AGRICULTURAL SCIENCE

FOR

Junior Secondary School

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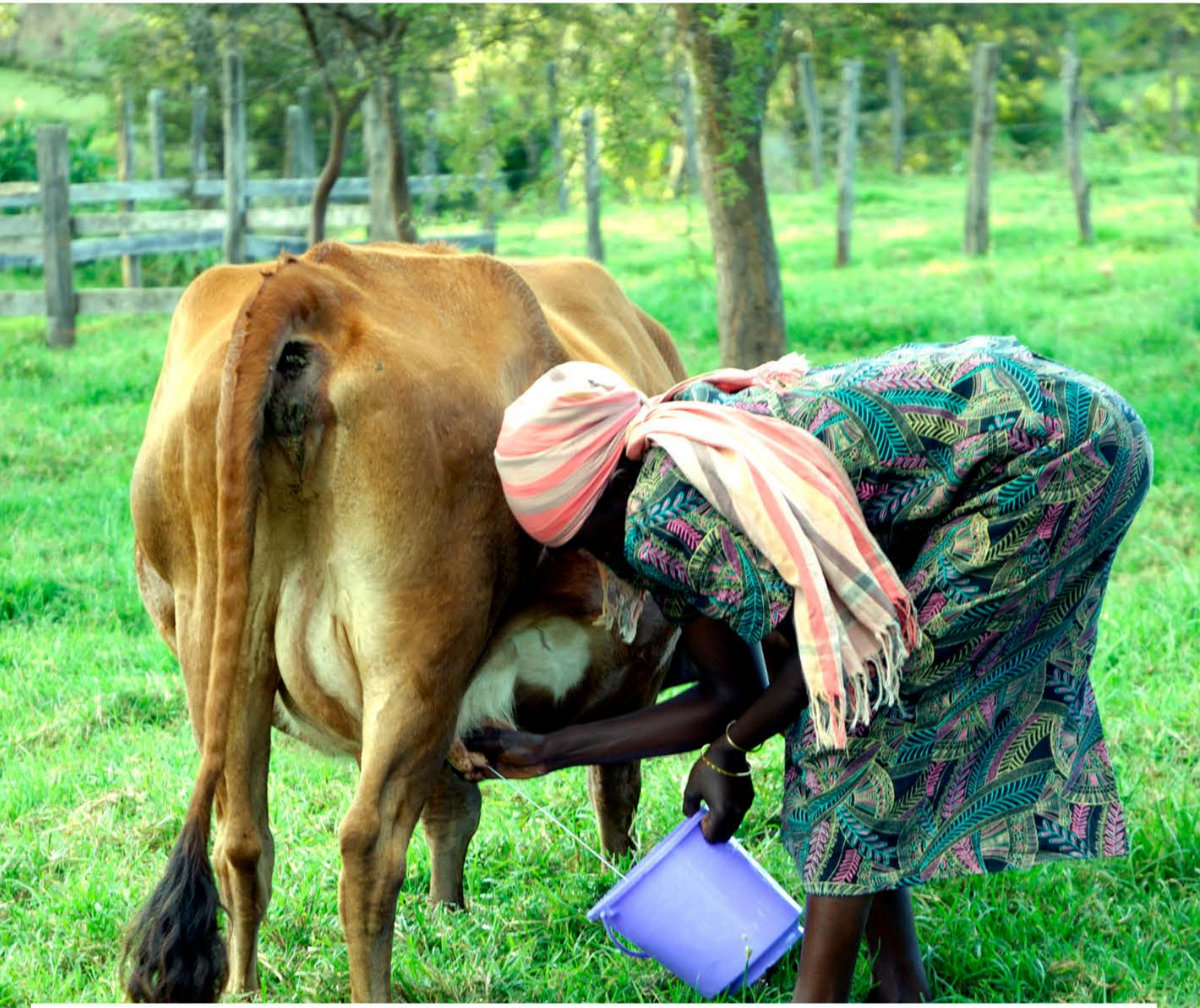

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JSS2 FIRST TERM NOTES ON AGRICULTURE

Week 1 & 2

Topic: SOIL COMPOSITION AND PROPERTIES

Contents:

A. What is Soil?

Soil is the loose or thin layer on the surface of the earth on which the plants and animals lives. It is the loose combination of inorganic and organic materials. Soil is the upper layer of earth in which plants grow, a black or dark brown material typically consisting of a mixture of organic remains, clay, and rock particles.

Soil is considered to be the "skin of the earth" with interfaces between the lithosphere, hydrosphere, atmosphere of Earth, and biosphere. Soil consists of a solid phase (minerals and organic matter) as well as a porous phase that holds gases and water. Accordingly, soils are often treated as a three-state system.

