ORIGIN AND DISTRIBUTION OF CROPS

Most cultivated crops have one location or the other as a place of origin. The origin of some crops still in dispute as there are varying opinions that seems to contradict other. It worth nothing that the origin of most of the crops have been otenticated by notable scientist one of which is the Russian scientist known as Vavilow.

The distribution of crops varies from one climatic condition to another some of the climatic conditions support the growth and development of some crops while others don't. it can therefore be concluded that climatic conditions such as sun energy amount of rainfall, type of vegetation, soil type of humidity and the rest influences the distribution of crops in Nigeria and the whole world.

The distribution of the cultivated crops and those growing as weld varies from one agricultural zone to another.

The identification of such centers along was a valuable contribution for giving breeders and agronomies clues as to where the source material can be found. However, Vavilov was not satisfied by merely stating the facts but used them to elaborate an exciting theory of great importance that has passed the test of time. The theory states that the great diversity of forms, varieties and species of particular cultivated plant in definite parts of the world attests to the fact that the speciation process is geographically localized.

Centers of origin of cultivated plants are separated from one another by mountain chains, deserts or expanses of water that is they gave rise to independent, isolated agricultural civilizations. In most cases a particular genus or species is associated with a single center, but some crops are associated with two or more centers or centers of origin, where the plant in question takes the most diverse forms and was domesticated for the first time and secondary centers arising as a result of migration of individual forms from the primary one e.g the primary centers of maize origin is in Mexico, whereas China served as the secondary center of origin of its waxy varieties.

Vavilov identified eight independent centers of origin of the major cultivated plants world wide or in other words eight regions of domestication of various plants. The centers are:

1. The Chinese center of origin. This region is characterized by an extremely great variety of cultivated plants/almost 136 species), including representatives of temperate: sub tropical and tropicals zones e.g of crops of this center are millet, buckwheat, soy bean and some other species of grain legumes. The variety of root and other tubers is immense in the abundance of fruit crops this center has no rival. The fruit crops that are indigenous to this center include pears apples, peaches, apricots, pluma, cherries, quinces and some citrus.

2. The Indian (Hindustan) center of origin. This is the second most important center. This center include the Indian subcontinent including Buzma and Assia. It is a home of 177 cultivated plants e.g Rice, Sorghum, ragi, chick pen, cajari pea, mengbean, cowpea, jack bean sesame, sunflower, tree cotton, jute, ambari Indian hemp, black pepper etc. It is also the birth place of many vegetables including eggptant cucumber, Indian lattuce and fruit crops like mango and some circruses e.g lemon, orange and some tangerine species.

2a. The Indo-Malay center of origin. This is part of the Indian center and it includes all of the Malay archipelago, the Philippine and Indo-China. The center is a home of 55 cultivated plants e.g banana, some citrus and coconuts.

3. The central Asiatic center of origin. This center covers north western India (Punjab) northern part of Pakistan, all of Afganistan the Tadjik and Uzbek of the former soviet Republic, and western Tiensham. It is a home of 42 cultivated plant species, some of them being paramount for world agriculture. It is the birth place of club wheat, shot wheat all the chief legumes, such as peas, lentils grass peas, horse beans, chilk peas all of which are exceptionally rich in genetic resources.

4. The Near Eastern centers of Origin

The center includes the interior of Ashia minor, the whole of transcaukasia Iran, and the highlands of Turkmenistar. It is the origin of about 94 cultivated pants e.g rye, graoes, pears, cherry plum, sweet cherries, pomengrante, quince, walnut, almonds and figs, also a home of alfalfa, Persian clovers etc.

5. The Mediterranean center of origin

The center is the birth place of 84 cultivated species e.g einkorn wheat oats lentils vetch, pea lupine, clover, mustard, sweet cherries figs and vegetables like beat, cabbage and lettuce. It is also the origin of olives.

6. The Abyssinian center of origin. This region is situated in Africa with 38 cultivated species to its credit. It is the birth place of coffee, date palm, grain sorghum, taff (a grain cereal pearl millet ragi millet, guizotia (an oil bearing plant) sesame sunflower and Abyssinian banana.

7. The south Mexican and central American center of origin. It has 49 cultivated plant species to its credit. It is known to be the birth place of maize as well as the three American species of bean (common bean, multiplorous bean, lima bean) three squash species, chayote, pepper, and many tropical fruits. Others are arocado, cacao, sweet potato and American upland cotton on which the world cotton production is based.

8. The south American (Peruvian – Ecuadorian Bolivian) center of origin.

It consist of the moutainsous areas and plateaus of Columbia, Ecuador, Peru and Bolivia. It's a native of 45 crops including a great variety of potato species, cereals, tobacco, tomato pepper, Peruvian cotton, fruit vegetable and cucurbitous crops species and narcotic plants. This center is divided into 2 subcenters.

8a. The chiloe centre – It is a birth place of 4 crops common potato, tarmeed, chiloe bromegrass and strawberry.

8b. The Brazilian – Paraguaya center – birth place of 13 crops including rubber, manihot peanut, some species of ccocoa, pineapple feijoa and others.

SORGHUM

Common Names: Guinea corn in West Africa, Kafir corn in South Africa, Dura in the Sudan, intama in east Africa, InIndia the crop is known as juar, towar or cholam, Kaoling in China, Milo or Sorgo in the America while in Hausa it is known as dawa.

Sorghum is the fifth most important crop in the world, following wheat, maize, rice and barly. However in Nigeria, especially the Northern part of the country it is considered as the most important cereal crop even though this position is deing challenged by maize of recent. This challenge is due to the fact that maize takes a longer period of time than maize to mature. To save sorghum from extinction, there is the serious need for the breeders to work hard and evolve cultivars that can favourably complete with maize in terms of early maturity and yield.

Importance of Sorghum

Sorghum is very important to man as it serve as a staple food for a large population of the world, especially those living in the semi-arid areas. It is one of the most important grain crops of the tropical world, and is eaten in many different forms.

Sorghum is also an important raw material in many agro-allied compounes especially in the brewing industry. It is used in the brewing of alcoholic and none alcoholic drinks. It also serve as raw material in the flour mills industry.

This crop is useful in the preparation of concentrated animal feeds. The green plant is also used as fodder or processed to make silage. The stems can be used for making baskets, and mats, thatching or roofing houses and supports for growing crop like yams and beans. The desirable stocks are used for fencing house, mulchin as a source of fuel and when incorporated into the soil it becomes organic manures.

Origin and Distribution

Sorghum has many annual and perennial species which occur in the wild form. The greatest variation in the genus is found in North East quadrant of Africa. This crop is believe to have originated from Africa. It was believe that a form or forms of sorghum were first domesticated in Ethiopia some 5000 years ago. The cultivated forms were then spread by man throughout Africa. It was later taken to India and later to China. From China to Mediterranean countries. Then crop then move to united states from Africa in about the middle of nineteenth century.

In Nigeria, the crop is a nature of the northern region with countries of production around Kano, Katsina, Keffi Kaduna, Sokoto, Borno. Bauchi and other northern states.

