SECOND TERM

CLASS SS1

AGRICULTURAL SCIENE

WEEK 3

TOPIC: PRE-PLANTING, PLANTING AND POST-PLANTING OPERATIONS

Post planting operations:

They are the operations carried out after planting. It creates a good condition and proper maintenance for plants growth.

Post planting operations include the following:

- Thinning
- Supplying
- Irrigation/ watering
- Use of manure and fertilizer
- Mulching
- Weeding
- Harvesting
- Processing
- Storage, etc.

- **Thinning:**

It is the removal of excess, weak or not well-positioned seedlings from a seedbed after the viable seeds have germinated

Advantages of thinning

- It helps to avoid overcrowding
- Proper aeration is ensured leading to high yield

- **Supplying:**

It is the replanting of propagative materials where they fail to germinate. Supplying should be done as soon as possible.

Advantages of supplying

- Correct plant population can be maintained
- The farmer can achieve uniform maturity

- **Irrigation (watering):**

It is the artificial watering of farmland, especially during the dry season.

Advantages of irrigation

- It makes the soil temperature moderate for plant growth
- It enables a good nutrient supply to plant

- **Manuring/fertilizer application:**

It is the addition of organic manure such as poultry droppings, cow dung and green manure or inorganic manure (made from chemicals) to the soil to maintain soil fertility. Manure can be in the form of:

- Animal and plant refuse (organic manure)
- Chemical manure (inorganic manure).

Organic manure

- **Green manure:** This involves growing of a crop usually a legume and just before flowering it is ploughed into the topsoil to rot down
- **Farmyard manure:** This consists of faeces or excreta, urine and other waste products of domesticated animals. Animals dropping are usually mixed with straw.
- **Compost:** Plant and animal remains and ashes heaped together and allowed to decay properly by ensuring that there is plenty of air in its making. It is then spread on the farmland to incorporate nutrients into the soil.

WEEK 4

Inorganic manure (Fertilizer)

These are chemical substances which are usually prepared in the farm, they are made in form of liquid, powder, granules, pellets or crystals Fertilizers should be added to the soil only when the soil shows that some important minerals are lacking commercial fertilizers usually contain macronutrients or elements which are removed in large amount by crops. Fertilizers therefore usually contain nitrogen (N), phosphorus (P) and potassium (K).

- Some examples of Nitrogen fertilizers are ammonium sulphate, ammonium nitrate urea, sodium nitrate, potassium nitrate etc.
- Examples of phosphate fertilizers are single superphosphate, triple superphosphate.
- Examples of potash fertilizer are potassium nitrate, sulphate of potash.

Care should be taken when applying in-organic fertilizer because it can burn the plant if it comes in contact with it.

Ways of applying fertilizer

- Broadcasting
- Localized placement in the row or in a circle around the plant (side placement)
- Spraying
- Foliar fertilizer application

Advantage of manuring/fertilizer application

- It supplies the plants with essential nutrients.
- It maintains good soil structure

- **Mulching:**

Mulching is the covering of the surface of the soil with a layer of the clean dry vegetative part of a plant such as grasses or leaves.

Advantages of mulching

- It conserves soil moisture.
- Regulation of the soil temperature.
- It reduces weed and prevents erosion.
- It adds humus to the soil.

- **Weeding:**

Weeding is the removal of unwanted plants (weeds) from the farm. It can be done with the aid of cutlass and hoes or by spraying herbicide. It is done for the following reasons:

- To avoid competition for nutrients, moisture, sunlight and space between crops and weed.
- To prevent the buildup of pest and pathogens.

- **Harvesting:**

It is the removal of the ripe or matured useful part of a crop is known as harvesting. Commonly harvested parts of a plant are tubers, leaves, fruits, seeds, roots etc. Harvesting tools like cutlass, hoe, knife, sickle etc. are usually used for harvesting and in mechanized farms, harvesters are used.

