government and private agencies and helping them adjust production to demand.

Specific functions of extension service include:

1) Stimulation of farmers to try accept and use new agricultural practices

2) Dissemination of research results through the development of appropriate production packages and encouraging rural farmers in their use.

3) Organization of credit, marketing and farmer's cooperatives.

4) Provision of farm management advisory services

5) Guidance and general education.

Teaching methods in agricultural extension

Teaching is imparting of information. Extension teaching methods are devices which facilitate learning by farmers so that they become interested in, learn about, develop skills in, and make use of new agricultural technology. Methods used in extension teaching include:

1) Individual teaching method

- Farm and home visit
- Training and visit systems
- Farm supervision

- Letters
- Projects
- Telephones

2) Group teaching method

- Meetings
- Lectures
- Discussion panels
- Tours and field days
- Agricultural shows
- Method demonstration
- Result demonstration

3) Mass teaching method

- Radio
- Television
- Newspapers
- Bulletins and leaflets

- Circular letters
- Posters
- Cinema vans
- Public address systems

Agricultural extension brings help to farmers through education. Farmers are encouraged to organize cooperatively among themselves. Education in this context is voluntary, non-formal and purposeful.

INSECT PESTS OF ECONOMIC IMPORTANCE IN CROP PRODUCTION

Meaning of crop Pests: A pest can be described as any organism capable of causing damage to crop plants.

Classification of Insect Pests

Insect pests can be classified into various groups based on their mode of feeding (feeding habits) as follows:

a. Biting and chewing insects

b. Piercing and sucking insects

c. Boring insects

a. Biting and chewing insects

These possess strong mandible and maxillae (mouth parts) which enable them to bite and chew. Examples are: termites, grasshoppers, leaf worms, army worms, mantids, locusts, crickets and beetles

b. Piercing and sucking insects

The insects possess strong mouth parts called proboscis which enable them to pierce through plants and suck liquid materials from plant tissues. Examples are:

aphids, cotton stainers, mealy bugs, scale insects, white flies, minds and capsids.

c. Boring insects

These bore into plant parts and destroy the tissues of the plants or fruit or seeds. Examples include: bean beetle, stem boners, maize weevils, rice weevils.

ECONOMIC IMPORTANCE OF INSECTS PESTS

1. Insects pests destroy crops in the field through their biting, chewing, boring sucking and defoliation activities.

2. They cause reduction in viability of stored produce.

3. Spot of injuries by insects may predispose crops to disease attack.

4. They increase the cost of production during the cause of controlling them.

5. They render vegetables and fruits unattractive and unmarketable.

6. Some are carriers or vectors of diseases.

7. The profits of farmers are reduced.

8. They reduce the quantity of produce either in store or in the field

9. They generally reduce the yield of crops.

10. They can also cause total death of crop plants.

Prevention and control of Pests

Pests of crops can be prevented or controlled through the following methods

1. Physical control
2. Cultural control
3. Biological control
4. Chemical control

5 Integrated control

1. Physical control

This involves the physical removal of pests by

Handpicking of insects and larva

ii. Setting of traps to catch rodents

iii. Shooting rodents with guns

iv. Fencing round the farm with wire nets

2. Cultural control

This involves the use of farm practices to prevent or control pests especially on the field. Examples of cultural control

Practice of crop rotation.

ii. Use of pest resistant varieties of crops.

iii. Appropriate tillage operation

iv. Use of insect traps

v. Hand-picking and destruction of insects

vi. Burning crop residues

vii. Timely planting of crops

viii. Proper weeding or sanitation

ix. Timely harvesting

x. Close season practices especially in cotton

3. Biological control

This involves the introduction of the natural enemies of pest to control or keep the pests population under control. Such enemies eat up or feed on these pests e.g Epidinocarsis lopezi

4. Chemical control

This involves the use of chemicals called pesticides to control pests of crop plants. Examples of chemicals used to control pests:

Pesticides- chemicals to control pests

ii. Insecticides- chemicals to control insects

iii. Rodenticicles- chemicals to rodents

iv. Avicides- chemicals to control birds

v. Nematicides- chemicals to control nematodes

5. Integrated control

This involves use of two or more of the above methods to achieve effective control. This type of pest control is more economical and more effective.

Side effects of chemical method of control

i. Some beneficial insects and soil organisms may be destroyed

ii. The chemical used may be toxic to man and domestic animals

iii. It may leave undesirable residue in the environment.

iv. Pests and diseases may develop resistance to chemicals.

v. Some are washed out of soil to rivers and streams where they can endanger aquatic life and cause pollution.

vi. Empty containers may be a source of poisoning when used as containers for consumables.

Side effects of biological method of pest control

i. The new organism introduced may start attacking crops which were originally free from attack.

ii, The predators expected to control others may rather feed on beneficial insects

iii. The activities of the new organism introduced may cause serious imbalance in the ecosystem

Side effects of cultural method

i. The use of fire to kill harmful pests may also result in destruction of other beneficial organisms.

ii. Resistant varieties may become adapted to the environment so that the resistance is short-lived where is used.

iii. If care is not taken fire may spread to other unintended places and farms.

iv. The use of fire may cause the destruction and loss of organic matter from the soil.

v. It may lead to destruction of soil structure and cause soil erosion.

Common storage pests and their control:

Different pests have been identified with farm produce some of which are found to be of economic importance even after such crops have been harvested and stored. This applied to both fruits and grains.

Examples of some common storage pests of grains

- Maize weevils – *Sitophilus zea mays*
- Rice weevils – *Sitophilus oryzae*
- Bean beetles – *Calosobruchus maculates*

Some common methods of controlling pests of stored produce:

Fruits crops:

The use of low temperatures by storing in refrigerators or cold room has proved effective.

Drying is also helpful to preserve some fruits from pest damage: tomato, pepper, okra etc.

Grains crops:

Storage under dry condition with the grains dried to about 14% moisture content

Storage under cool conditions in cold room has helped to maintain seed viability or storability

Storage in air in tight conditions at moisture content of about 14% in drums or even Jerry cans have been used over time.

Storage in jute bags with polythene inside and some tablets of phostoxin (Aluminum phosphide 57%) stored in a dry condition outside living room has proved efficient

Read up methods for storing:

- Yam

Groundnut