CLASSIFICATION

Division	-	Spermatophyte
Sub-Division	-	Angiosperulae
Class	-	Monocotyledon

Order	-	Graminales
Family	-	Gramiae
Sub family	-	panicoideae
Genus	-	Sorghum
Specie	-	durra, bicolour, Sudan six

Botanical Characteristics of Sorghum

Sorghum plant have erect solid stems, supported by the profusely branched adventitions root system which develops from the lower modes of the stem. Sometimes prop roots are developed from the lowest nodes of the stem. The prop roots have a stiff rigid structure, light green in color and intermediate in structure between stem and root and they give added support to the large aerial parts of the plant.

The stem is made up of short interned at the base becoming progressively longer up the stem, with the modes slightly thickened. The leave of the plant have a long lead sheath with membranous margins, usually exceedring the length of the internode. The inflorescence is a more or less compact panicle, various in size and color, the axis varces in length, the paricle axis is deply furrowed, having at the nodes and hearing numerous branches. The grains is rounded and bluntly pointed, varying of gently in size shape and colour with variety. It is a little flattered and flinty.

CLIMATIC REQUIREMENTS

Sorghum can be cultivated under a wide range of climatic conditions, for this reason the crop can be grown in conditions that are unfavourable to most cereals. The crop tolerate hot and warm condition and as such can with stand extreme heat better than other crops. Sorghum usually perform well in high rain fall areas and has the ability to tolerate drought as well. During this period of drought tolerance, the plant remain practically dormant but resume growth as soon as there is sufficient water to wet the soil. This characterictic account for the larger part of the success of sorghum in a dry season sorghum is cultivated in drier savannas and grassland of tropical Africa. It prepers plains however it can do well even on planteau with attitide of up to 2,400m above sea level. The optimum temperature for the growth of thecrop ranges from 27 –32 oC. The minure and maximum temperatures of the crop are 15 oC and 40 oC respectively. Sorghum grow best were the annual rainfall ranges from 400 – 700 cm, however it can also do well in areas with up to 1000 cm of annual rainfall or more. The most outstanding characteristic of sorghum is its ability to resist drought. This ability is due to some morphological and physiological reasons. They are as follows.

i) The proliferation of roots than grow deep in to soil profile to source for water and nutrients for the plant use.
ii) The presence of a waxy substance that cover the stem and leaves which helps in reducing water loss during transpiration.
iii) Sorghum has a reduced leaf surface area as compared to other crops this also help to reduce the loss of water from the sorghum plant.

iv) The lead of sorghum has the ability to curve inward in situation of water stress, this also helps to conserve water.

v) The crop has the ability to remain dormant during hot, dry periods and then resume growth which conditions are favourable.

vi) The above ground portion of the plant grow slowly until the root system is well developed.

vii) Sorghum has the ability to complete favourably with weeds.

Sorghum can be grown on a variety of soils, ranging from well drained soils to any soil. In moist season the highest yields are obtained on lamy soils but in dry season. It doest best on sandy soil. It tolerate a soil PH range from 5.0 – 8 –5 and also some degree of salinity alkalinity and poor drainage. In the tropics sorghums tends to be grown on heavier, deep-cracking vertisols sand light sandy soil.

CULTIVATED VARIETIES OF SORGHUM IN NIGERIA

There are many varieties of sorghum that are in production in Nigeria. The varieties differ in height, shapes and size of fruiting head, aid in the shape, size and color of the grain. The most common races grown are:

i) FARFARA: This is a hybrid between the previous races. It is grown in areas with heavier rainfall. It attains a height of 3 m and has while seeds. Late maturity.

ii) KAURA (Short). This variety is more adopted to the drier parts of the northern part of Nigeria. It is of major importance in Katsina, Kano, Jigawa, ?Sokoto, Birnin-Kebbi Yobe and Borno states. It is dwart, yello seeded and late maturity.

iii) KSV3, KSV4, KSV11, KSV 12, and KSV15 are suitable for production in sahel ecological zone.

iv) KSV2,5,7 and 8 are recommended for production in the Sudan Savannah ecological zone.

v) For the northern guinbe Saranna the following ae recommended for production SSV2,3,6,7,9 and 10, MSV 1 and 2

vi) The following varieties are cultivated in the southern guinea savannah; MSV,MSV2 and MSV 3.

vii) In the forest savannah Hybrid SSMZ, SSM3 are widely cultivate.

The institute for Agricultural Research Zaria also developed some varieties for local consumption or cultivation. These varieties are coded as SAMSOREG (Samaru Sorghum) We have SAMSORG 1 –40.

PRODUCTION PRACTICES

CROPPING SYSTEMS

Sorghum can be cultivated or grown as a sole crop. However in many parts of Nigeria Sorghum is interpolated with a variety of crops. Different types of cropping mixtures are available depending on the location, of the farmer the following mixtures are pramment.

i. Sorghum + millet
ii. Sorghum + Maize
iii. Sorghum + cowpea
iv. Sorghum _ groundnut
v. Sorghum +soya bean
vi. Sorghum + rice – not widely practiced .

iv) The lead of sorghum has the ability to curve inward in situation of water stress, this also helps to conserve water.

v) The crop has the ability to remain dormant during hot, dry periods and then resume growth which conditions are favourable.

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LAND PREPARATION

The production of sorghum in Nigeria is mainly through rain fed condition, however in lake-chad region of Borno state the crop can be with residual moisture around the late- chad with little or no irrigation. Conventionally the land for the cultivation of sorghum is ploughed harrowed and ridge, but in most cases, due to lack of enough capital and equipments operations like plowing or Harrowing are usually skipt. Tractor is use for land preparation, however at peasan level Ox drawn ridgers are used. Sometimes sthe use of by hoes is necessary.

SOWING: Once a fine and levelled truth is a chiefed seeds are dressed with Apron plus or any protective chemical aat the recommended rate e.g Apron plus at the rate of 10g sachet of the chemical to 1 kg of Sorghum seeds. This treatment is meant to control smut disease. Other chemicals like Adrex T or Formosan can also be used as seed dressing chemical on sorghum. Seeds are sown as soon as the land is prepared and the rains established. The crop is sown either on flat prepared land or on ridges at the recommended spacing of 70 –75 X 25 –30 cm. The seed rate is determine by the number off seeds per stand. If it is 2 seeds per stand the rate per hectare is about 3 –5 kg. But when 3 –5 seeds are planted per stand the seed rate per hectare is going to be 10-14 kg. The depth of planting is usually 2.5 –30 cm. In some countries planting is done by either broadcasting the seeds on flat prepared land as in East Africa or by drinning or even sowing in furrows. In Nigeria planting on ridges is favoured because of;

i) Easy weed control
ii) Control of water loggi
iii) Control of erosion

In situation were more than two seeds are planted, the excess most be planted to avoid over crowding which encourages serious competition and the spread of a disease.

FERTILIZER APPLICATION

Sorghum response positively to fertilizer application. The crop responses more to introgrenous and phosphorus fertilizers which can be applied singularly or as a compound fertilizer e.g ammonium sulphate, N.P.K etc. Improved dwarf and semi-dwarf cultivars give very high yields with better fertilization and better crop management. The rate of fertilizer application varies from one sorghum ecological zone to another, the requirements are as follows:

Region	Fertilizer rate
Savanna zone	64kg N/ha 32 kg P2 05/ha 30 kg K2 0/ha
Southern Guinnea And Forest zones	32 kg N/ha 16 kg P2 05/ha 15 kg K2 0/ha

WEED CONTROL

Weed can be a serious problem at the early storage of the growth of sorghum. As such weeding is necessary as it enhance high yield due to controlled competition while esathing up (remoding of ridges) after hoe weeding help the roots to gain proper development in the soil. This should be done at the early stage of the plant growth i.e 5 –8 weeks after planting.