Effects of timely versus late harvesting

Delayed harvesting can lead to a total loss of products, although some crops like maize can be left on the field to get dry before harvesting, others like tomatoes and other perishables must be harvested immediately they are due for harvest. Delayed harvesting can lead to pest attack on crops or decay of products.

Post-harvesting operations

After harvesting, processing of the product is required to make the product more acceptable and to prevent spoilage. In some farm products, processing starts from the farm site, e.g. melon, groundnut, cassava etc. Melon is usually extracted from its pod and pulp on the farm, also groundnut is detached on the farm, at times, peeling of cassava starts from the farm. Extraction of cocoa beans from its pods, fermentation and drying of beans in most cases take place on the farm.

Other forms of processing like milling, de-husking etc. which cannot be done on the farm are done in factories where machines have been installed for that purpose.

- **Storage:**

After crops have been processed to usage forms, storage which is the keeping of farm products for future use is done. Methods of storage are the usage of barns, cribs, silos, refrigerators, baskets, sacks etc.

WEEK 5

TOPIC: HUSBANDRY AND CULTIVATION OF SELECTED CROPS

Husbandry

Animal husbandry is the special branch of agriculture concerned with animals that are raised for meat, fibre, milk, eggs, or other products. It includes day-to-day care, cultivation, selective breeding and the raising of crops and animals.

Cultivation of cereals

	MAIZE (Zea mays)	**RICE (Oryza Sativa)**
Description	Maize also called corn is a member of the grass family (Gramineae). It produces grains, used as food by human beings and livestock. The seed/fruit is called a caryopsis.	Rice is a member of the grass family (Gramineae). The seed/ fruit is called a caryopsis
Varieties/cultivar	Sweet maize, flint maize, dent maize, flour maize and popcorn	Swamp rice (Toma) and upland rice (Agbede).
Land preparation	Clearing the land and making ridges either manually or mechanically.	Clearing the land and making ridges either manually or mechanically.
Climatic requirement	Temperature – 26^0C-30^0C, Rainfall – 75cm-150cm per annum	The temperature of 20^0c, Rainfall of 75cm-120cm for

		upland rice and over 250cm for swamp rice.
Soil requirement	Sandy-loamy soil of PH 6-7	Loamy-clayey soil.
Method of propagation	By seeds	By seeds
Planting date	Early maize – March/April Late maize – July/August	South – April/May, North – August/ September.
Planting method	It can be done manually using cutlass or mechanically by planter at 2-3 seeds per hole.	Planting can be done by broadcasting, sowing or drilling.
Seed rate	20-30kg per hectare of land	65kg per hectare at 2-3 seeds per hole.
Spacing	80cm between row and 30cmwithin row	25-30cm apart depending on varieties.
Cultural practices	Supplying, thinning, weeding fertilizer application, control of pests and diseases.	Supplying, thinning, weeding fertilizer application, control of pests and diseases.
Maturity period	90-120 days after planting depending on varieties.	4-7 months depending on varieties.
Harvesting	Harvesting can be done manually with hand or using a hand sickle and mechanically using a combined harvester.	Redheads of rice are harvested with a knife, sickle or combined harvester.
Processing	It is eaten either boiled, roasted or processed into corn flour or corn flakes.	Sun drying, threshing, winnowing, per boiling, hulling and polishing.
Uses	It is consumed by man and farm animals and as a raw material in brewery industries	It is consumed by man and farm animals.
Storage	Dried cobs are stored in cribs, rhombus or a fireplace, grains stored in a silo.	Processed form in silos or jute bags.

Cultivation of Legumes

Legumes are usually grown agriculturally, primarily for human consumption, for livestock forage and silage, and as soil-enhancing green manure. Well-known legumes include alfalfa, clover, beans, peas, chickpeas, lentils, lupins, mesquite, carob, soybeans, peanuts, and tamarind.