Traditionally two well timed hoe weeding are adequate for a good crop of growth. Chemical weed is a better method of weed control in which formulated chemicals known as herbicides aare used to control weeds thereby reducing competition between the weeds and the crop as a result of which the yield of the crop is increased. Herbicides such as Atrazine at the rate of 1 kg/hectare can be use. Also a mixture of atrazine and metolachlor or a trazine and alachlor at equal proportions i.e 2 kg/ha enough to give a good weed control. Inseriously infested weed plot there is the need for supplementary hoe weeding after herbicide application.

The most notorious weed of sorghum plant is parasitic weed called straiga. This weed attack sorghum in virtually all sorghum fields. Straight can be control, manually by hand pulling crop rotation proper nitrogen fertilization and the use of mixture of amatory and atrazine for spot spous of the parasitic weed. A severe attack by striga resembles drought attack. Careful weeding of striga before they flower and set fruit is very important to reduce infestation.

DISEASE OF SORGHUM

Most of the diseases of sorghum are caused by Fungi and Bacteria major disease of sorghum are:

i) Head smut: Head smut is different from the grain in that the head smut destroys the entire head; i.e the whole panicle. The whole panicle form the spore sac and when the sac ruptures, the spores or better, the hyphae are liberated.

INSECTS PEST OF SORGHUM

Like other cereals, sorghum have both field and storage insect pests. The field insect pests of this crop are:

i) Stamborer: The damage is cause by the feeding bahit of the insect larvae which bone in the stalkc of the plant on feed on the tissues inside. This action reduces or stops translocation of obsorbed food material and that of photosynthesised food material.

The central of stemborer of any kind is very difficult especially when it is chemical method. The most effective chemicals for the control of this category of insects are the systemic chemicals e.g Dipterex, DDT(EC,wp)0.15%, Dimecron sevin, Throdan cataryl, furadan and Fenithrothion.

ii) Army worm –spodoptera

The damage is caused by the caterpillars that feed on young succulent sorghum plant. The best method of control is the use of chemicals known as insecticides e.g DDT, Dpterex, sevin and Throdan.

Sorghum Midge- Contarinia sorglucola

The damage is caused by the larvae that feed on the ovary, often one larvae to one development and results in blasted panicle. The affected grain head is

flatten with tiny shrimken may be seen in the head to confirm presence of an infestation.

This pest can be controlled through early and un form planting. The use of resistant

MAIZE

Maize also called corn is an important grain crop in the world. It rank third following wheat and rice in terms of importance in world production. In Nigeria, it is the second most important cereal crop after sorghum. However, it is now gaining more popularity because of the following reasons:-

- It gives highest yield per unit area,
- it provides nutrient in a compact form
- Its husk give protection against birds damage and rains
- It is easy to harvest, and it does not shatter
- It can be harvested over a large period
- Culviars differ in maturity period
- It stores very well if properly dried,
- It is easily transportable,
- It has higher consumer preference than millet and sorghum and
- It can be used as good livestock feed

ORIGIN AND DISTRIBUTION

There are a number of theories about the origin of maize. The crop seems to have originated from Mexico or central America. The first European to see and describe maize was Christopher Columbus. He and his contemporaries were believed to have introduced the crop from central America to Spain and Portugal, from there to Africa and other Asian countries by the Portuguese.

SOIL AND CLIMATIC REQUIREMENTS

The ideal soil for growing maize is a deep medium textured, well drained fertile soil with a high water-holding capacity. Clay and sandy soils are not very conductive for its growth. The crop can grow on a wide variety of soils and will give high yields if it is well managed. It prefer soils with a pH range of 5.5 – 6.0 although the optimum pH range is 5.5 – 7.0. saline soils are not good for the crop.

Maize is a worm weathered crop and can be cultivated from latitudes 40'N and 50'N all over the world. Most maize are grown where the mean summer temperature vary between 2/and 27^{0}c. the best rainfall regions are those that receive between 600 – 1000cm of rainfall annually. Maize plant can even tolerate higher amount of rainfall, however it does not tolerate water logging conditions.

TYPES OF MAIZE

Several cultivars of maize are now grown in the world and these cultivars are classified into seven major groups or types based on their seed characteristics. The groups are:

- dent maize (zea mays induntata)
- sweet corn (zea mays sacharata)
- Soft flour (zea maus

- pop corn (zea mays everta)
- Pod maize (zea mays tunicata)

Some prominent cultivars in Nigeria are:

- open pollinated types
- Hybrid maize
- quality protein maize (QPM)
- Extra easily maize

PRPODUCTION PRACTICES

The production practices include:

a. Cropping system

The crop can be grown as a sole crop in a monoculture and cam go into rotation with other crops in a rain fed condition maize can go into inter cropping with crops like sorghum cowpea, groundnut, upland rice etc.

LAND PREPARATION

A fine tilth is preferable for the maize crop. Plow the land, two harrow and ridging. In some cases there is no need for double harrowing. In some situations maize can be grown under zero tillage. This conventional method of land preparation is difficult to achieve in Nigeria as the crop is produced on small land holdings which are two small for mechanization. For this reasons farmers prefer to use animal fraction or manually by the use of big hoe to tilth the land. This amount to minimum tillage. The technology of minimum tillage for maize production has given yields that are equal or even greater than those obtained from conventional tillage.

SOWING

Maize is planted when the rains are well established. The dept of sowing should be between 2 – 4 cm depending on the type of soil. The spacing is 75 x 75 interrow spacing while intra row spacing is 25 x 25cm.

Two seedsare sown per hill or in some recommendation only one seed is sown per stand. On the average the seed rate is 15 – 20kg/ha.

FERTILIZER APPLICATION

Farmers generally use to apply small quantity of fertilizer to maize crop, but the use of fertilizers are now in the increase. Recent research has shown that maize has a high demand for Nigerian, and this is often limiting in most maize growing soils. Indigenous local varieties of maize tend to respond slowly to fertilizer application. The improved hybrids varieties however can only reach their fullest expression when adequate amount of fertilizers are applied at high plant densities. It is advisable to apply Nitrogen fertilizers at two split applications. The first doze at land preparation or 3 – 4 weeks after planting and second dose at 6-8 weeks after planting. Urea is applied during grain formation. The recommended fertilizer rate for maize is:

120kg N/ha
60kg P_2O_5/ha and
60kg K_2O/ha.

Both P_2O_5 and K_2O should be applied at land preparation or after germination (3 weeks). Side dressing of fertilizer is preferred at the depth of 2-3cm.

WEED CONTROL

Under traditional method, weeds are controlled by hoe weeding. This is usually done at 3 – 4 weeks after planting and 6 – 8 weeks also. Insufficient weed control is one of the main factors causing low average yields of maize in Nigeria. The period of tasseling is the most critical period for weed competition in maize. Tractor mounted cultivars can also be used to control weeds. Similarly ox-drawn rotary weeders are perfect implements for weed control, this helps to reduce the drudgery of using hand hoe. The use of chemicals known as herbicides have proved to be the most effective method of weed control. Herbicides if properly applied controls weed without any problem. Wrong application of herbicide have resulted in the many problems which may include crop injury or total destruction of the cultivated crop.

The application of atrazine as pre-emergence herbicide at 2.0kg ai/ha has been found to be very effective in the control of weed that germinate in the top 2-3cm of the soil. This herbicide can also be used for early post emergence application. A mixture of atrazine with prometryme or ametryne for post emergence application has proved effective.

RICE

Rice is the second most important cereal crop in the world, coming next to wheat. It is however the most important food crop of about half of the human race.

ORIGIN AND DISTRIBUTION

The genus oryza belongs to the family of Grammineae. There are 25 species of oryza, of these only two of the species are cultivated, namely orza sativa and oryza glaberrima.

The general consensus of opinion is that rice was first domesticated in India probably in the coasted area of eastern India where there are marshy areas. Rice had been under cultivation in south and east Asia since olden time. From India rice spread to southern China and to all the countries of south and east Asia. From India the crop also move to Iran, Syria, Egypt and Spain. The Portuguese introduced the crop to Brazil while the Spaniards introduced it to central America. Portenes (1956) traces back the cultivation of Oryza glaberrima to the central Nigerian delta region to 1,500 B.C. This may be the reason why some are of the view that glaberrima originated around the swamping areas of the river Niger in west Africa. This species is characterized by a smooth, haurles glumes, red grains, short legules with roundish tips, high seed dormancy and upright panicles with few or no secondary branches, however it produces tillers profusely. Oryza sativa has three major sub-species namely:

- Oryza sativa indica
- Oryza sativa japonica
- Oryza sativa javanica

Ecological requirements

Rice is grown under a wide range of climatic conditions. In fact it is very difficult to state the climate that is most suitable for the development of the crop. Except in the Artic region, race is being grown on every continent of the world. The crop can do well from the equator to latitude 53^0N (in China0 and 40^0S and from the sea level to the Himalayas i.e 200m above sea level. The major limiting factor for the cultivation of this crop is the availability of water. The crop is most suitable to the tropics and the sub-tropics hence the crops can tolerate warm conditions. The optimum temperature for the cultivation of rice ranges between 20^0c - 35^0C. sandy soils are usually unsuitable for growing rice. The crop can tolerate a pH of 3.5 – 8.5.

CROPPING SYSTEM

There are many cropping systems for rice cultivation, under lowland conditions the following systems are prominent.

- Monoculture – that is growing rice alone year in year out on a piece of land.
- short duration water – loving crop is grown before rice.

In the upland condition, rice can be grown as a sole crop or an intercrop or it can enter into rotation with other crops which can be grown before or after the rice crop.

Varieties of rice

1. Upland – this variety is grown and cultivated like any rain fed crop. It does not require plenty water supply
2. Lowland: It is mostly cultivated in swampy areas. Its water requirement is high
3. Floating: This variety requires high amount of water. It grows very tall as the volume of water increases. It is found in floaded areas of south east Asia.
4. Faro varieties. There are many of this type with varying characteristics. Faro varieties are from 1 – 40.

CULTIVATION

Upland rice cultivation

This is also called dry land rice cultivation or Hill rice cultivation. The cultivation of rice under this condition is like the cultivation of any other rain-fed crop. It requires at least (750mm) water for 3 – 4 months. This type of rice is of great importance to Africa where it accounts for up to 75% of the total rice areas.

LAND PREPARATION

Under this system land preparation is not as elaborate as in lowland system. Reduced tillage is tolerated. Single plowing and a harrow is enough. Sometimes ridges are used, but most often farmers prefer flat lands. The seed rate is 30 – 40 kg/ha which is usually broadcasted or dibble or sometimes drilled.

WEED CONTROL

This is a very important operation in rice production. Its gains being increased yield, increased quality of grains as there are no weed seeds, reduce incidence of pests and disease attack as the farm is left clean.

The control is by hand pulling when the rice is planted in rows how weeding is employed. Two to three hoe weeding are adequate for a good crop of upland rice. The use of herbicides like Risane, Tama rice, stam f-34 have proved effective.

The recommended fertilizer rate for upland rice is 100kg.Nha, 50kgP_2O_5/ha and 50kgK_20/ha.

LOWLAND CULTIVATION

This is also referred to as swamp rice, wet rice or floated rice production or cultivation.

The cultivation of this type of rice is on flooded or irrigated lands. It requires high amount of water supply. It is grown most in standing water until about to be harvested. The depth of the standing water should not exceed 50cm. There are two methods of cultivation of this type of rice;

i. Direct seeding and
ii. Transplanted rice cultivation

DIRECT SEEDING

After proper land preparation (i.e plowing and harrowing) seeds are broadcasted at the rate of 100kg/ha. Bands are created to help in holding water. Drilling at the spacing of 20 – 30cm inter row help in reducing the amount of seeds to b planted. After germination in about four weeks weeding should take place.

Fertilizer application should be done after first weeding. The recommended fertilizer rate is about 120kg/N/ha, 60kg P_2O_5/ha and 60kg K_20. When there is a standing water in the field, urea should be used as the source of nitrogen to be applied. Sometimes pre-sprouted seeds are planted in already flooded and puddle fields.

2. Transplanted rice cultivation: - This method consists of raising seedlings by planting seeds in well prepared nurseries and thereafter the seedlings are transplanted in a well prepared puddle and leveled fields.

Land preparation: For low land rice the cultivation is a very important operation that will lead to a bumper harvest. The field is divided into small plots with bunds and each segment or plot is leveled. Before this operation the field must be ploughed and harrowed. After leveling then the field is flooded with water then puddle to form a uniform consistency. The upper layer of the soil should be in smooth, soft, muddy condition, this will allow the roots of rice to ramify freely in the medium and allows for subsequent retention of water. Land preparation for upland soil is not as elaborate as that of lowland rice, as mentioned above the field should be ploughed, harrowed and ridged only once, just as other crops.

Raising nursery: For transplanting rice, seedlings are raised either on wet or dry nurseries. In the former the land is prepared of 1 – 1.5m wide and of appropriate length is flooded puddle and fertilizer is applied together with farm yard manure, pre-sprouted seeds are then planted, weeds are properly controlled. Seeds are ready for transplanting at about 25 – 30 days, that is when the leaves have attained 15 – 30 cm tall and have developed 5 – 7 leaves. For dry nursery, a slightly raised beds are used for planting one hectare of field. Seedlings are raised in nurseries of about 350 – 500m^2 (square meter) in area. Adequate fertilizer is applied (60 – 100g N and 50gP_2O_5 per sq. m) before sowing.

Transplanting rice: When seedlings are ready, transplanting should be done promptly. Seedling are pulled up in small bunches and are transplanted soon after words. If the seedlings are tall, the top portion of the leaves are sometimes prune in order to reduce transpiration and give rigidity to the young plants. Bunch of seedlings are held with the left hand and the right hand is used to put the seedlings in place. It is better to transplant seedlings in a straight row. 2 – 3 seedlings are transplanted per hill and the optimum sow spacing (both ways) is 15 – 20 cm for long duration and 15 – 20cm for short duration cultivers transplanting is one of the most hardest and tedious and most expensive operation in rice cultivation.