Many farmers understand the value of growing legumes along with their main crops, or between harvests. The legumes replace nitrogen used by crops. They also provide a cover for the soil to help protect it from heavy rains and strong winds. The roots of the legume plants hold the soil in place

	COWPEA (Vignaunguiculata)	**GROUNDNUT (Arachis hypogea)**
Description	Cowpea is a member of the pulses or legumes. It belongs to the family Leguminosae. It is rich in protein. The	Groundnut is a dual-purpose crop. It serves as an oil crop as well as a pulse or leguminous crop. However, it is grown

	fruit of cowpea is called Pod.	mainly for its oil. The seed gives about 40-45% of excellent edible oil.
Varieties/cultivar	Erect type, creeping type, Ife brown, Ife bimpe	Bunch or erect type, creeping type, Kano local, Kano 50.
Land preparation	Clearing the land and making ridges either manually or mechanically.	Clearing the land and making ridges either manually or mechanically.
Climatic requirement	The temperature of 27°-35°C, Rainfall of 60-125cm per annum.	The temperature of 25°-30°C, Rainfall of 70-100cm per annum.
Soil requirement	Well-drained sandy loamy soil	Coarse textured sandy loamy soil which is slightly acidic and rich in calcium and phosphorus for pod formation.
Method of propagation	By seeds	By seeds
Planting date	April to September depending on the ecological zone.	South – March / April North – May / June
Planting	Planting can be done manually or mechanically at 2-3 seeds per hole.	The planting can be done manually or mechanically at 2-3 seeds per hole.
Seed rate	20 – 25kg per hectare.	30 – 35kg per hectare.
Spacing	Erect type – 30 x 75cm, Creeping type – 25 x 90cm	Erect type – 60 x 15cm Creeping type – 60 x 20cm
Cultural practices	Supplying, thinning, weeding fertilizer application, control of pests and diseases.	Supplying, thinning, weeding and control of pests and diseases. Groundnut does not need fertilizer application except on very poor soil.
Maturity period	9 – 12 weeks after planting depending on varieties.	3 – 4 months after planting.
Harvesting	Hand-picking of matured brown pods.	It is ready for harvest when the leaves turn yellow and begin to wilt. It is done by uprooting the plant manually or mechanically and allowing to dry for easy removal of pods.
Processing	Sun drying, threshing and winnowing.	Sun drying, removal of seeds from the pods by slightly pounding in a mortar or using a decorticating or shelling machine.
Uses	A source of plant protein for man Serves as a cover crop It serves as forage legumes It is used for making green manure.	Used for making oil For making a cake to feed man and farm animals For making groundnut butter.
Storage	Seeds are stored in jute bags silos or airtight container after proper drying. Seeds should be treated with insecticide and the store fumigated to prevent weevils attack.	Dried groundnut seeds are stored in silos or rhombus. Unshelled pods are stored in jute bags.

WEEK 6

Cultivation of roots and tubers

	YAM (Dioscorea spp)	**CASSAVA (Manihot spp)**
Description	Yam belongs to the family Dioscoreaceae. It is a root and tuber crop grown in West Africa and it is rich in carbohydrates.	Cassava is a root and tuber crop, rich in carbohydrate. It is easily cultivated and can grow in relatively poor soil.
Varieties/cultivar	Water yam (Dioscoreaalata) Yellow yam (Dioscoreacayenesis) White yam (Dioscorearotundata) Bitter yam (Dioscoreadomentorum Aerial yam (Dioscoreabulbifera)	Sweet cassava (Manihotutilissima) Bitter cassava (Manihotpalmata)
Land preparation	Clearing the land and making ridges either manually or mechanically.	Clearing the land and making ridges either manually or mechanically.
Climatic requirement	The temperature of 25^{o} – 30^{o}C, Rainfall of 100cm – 180cm per annum.	The temperature of 21^{o} – 35^{o}C, Rainfall of 150 – 200cm per annum.
Soil requirement	A well-drained sandy-loamy soil, rich in humus.	Dried loamy soil. It can also tolerate poor soil.
Method of propagation	By yam seeds or yam sets.	By stem cuttings (25 – 30cm long).
Planting date	Early yam – November / December Late yam – March / April	March to September depending on the ecological zone.
Planting	Open a hole on the ridge using a hoe and place one yam sett inside with the cut surface turned upward and slantly placed at an angle of 45 degrees	2/3 0f the stem cuttings are buried in slanting position or at an angle of 45 degrees.
Seed rate	3 – 5 tonnes per hectare	
Spacing	90cm x 100cm	100cm x 100cm.
Cultural practices	Mulching, weeding, application of fertilizers, staking, training of vine.	Weeding and fertilizer application.
Maturity period	8 – 12 months depending on the variety.	10 – 15 months depending on varieties.
Harvesting	This is done by digging the soil gently with a cutlass to remove the tuber from the soil.	This is done by digging the soil gently around the tubers and pulling the stem gently so that the tubers are pulled along or use cassava puller.
Processing	It can be processed into yam flour.	It can be processed into cassava flour, garri or foofoo.