ADVANTAGES OF TRABSPLANTING

- Less seeds are used
- It result in high yields
- weeding operation is easy
- Disease incidence is low.

Fertilizer application

The recommended fertilizer rate for lowland soil is 120kgN/ha, 60kg P_2O_5/ha and 60kg K_2O/ha. P and K are to be applied at land preparation while N is applied as two split dose, half at 4 weeks after planting or immediately after transplanting and at 8 weeks after sowing or 4 weeks after transplanting. Urea is preferred as N source under lowland condition. The recommended rate of fertilizer for upland rice is 100kh/ha N, 50kg K2 0/ha and 50kg P205/ha. It is better to place N at the root zone of the plants i.e 10 – 12cm deep, this will help to reduce volatilization and denitrification.

WEED CONTROL

Under traditional condition 2 – 3 hoe weeding are adequate for a good crop of rice. Hand or hoe weeding at 2 – 3 weeks and 5 – 6 weeks after planting can give a season long weed control. Directly seeded field has greater weed problems than transplanted fields. 308 man-hours of labour per hectare is required to hand weed transplanted rice as against 1200 man-hours for directly seeded rice.

The following herbicides were found to give a good control of weeds all are to be applied at the rate of 3kg /ha.

- Stem F – 34 (propanil)
- Risane (Propanil + fluoro difen)

- Tamarice (Propanil + throbencarb)
- Stam f-34 + Bassagran (Bentazone)

The herbicides are to be applied as post – emergence 21 days after planting.

Harvesting and threshing:

Rice is ready for harvest when the ears are ripe and the straw has turned yellow with some slight green colours. This stage is reached usually at 4 – 6 weeks after flowering.

At this stage the moisture contents of the grains is 18 – 25%. The rice is cut from the base by using hand sickle. The cut material is left on the field for 3 – 4 days to dry, then they are threshed by beating with sticks and then winnowed. In advanced cultivation combine harvesters are used. Sometime the threshing is done by beating the straw against a hard surface, or by having animals to tread on the sheaves. Foot-operated pedal threshers are sometimes used. Some small portable drum-type threshers operated by engine or small tractor engine are also used as rice threshers. These machines are economical and time saving.

Processing:

Rice may be parboiled before milling. This consists of steaming the rice paddy in hot water, steam it and then drying it down to a suitable moisture content for milling. Commercial milling of rice comprises cleaning hulling (removal of hulls) and milling, a process in which the bran and the germ are partially or wholly removed. When the hulls are removed we have brown rice. The bran is removed by machine to give unpolished milled rice. This is then polished by a machine to remove the aleuzone layer and any adhering particles to give polished rice.

Yields:

Yield in rice varies greatly, the highest yield of up to 8 tonnes/ha was recorded in Australia, in Africa 1 – 3 tonnes/ha is the average yields. In Nigeria there are places that recorded over 5 tonnes per hectare.

Storage:

Properly dried paddy can be stored for a long time, large losses occur during storage as a result of insects and rodent damage. Bacteria and fungi may reduce quality if the relative humidity of air is high (above 70%) or if rain water enters storage building. Storage floors should be watertight to discourage seepage. Storage chemicals also helps to control attack by storage insect, hence irrigation is very important.

Crop Protection:

Diseases:

1. Blast caused by Pyricularia oryzea it attack rice at all stages of its growth. Control by spay of silica, potassium, or hinosan.
2. Stem rot caused by Helminthsporiam sigmoideum. Proper use of fertilizer can reduce the attack.

3. Bacterial leaf blight caused by Xanthomonas oryzea, no single measure is effective to control the disease. 5 foliar of 250p.p.m. Agrimyan 500 a.i. at 12 day intervals leguming at 23 days after transplanting.
4. Virus disease – Plant resistant varieties and rogue infected plants.

Insect Pests

1. Stem borers: there are about 7 different types – use systematic insecticides to control the attack.
2. Plant bugs: these can be controlled by using 5% BHC (Lindane) dust to control the insects.
3. Grasshoppers can be controlled with suitable insecticides.

Uses of Rice

1. Rice is mainly consumed as human food.
2. Rice on milling gives approximately 20% husks, 50% whole rice, 16% broken rice and 14% bran and meal.
3. Manufacture of laundry starch.
4. Manufacture of cosmetics.
5. Manufacture of beer, wine and spirit.
6. Rice bran is high in oil content 14 – 17%.
7. Rice hulls is used as roughage for livestock.
8. The straw is also use as livestock feed also for strawboard, thatching hats and mats.
9. Rice ash can be a carrier for pesticides.
10. Wax can also be obtained from rice bran.

WHEAT (Tariticum aestivum L.)

Wheat is the most important cereal in the world. The cultivation of wheat reaches far back into history, and it was predominant in antiquity as a human food. The crop had been associated with development of past civilizations. It is the number one cereal crop of the temperate region. Nowadays the crop is also grown in a large scale in the subtropical and tropical regions of the world.

Origin and distribution:

Different species of wheat were believed to have originated in various localities in the area adjoining Southern Turkey, Iraq and adjacent territories of Syria, Iran and Transcaucasia (USSR). Helback (1966) reported that grains of domesticated wheat were found in the archaeological remains in Ali Kosh in Tramian Khuzistan, dating to 6,500BC, and in Anatolia in Turkey, dating 5,500BC. The cultivation of wheat spread from its center of origin to India, Pakistan and China in the east, to the Mediterranean countries in the west and to USSR and other European countries in the North. Some 5000 years ago the crop was taken to Ethiopia by immigrants. The greatest diversity of Triticum durum L. was found in Ethiopia. Wheat was introduced to America and Australia in the very recent past.

Ecological Requirements:

Wheat is grown from the tropics to 60^0N and 40^0S. the crop is however a cereal crop for the temperate regions of the world. The crop is more adapted to

regions with high altitudes in the tropics or in lowland where the conditions exist. In the tropics and the sub-tropics the crop is only grown in the winter season, usually under irrigation. However some varieties can be grown under rain fed condition and at a wide range of temperature variations. The ideal temperature for different stages of growth of the wheat plant are.

Optimum temperature	Growth stage
20 – 25°c	Germination
16 – 20°c	Tillering
20 - 23°c	Growth/development
20 - 23°c	Maturation stage

The availability of water is the major factor in wheat production, the amount and distribution of the precipitation are of prime concern to wheat production. Where irrigation water is available the distribution of rainfall is not of critical concern.

The crop requires 250 – 750mm of annual precipitation. The crop can tolerate wide range of soils conditions, however it is best adaptable to fertile soils that are well-drained silt and clay loam soils. It is poorly suited to sandy and clay soils varieties. There are many known wild and cultivated species in the gene Triticum and there are thousands of cultivars. The principal wheat of commerce are:-

Triticum aestivum
Triticum durum and
Triticum compactum

There are many varieties and cultivars that had been developed by breeders. One of the greatest development in modern times has been the production of dwarf cultivars suited to warmer countries. These cultivars are very responsive to high doses of fertilizer and high levels of management. They are high yielding cultivars and have revolutionalized agriculture in many countries.

Cropping Systems:

In Nigeria, wheat cultivation is becoming popular. The crop is grown during the dry season (November – April) under irrigation. With good management, a second crop, either maize, sorghum or millet, can be grown during wet season.

Land Preparation:

More than two ploughing are wasteful in wheat fields. After presowing irrigation, a single harrowing is sufficient to create a satisfactory seed bed.

Planting:-

The optimum time for sowing wheat is determined by several factors, the most important of which is the temperature during the growing season. In Nigeria the best time to plant wheat is the middle to the end of November. The recommended seed rate is 100-125kg/ha. Today drill planting is practiced almost all over the world. The plant population per square metre should be about 500 earheads. Depth of sowing should not exceed 3-4cm. Wheat can also be planted by broadcasting, in which case the broadcasted seed are covered with light harrowing. This practice is very common Nigeria.

Fertilizer Application:

The recommended fertilizer rates for wheat is

100 – 120 kg N/ha

40 kg p2.05/ha

40kg k2 0/ha and 25kg/ha Zn.

N should be applied in two light dozes first at planting and the second dose at the crown root initiation stage i.e 20 – 25 days after sowing. The fertilizer can be broadcasted, this use to give a good or similar response to placement by drill.

Weed control:

When the field is well prepared as described above, weed will not be a major problem under traditional condition it is difficult to use the hand hoe to carry out weed control. Farmers use to employ hand pulling of weeds as means of control. Under intensive cultivation, the use of chemicals is the only suitable method of controlling weeds.-

Non graminaceous weeds such as, Chenopodium album Carthamus oxycantha, Asphodelus tenifoluis, melitotus spp, and others can be effectively controlled by a spray of 2,4-D (beta amine – formulation) at 1.0kg a.c/ha in 75^{0}c of water five weeks after sowing. To control grass weeds such as phalasis minor, Avenva futua and few others is a little more difficult. The application of Avadex (diallate) at 1.0kg ai/ha mixed in the top 2 – 3 cm of soil gives a selective control of A futua. Similarly pre-emergence application of TOK E – 25

(nitrogen) at 1.5 kg a.c./ha has gives satisfactory control of P minor. The two grasses can also be controlled by the application of tribunil (methabenz thazuron) applied at the rate of 1.5kg a.c./ha either pre-emergence or about 30 days after sowing.

HARVESTING AND THRESHING

Wheat is harvested somewhere in the world every month of the year. The crop matures about 30 days after the forming of the florets. Kernels are completely filled when they reach the dough stage, at which time the leaves, stalks and spikes begins to lose their green colour and become golden yellow. From this stage onward, ripenings consist of the gradual loss of moisture of the kernels. When completely air-dry, the moisture of the kernels average about 10 – 12%. At this moisture content the grein can be stored.

Harvesting may be done by using hand sickle or by machine sometimes combine harvesters can be used to harvest, the crop. On small scale, threshing is done by threshers, or having bullocks tread on the harvested materials. Where harvesting and threshing are done manually, winnowing must be done to separate grain from chaff.

Yield:

The world average yield is about 2,300 kg/ha where as in Africa the average yield is 1500 kg/ha. The highest yield of about 6,300 kg/ha was obtained in France. In Nigeria yields of up to 2500kg/ha have been obtained.

Storage:

Grains most be clean and has at most 10% moisture content for proper storage. There is need for protection against insect pests. Fumigation of grains after storage is equally important.

CROP PROTECTION

Diseases.

1. Rust e.g black rust, yellow rust, caused by purrium graminis and p. strisforms respectively control by planting resistant varieties.

relatively high amount of the essential amino acids liquine and trypophan, and thus usefully complements the protein supplied by cereals in which the contents of lysine and trypophan are relatively low.

Proteins for both field beans and soya beans are nutritionally complete when supplemented with methrovine. Soyabeans meal contains about 40% protein (comparable to some animal protein and for less experience). Groundnuts, contains thiamine (vit.B1) miacin (VIT B6) and calcium.

The protein requirements of man can therefore be fully satisfied with a balance diet of cereal – legume diet, or with legume diet supplemental with specific amino acids. The combination of soyabeans and rice, wheat and grain, or orange and beans provides well-balanced nutrition.

Legumes are cultivated for their mature seeds for human consumption and are called pulses or grain legumes but their immature seeds and the young pods and leaves are also eaten as vegetables. The vegetative parts of grain legumes are commonly fed to livestock after the seeds have been harvested species which are cultivated only to feed livestock are called fodder legumes or are grown in mixtures with partuse granes, pasture legumes. Another group is the cover crops are grown mostly in the tropics to smoother weeds, or restrict soil erosion and enrich soil nitrogen.

COWPEAS (Vigna unguiculata (L. Walp)

There are over 170 species in the genus vigna. Some among these are the most important grain legumes of the world. These are (V unguiculata) cowpea, (V. radiata) green grain and black grain (V. mungo). Cowpea when grown for their dry seeds are known as black-eyes peas, black-eyed beans.

Origin and distribution

The wild species of cowpea is found in Africa, it is known as subspecies dekindata. This was later domesticated in Ethnopian region or even in west Africa, or in the African savanna zone, more than 4000 years ago. This subspecies reached India with sorghum and bulrush millet from east Africa around 1,500BC. Cowpea reached Europe from Asia before 300BC, and the New world in the seventeenth century from west Africa and Europe.

Ecological requirements:

Cowpea is an annual crop and a warm weather crop. It withstand heat better than most other legumes and is drought resistant. It is also important in semi-arid tropics where it is grown for its mature seed. The crop can be grown with less rainfall and under adverse conditions, than other common beans e.g (P. vulgaris).

Cowpea can adapt to a wide variety of soils provided the soil is well drained. Light sandy loam soils are more suitable than heavy soil. The crop can tolerate acidity under conditions of heavy rainfall. Sometimes they are grown on poor acid soils or soil improver.

CROPPING SYSTEM

Cowpea have a beneficial effect on subsequent crops in the rotation and when grown in association with them. They have deep root and tend to fix nitrogen from the atmosphere to the soil. In traditional farming system of Africa, cowpea is inter-panted with sorghum or millet after six weeks of planting of the cereal. The spreading varieties of cowpea tend to smoother weeds. Cowpea is also used as a trap crop for infested fields of striga.

Land preparation:

When cowpea is to be inter-planted with a cereal crop or yam, there is no need for further or additional land preparation. When the crop is to be planted sole then there is need for the field to be farm free from clods and moist during sowing. For that reason land should be plough, harrow and ridge only once.

Planting:

Planting in cowpea depends on the ecological zone. It is important to sow cowpea in such a time that the crop will mature at the ends of rain, for this reason, in Nigeria for example cowpea is sown in first week of July in the Sudan zone, by mid – July in Northern guinea zone, by third to fourth week of July in northern half of the southern guinea zone, as soon as the last rain starts in the

southern part of southern guinea saharann and at about mid-August in the dried savannah and forest zones.

Recommended seed rate for spreading varieties is 10 – 15kg/ha for erect types, the seed rate is about double that of the spreading type. Spacing is usually 90cm between rows and 30cm within the row. This is however, adjusted to suit the cultivar that is in use. When erect varieties are to be planted then the spacing should be closer.