Uses	It is consumed by man and farm animals.	It is consumed by man and farm animals.
Storage	Yam tubers are store in barns.	Cassava is stored in processed form in sacs.

WEEEK 7

TOPIC: ROCK WEATHERING AND PROCESS OF ROCK WEATHERING

Rock weathering

The process of soil formation is referred to as weathering. Weathering is defined as the disintegration of rocks into smaller particles to form soil.

Processes of rock weathering

The processes of soil formation (rock weathering) include:

- Physical process
- Chemical process
- Biological process

The physical process of rock weathering

Agents of physical weathering include temperature, ice, rainfall, wind and pressure.

- **Temperature:** The rise and fall of temperature bring about the expansion and contraction in rocks respectively. After a long time, rocks begin to crack and break down which later give rise to the soil.
- **Ice:** When rivers overflow their banks or when it rains, water collects in the openings. At a cool temperature or freezing point, the water in the openings freezes and increases in volume, the force of expansion makes the rock to expand thereby cracking them to particles. As the temperature rises, ice melts and carries the rock particles away from their origin to a different place to form soil.

- **Rainfall /water:** The splash of rainfall exerts a force on the rock surfaces. Flowing water also carries and hits rock particles against one another turning them into fragments.
- **Wind:** heavy winds carry particles of rock, hitting them against one another or against hard surfaces to form smaller fragments.
- **Pressure:** high pressure on hanging rock may cause such rocks to fall and the process breaks into smaller particles to form soil.

The chemical process of weathering

Agents of chemical weathering include solution, hydration, hydrolysis, carbonation and oxidation.

- **Solution:** This is when water dissolves soluble minerals present in the rock and the minerals taken from one place to another while flowing.
- **Carbonation:** Carbon (iv) oxide reacts with water to form trioxocarbonate (iv) acid, a weak acid which weakens and dissolves rock minerals.

- **Hydration:** This is the reaction of water with rock minerals which result in chemical alteration of the mineral. An example is the conversion of iron (ii) rocks to hydrated rocks.
- **Hydrolysis:** This is the reaction of water with rock minerals to produce a rock that is different from the original one.
- **Oxidation**: This is the reaction of rocks with oxygen from the atmosphere which then weakens the rocks.

The biological process of weathering

This is the activities of plants and animals in the breaking down of rocks to form soil.

- The action can be brought about by some animals such as termites, earthworms, millipedes and other soil organisms.
- Movement of some organisms /heavy animals like cattle can cause small fragments of rocks to disintegrate.
- The roots of some crops penetrate through cracks in rocks making them expand and break to form soil
- Activities of man during tillage can break small rocks into tiny pieces.

WEEK 8

Factors of Soil Formation

Factors of soil formation

The factors that control soil formation include; climate, parent materials, topography, biotic factors (living organisms) and time.

- **Climate:**

Climate refers to the average weather condition of a place measured over a long time. Elements of climate include sunlight, temperature, wind, relative humidity, rainfall and pressure.