FERTILIZER APPLICATION

When cowpea is inter-planted with other crops the fertilizer that was supplied for the other crops is sufficient for the cowpea. Similarly, if cowpea is to follow another fertilizer crop there is also no need of fertilizer application, only on poor soils an application of only 20kg N/ha is recommended as a starter dose for the crop.

Cowpea however has a high requirement for phosphorus. The recommended P rate for cowpea is 40kg P_2 05/ha, a similar quantity of K_20 can also be applied in a hectare of cowpea. All the fertilizers are to be applied at land preparation.

Weed control:

When control is very essential at the early stages of growth of the plant, weed can be removed by hoe weeding or by Ox-drawn implements. Some selective herbicide can also give a very effective control of weeds, several herbicides are available but the following are recommended for pre-emergence application:

1.5kg a.i metolachlor + 1.0kg a.i. prometryre per hectare, or 1.5kg a.i metolachlor + 0.8kg a.i divisor per hectare.

Harvesting and Threshing:

Early maturing varieties mature in about 3 months while late maturing types mature at about 5 months. The pods of cowpea tend to ripen unevenly, hence several (4-6) hand-picking are needed to prevent damage of pods and seeds by insects. After hand picking the pod are threshed by hand or by conventional threshers. Seeds should have only 10% moisture contents before being taken for storage.

Yields:

Under farmer levels, cowpea yield may vary from 250-1000kg/ha dry grain. By adoption of recommended practices and good management yields may be up to 1,500 – 2000kg/ha.

Storage:

Cowpea is very susceptible to serious damage by insect pests during storage. Well dried seeds are to be stored and suitable chemicals are to be used to control insects. Fumigation is also a good control measure.

Crop Protection:

Diseases – The most important diseases of cowpea are Cowpea wilt (Fusasium oxysporium), Scacb (sphaceloma spp), brown blotch (Colletotrichum capsici) and septoria leaf spot (Septoria spp).

All the above can be controlled by application of a mixture of 2.5kg/ha Dithane m-45 (mancozeb) + 0.6kg/ha Benlate (benomyl) applied weekly, beginning at 4-5 weeks. Disease resistant cultivars are available when planted, can reduce infection.

Insect pests:

Cowpea's major pests are thrips, flower beetles, pod-sucking bugs and maruca testulalis. These insects can attack cowpea on its different parts. The application of pyrethroids, (cypermethrin and deltanulthrin) can control most of these pests. Bugs can be controlled by the application of dimethrate.

Utilization (uses)

Cowpea is an important food for man and they also provide feed, forage, hay and silage for livestock. Cowpea is also used as green manure and cover crop, these help to maintain soil productivity. Fresh pods can be eaten as vegetables. Good cover crop prevents soil erosion. Dry seeds can be grounded into flour which can be used in various ways. Cowpea seed can also be canned or frozen.

GROUNDNUTS

(Arachis hypogea)

This crop is also called pea-nut, monkey-nuts, earth nuts, groundnuts are grown as legumes and as oil-seeds. It is a cash crop and is grown in the tropics and sub-tropics as a source of food, oil and high protein meal produced after oil extraction.

Origin and distribution:

The exact origin of groundnuts is not known, however, evidence seems to favour the upper plata basin of Bolivia as the home of this legume. Portuguese navigators were believed to have introduced the crop from South America to Africa, India and possibly other areas. The crop was taken to Mexico probably from the coast of Peve and from Mexico it crossed the pacific to China and Indonesia. The crop was later readapted and specialized in tropical America and the Unites States.

Ecological requirements:

Groundnut is grown from latitude 40^{0}N and 40^{0}S of the equator where the annual rainfall is 1000mm or more. It is a warm-season crop and it needs abundant sunshine and warm climate for their normal growth. Groundnuts are killed by frost. The crop can be produced successfully under irrigation in drier regions. It requires moisture throughout the growing season, however pegging and fruiting periods stages are the most critical times in which moisture must be adequate to the plants. Too much moisture and high temperature can reduce yield.

The crop can adapt to a well-drained, loose and friable, sandy loams, well supplied with lime and with moderate amounts or organic matter. Good yields can be obtained from fairly heavy soils provided they are rich in organic matter and having good tilth. The optimum PH range is from 6.0 – 6.5. Seedling of the crop can tolerate salinity better than nature plants.

Types of groundnuts

The crop is classified into two (2) main groups according to their habit of growth.

1. Spreading or runner types – In cultivars belonging to this group, the gynophores (pegs) are distributed from the basal to the terminal regions of the branches, or occur in clusters along these branches, up to 40cm from the base of the plant. As the branches grow more or less prostrate on the ground, the pods are scattered underground in a relatively large area around the base of the plant. Cultivars of the group are generally very productive and have large kernels. Harvesting is very difficult and many pods are usually left in the soil.

2. Bunch type: Cultivars in this group has an erect growth habit. The pods are clustered around the base of the plant and mature at about the same time. The pods and Kernels are small and the individual plants are very productive. They are easier to harvest, however, they are better suited to inter-row cultivation.

Cropping systems:

Groundnuts are an extremely soil-exhausting crop when the nuts and the entire top growth are harvested. But if its top-growth is buried in the soil after removing the nuts, the effect on the soil is less harmful. Yields tend to decline when groundnuts are ground continuously on the same land. Furthermore, this practice favours the built-up of some disease organisms. It is not advisable to grow groundnuts year after year. The crop has the ability to use residual fertilizer from previous season's crop, they are good in fallowing heavily fertilized crops such as maize, cotton or sorghum.

Groundnuts can go into intercropping with millet, sorghum and maize, this is a common practise under rain fed cultivation in Africa. Such mixtures tend to give higher overall yields for the cereal crops.

Land preparation:

Groundnut requires loose and friable soil, into which the pegs easily penetrate, and which prevent excessive loss of nuts during harvesting. The land

should be plough to the depth of 25 – 30cm harrowed leveled and ridged before sowing.

Seed treatment and sowing:

Groundnuts suffer from seed-borne diseases and to control these, groundnut kernels must be treated with appropriate fungicides such as Aldrex T (Aldrin and Thisain) or Fernasan D (thiram). Apron star can also be used for seed dressing. The recommended plant population vary widely from 100,000 plants/ha to 350,000 plants/ha. On the average a seed rate of 40-60kg/ha of shelled kernels should be sufficient for normal planting. Planting should be done at inter-and intra-row spacing of 30-45cm and 15-25cm respectively. Planting at these spacing should give 100,000 – 200,000 plants/ha. Yayock (1976) reported that it is important to plant groundnut early in t he season so as to escape rosette infection. In Nigeria farmers plant on ridges 1m apart and 1-3 kernels per hole on a ridge at a distance of more than 30cm. The recommended sowing depth is from 2.5-4cm in heavier soils 4 – 6cm in lighter soils or when large seeds are used.