- **Rainfall:**

Running water as a result of from rainfall causes gradual wearing away of rocks during erosion giving rise to the soil. Impact of raindrops can also break rocks to form soil.

- **Temperature:**

The alternate heating and cooling of rocks give rise to continuous expansion and contraction of rocks. This causes cracks in the rock and over time lead to the formation of soil.

- **Wind:**

High wind velocity most especially in desert regions carries tiny rocks which hit themselves or other rocks leading to the breakdown of rocks into tiny pieces to form soil.

- **Pressure:**

High pressure in a hanging rock may cause the rock to fall and break into tiny pieces to form soil.

- **Parental materials:**

The physical and chemical features of parent materials determine the type of soil that can be obtained from such material. Parent of predominantly quartz mineral gives rise to sandy soil while that of micas and feldspars give rise to clayey soil.

- **Topography:**

Soil erosion is more pronounced in a sloppy area than flat land. Wind or water easily wears away the soil and rock surfaces in a sloppy area. As the rock particles are washed down to the bottom of the slope, the particles further break up into smaller particles due to the combined effect of other processes of weathering.

Biotic factors (living organisms)

The action of microorganisms, plants and animals plays an active part in the rock formation.

- Termite and earthworms mix the minerals and organic matter resulting in the formation of soil.
- The burrowing activities of earthworm and crickets permit the air and water movement in the soil which reacts with the rock to cause breakdown into the soil.
- Activities of man during tillage operation break the rock into tiny pieces to form soil.
- Penetration of plant roots causes weathering of rocks.
- The decaying of falling leaves of the trees with the aid of bacteria results in the formation of humus-rich in plant food.

Time:

Time also plays an important role in soil formation. It takes a long time for mature soil to be formed. It takes time for small pieces of rocks to disintegrate into grains of soil. It also takes a long time for plants to decay and become part of the soil.

WEEK 9

TOPIC: AGRICULTURAL ECOLOGY

Meaning of agricultural ecology

Agricultural Ecology is defined as the study of crop plants and farm animals in relation to their environment. Ecology is derived from the Greek word "**Oikos"** which means home or dwelling place. In order words, agricultural ecology can be defined as a field of study which deals with the relationship of living organisms with one another and with the environment in which they live.

Agricultural Ecology is divided into:

- Autecology
- Synecology.

Autecology is concerned with the study of an individual organism, or a single species of organism and its environment. For example the study of a single cattle and its environment.

Synecology is concerned with the study of the inter-relationships between groups of organisms or species of organisms living together in an area. For example the study of different fishes in a fish pond in relation to their aquatic environment.

Ecosystem refers to a community of crop plants and farm animals functioning together with their non-living environment. In other words, the ecosystem consists of living factors (plants and animals) interacting with the non-living factors in a farm environment.

Components of the farm ecosystem

The farm ecosystem is made up of two main components. These are:

- Biotic (living) components
- Abiotic (non-living) components

- **Biotic components:**

The biotic components include the living things i.e. crop plants and farm animals. The biotic components can be grouped into two classes which are; Autotrophism and Heterotrophism.

(i) Autotrophism: This is a group of organisms which makes use of sunlight or chemicals to manufacture their food from an inorganic substance during the process of photosynthesis. In other words, autotrophs are organisms mainly crop plants which are capable of synthesizing their food, hence they are called producers.

(ii) Heterotrophism: This is a group of organisms mainly farm animals which cannot manufacture their food but depend directly or indirectly on plants for their food, hence they are called consumers. Farm animals that feed directly on green plants (producers) are called herbivores or primary consumers e.g. cattle, sheep, goat and rabbit.

- **Abiotic components:**

The abiotic components of an ecosystem include the non-living things which are:

(i) Climatic factors like rainfall, temperature, wind, humidity and sunlight.

(ii) Inorganic materials and nutrients such as carbon dioxide, oxygen, nitrogen, calcium and phosphorus.

(iii) Edaphic factors like soils, rocks, topography.

(iv) Other factors like dust, storm, fire and water.

Interaction among the components of agro-ecosystem in some farm settings

- **In mono-cropping/sole cropping:**

Mono-cropping is a system of cropping where one type of crop is grown on farmland at a particular time. For example oil palm farm, kola nut farm, maize farm, etc. The interaction between the biotic and abiotic factors in the environment include:

- Crop plants absorb nutrients from the soil to grow.
- Crop plants also absorb water to grow and produce fruits.
- Crop plants also take in carbon dioxide from the air to carry out photosynthesis.

- **In mixed cropping system:**

Mixed cropping is a system of cropping which involves the growing of two or more crops on the same piece of land at the same time. Crops like maize, cassava, cowpea etc. can be cultivated at the same time on the same farmland. Their interactions include:

- Crops like cowpea are capable of adding nutrients to the soil.
- Crops like cassava obtain nutrients from the soil to grow and produce fruits.
- The leaves of all crops which fall on the ground decayed and add nutrients to the soil through decomposition by soil microorganisms.

- **In mixed farming:**

Mixed farming involves the cultivation of crops and rearing of animals simultaneously on the same piece of farmland. The farm may be divided into two parts: one part for growing crops and the other for growing grasses and keeping of livestock. Their interaction includes:

- The grasses or the remains of crops serve as food for the animals.
- The animal dungs and droppings are used as organic manure to improve the soil fertility for the crops.

Rock Weathering and Process of Rock Weathering

Rock weathering

The process of soil formation is referred to as weathering. Weathering is defined as the disintegration of rocks into smaller particles to form soil.

Processes of rock weathering

The processes of soil formation (rock weathering) include:

- Physical process
- Chemical process
- Biological process

WEEK 10

The physical process of rock weathering

Agents of physical weathering include temperature, ice, rainfall, wind and pressure.

- **Temperature:** The rise and fall of temperature bring about the expansion and contraction in rocks respectively. After a long time, rocks begin to crack and break down which later give rise to the soil.
- **Ice:** When rivers overflow their banks or when it rains, water collects in the openings. At a cool temperature or freezing point, the water in the openings freezes and increases in volume, the force of expansion makes the rock to expand thereby cracking them to particles. As the temperature rises, ice melts and carries the rock particles away from their origin to a different place to form soil.

- **Rainfall /water:** The splash of rainfall exerts a force on the rock surfaces. Flowing water also carries and hits rock particles against one another turning them into fragments.
- **Wind:** heavy winds carry particles of rock, hitting them against one another or against hard surfaces to form smaller fragments.
- **Pressure:** high pressure on hanging rock may cause such rocks to fall and the process breaks into smaller particles to form soil.

The chemical process of weathering

Agents of chemical weathering include solution, hydration, hydrolysis, carbonation and oxidation.

- **Solution:** This is when water dissolves soluble minerals present in the rock and the minerals taken from one place to another while flowing.
- **Carbonation:** Carbon (iv) oxide reacts with water to form trioxocarbonate (iv) acid, a weak acid which weakens and dissolves rock minerals.
- **Hydration:** This is the reaction of water with rock minerals which result in chemical alteration of the mineral. An example is the conversion of iron (ii) rocks to hydrated rocks.
- **Hydrolysis:** This is the reaction of water with rock minerals to produce a rock that is different from the original one.
- **Oxidation**: This is the reaction of rocks with oxygen from the atmosphere which then weakens the rocks.

The biological process of weathering

This is the activities of plants and animals in the breaking down of rocks to form soil.

- The action can be brought about by some animals such as termites, earthworms, millipedes and other soil organisms.
- Movement of some organisms /heavy animals like cattle can cause small fragments of rocks to disintegrate.
- The roots of some crops penetrate through cracks in rocks making them expand and break to form soil
- Activities of man during tillage can break small rocks into tiny pieces.

- Some crops like cowpea and crop residue may decay to release nutrients to the soil.