Fertilizer application:

Like other legumes groundnut tend to fix atmospheric nitrogen to the soil and therefore fertilization is rarely required. When the crop is grown with cereals, the fertilizer applied for the cereal will also meet the requirements of groundnuts. If the preceding crop was not well-fertilized, 40 – 60kg/ha P_2O_5 and 40kg K_2O/ha may be applied. The application of calcium and boron are also very important. These are essential for liming, disease resistance and foster flowering and uniform maturity respectively.

Weed control:

Weeds can be a serious problem for groundnuts, cultural practice such as crop rotation may be use to prevent the building up of some trouble-some weeds or even provide an opportunity for their eradication.

In traditional practices, weeds are removed by hand pulling, hand-hoeing or with bullock-or tractor-drawn cultivators. Two to three weeding are

advocated at 15 days intervals, but no interculture should be undertaken after the plants has started appreciable pegging.

Weeds can also be controlled with herbicides, those herbicides can be applied at pre-sowing, pre-emergence or cracking time (the point when the seeds are just about to emerge) or as port-emergence applications.

Terbutryn and metolachlor are the most important herbicides for controlling weeds in groundnuts. The 1st central broadleaf weeds while the 2nd central grass weeds. They are all applied as pre-emergence in a mixture of 0.8, 1.6kg a.i/ha. A pre-emergence application of metolachlor at 2.0 kg a.i./ha followed by a post emergence application of bentuzone at 1.5kg a.i./ha about 6-8 weeks after sowing has also been found very effective in controlling weeds in groundnuts.

Harvestings:

Harvesting groundnut at the light time is very important. The time of harvesting should be so chosen that a maximum yield of matured pods can be obtained. The right time to harvest the crop may be recognized by a slight yellowing of the foliage and by an examination of the pod. If the pods have begun to shed at the base of the plant and if the inside of the shells has begun to colour brown and shown darkened veins, the crop is ready for harvest. Harvesting too early or too late results in 30 – 40% loss in yield.

Plants are lifted manually or mechanically by hand, hoe or mechanical harvesters. In advance technology it can be done by combine harvesters.

The manually harvested plants are sorted out by hand left in the sun to dry up. At harvest the moisture contents of the pods is about 50-55% they have to be dried to 25% moisture content.

Yields:

The average yield of groundnuts varies in different countries, however it ranges between 600-4,000 kg/ha.

Storage: Grains and pod if not properly stored can become rancid, mouldy or damaged by insects. They should be stored under low temperature. It was

reported that at 21°C, unshelled and shelled groundnuts can remain viable and sound for six months, while storage at 0-2°C the storage life of shelled nut might be up to two yeas. The relative humidity at storage should be below 70%.

CROP PROTECTION

To control diseases and pests, principal reliance should be placed on preventive measures;

1. Planting cultivar or strains that exhibit tolerance or resistance to locally prevented diseases and pests.
2. Practising field simulation, such as the use of crop rotation and removal of all plant residues promptly after harvest to reduce the amount of inculum that might infect new sowings.

Diseases

Groundnuts are infected by a number of diseases the major ones are:

1. Cercospora leaf spot (Cerospora personate and cercopora arechidic control is by planting resistant varieties are crop rotation, removal of crop detris chemical control by spraying sulphur mixed with copper.
2. Stem rot (Schlorotium rolfsilu) control by using tightly raised beds, burying the old debris, deep ploughing and application of pentachlormitrobenze (PC NB)_ to the soil before planting.
3. Rosette this is a very serious viral disease of groundnuts. Control by spraying appropriate misechicide to control aphids which the vector of the disease. The use of correct cultural practices and planting high population can control the infection.
4. Nematodes of different species can infect groudnuts and cause the formation of galls on roots, pegs and pods control is by crop rotation and soil funmigation with nematodes.

Insect pests:

1. Termites: there are many species that attack groundnuts. In Nigeria Amitermes evancifer is the most common. Control measures are by deep

ploughing, use cultivars that ripens at the same time, application of lindane dust in drills at 1 – 25kg a.i. / ha or alsrin or dieldrin at 500g a.c./ha. A seed dressing of aldrin (28.5g a.i./ha of seed gives effective control.

2. Leaf hoppers (Hilda patruchis) use diedrin dust at 1.12kg a.i/ha before planting in an effective control measures
3. Cutworms (Agrolis ipislon) control by appreciation of dieldrin 50% wettable powder as a bait mixed with 50kg of maize meal which is wetted, this will be sufficient for /ha.

Use of groundnut

Groundnut is a highly nutritious food. The average chemical composition of shelled groundnuts is approximately 11.7% carbohydrates 30.4% fibre, 2.3% ash and 5.4% water. Decortricated groundnut cake contains about 7.5% fat, 6.4% fibre, 5.8% ash and 10.3% water. The groundnut oil 10.3% water. The groundnut oil contains 53% oleic acid, and 25% linoteic acid. The kernels are rich in calcium, phosphorus and iroin. They also constitute an excellent source of the vitamins thiamin, ribofloarin and main.

The oil is used for cooking oil and cooking fat. A fraction of the oil can be used in manufacture of soap. Groundnut in the USA is used to make groundnut butter. It is also used in making snacks coandies and about 25% of it is roasted and salted and eaten as snack. Groundnut cake can be used to feed livestock as a concentrate feed. The hay contains about 7% protein is also fed to livestock.

Groundnut kernels can be made into flour and mixed with wheat flour to make bread, the flour can also be used to make beverages.

SOYABEANS (SOYABEANS)

(Glycine max (L) Merr)

Soyabeans is one of the oldest cultivated crops of the temperate regions and one of the world's most important source of oil and protein. In China the crop has long been used for food and as vegetable they also use it in wide variety of fermented food products made from the mature beans, as the edible

sprouts of germinating beans, soyabeans is also an important concentrate arunial feed that is rich in protein.

Origin and distribution:-

The center of origin of soyabeans is believed to be China. Glyane max was thought to have been derived from G. usururilensis and G. tomentsa which grow wild in China. The crop was under cultivation since pre-historic times in China, the first record of the crop dates back to 3,000 BC. From China the crop spread to mongohia, Korea Japan and Indonesia. Until recently the crop is considered a minor crop in India, the middle east, Africa and South America. The crop was introduced into Europe in the seventeenth century and into the USA in 1804, but the crop did not receive much attention until the twentieth century. Since 1920 the cultivation of soyabeans got a rapid expansion in terms of hectarages of production and importance.

Ecological requirements

The crop can be grown in the tropics to latitude 52°N. it is a warm season crop and can tolerate the same climate as maize. It need adequate moisture for germination and a temperature of 15°c or more in the soil. If the crop is well established it can withstand drought for a short period. The crop is less susceptible to first damage. Soyabeans are very sensitive to light duration (photo-period). They are short-day plants, but cultivars differ markedly with respect to minimum dark period required for flowering. The crop need high light intensity just like cotton, the crop can suffer from cloudy weather and are this adapted to area that have few cloudy days. Soyabeans can grow on a wide range of soil types, but it thrive best on sandy or clay loams and alluvial soils of good fertility. The optimum PH for soyabeans ranges from 6.0 – 6.5. Sometimes it is derivable to unnoculate thesoil with strain of Rhizobium faponicum which is a nitrogen fixing bacteria that is specific to soyabeans.

Cropping systems: The crop can be used in rotation, it can follow maize, sorghum and cotton, it can also be grown in mixtures with other crops, however