Soil is the end product of the influence of the climate, relief (elevation, orientation, and slope of terrain), organisms, and parent materials (original minerals) interacting over time. Soil continually undergoes development by way of numerous physical, chemical and biological processes, which include weathering with associated erosion.

Physical Properties of the Soil

1. **Texture**: Texture refers to the relative proportions of particles of various sizes such as sand, silt and clay in the soil. Properties that are influenced by soil texture, include porosity, permeability, infiltration, shrink-swell rate, water-holding capacity, and susceptibility to erosion.
2. **Structure**: The term texture is used in reference to the size of individual soil particles but when the arrangement of the particles is considered the term structure is used. Structure refers to the aggregation of primary soil particles (sand, silt and clay) into compound particles or cluster of primary particles which are separated by the adjoining aggregates by surfaces of weakness. Structure modifies the effect of texture in regard to moisture and air relationships, availability of nutrients, action of microorganisms and root growth. The clumping of the soil textural components of sand, silt and clay

causes **aggregates** to form and the further association of those aggregates into larger units creates soil structures called pedoliths or **peds**. The adhesion of the soil textural components by organic substances, iron oxides, carbonates, clays, and silica, and the breakage of those aggregates from expansion-contraction, caused by freezing-thawing and wetting-drying cycles, shape soil into distinct geometric forms. Classes of Soil Structure includes:

    - **Types**: **Shape** and arrangement of peds

3. **Platy:** Peds are flattened one atop the other 1–10 mm thick. Found in the A-horizon of forest soils and lake sedimentation.
4. **Prismatic and Columnar:** Prism like peds are long in the vertical dimension, 10–100 mm wide. Prismatic peds have flat tops, columnar peds have rounded tops. Tend to form in the B-horizon in high sodium soil where clay has accumulated.
5. Angular and Sub-angular: Blocky peds are imperfect cubes, 5–50 mm, angular have sharp edges, sub-angular have rounded edges. Tend to form in the B-horizon where clay has accumulated and indicate poor water penetration.
6. Granular and Crumb: Spheroid peds of polyhedrons, 1–10 mm, often found in the A-horizon in the presence of organic material. Crumb peds are more porous and are considered ideal.

    - **Classes**: **Size** of peds whose ranges depend upon the above type

7. Very fine or Very thin: <1 mm platy and spherical; <5 mm blocky; <10 mm prism-like.
8. Fine or thin: 1–2 mm platy, and spherical; 5–10 mm blocky; 10–20 mm prism-like.
9. Medium: 2–5 mm platy, granular; 10–20 mm blocky; 20-50 prismlike.
10. Coarse or Thick: 5–10 mm platy, granular; 20–50 mm blocky; 50–100 mm prism-like.
11. Very coarse or Very thick: >10 mm platy, granular; >50 mm blocky; >100 mm prism-like.
12. **Grades**: Is a measure of the degree of **development** or cementation within the peds that results in their strength and stability.
13. **Weak:** Weak cementation allows peds to fall apart into the three textural constituents, sand, silt and clay.
14. **Moderate:** Peds are not distinct in undisturbed soil but when removed they break into aggregates, some broken aggregates and little un-aggregated material. This is considered ideal.

15. **Strong:** Peds are distinct before removed from the profile and do not break apart easily.
16. **Structure-**less: Soil is entirely cemented together in one great mass such as slabs of clay or no cementation at all such as with sand.

17. **Density**: Density is the weight per unit volume of an object. Particle density is equal to the mass of solid particles divided by the volume of solid particles – it is the density of only the mineral particles that make up a soil; i.e., it excludes pore space and organic material.
18. **Consistency**: This is the resistance of a soil to deformation or rupture and is determined by the cohesive and adhesive properties of the soil mass. Consistency is the ability of soil to stick to itself or to other objects (cohesion and adhesion respectively) and its ability to resist deformation and rupture. This is a term used to designate the manifestation of the cohesive and adhesive properties of soil at various moisture contents. A knowledge of the consistence of the soil is important in tillage operations, traffic and pond constructions. Consistence gives also an indication of the soil texture. Consistence is described for three moisture levels:

1. **Wet soil –** non sticky, slightly sticky, sticky, very sticky; non-plastic, slightly plastic, plastic and very plastic.
2. **Moist soil** – loose, very friable, friable, firm, very firm, extremely firm.
3. Dry soil – loose, soft, slightly hard, hard, very hard, extremely hard.

19. **Porosity**: Particle density can be determined using specific gravity bottle technique and bulk density by taking soil core samples of known volume in the field and determining the even dry weight (Black et al., 1965a). Pore space is that part of the bulk volume of soil that is not occupied by either mineral or organic matter but is open space occupied by either gases or water. Ideally, the total pore space should be 50% of the soil volume. The gas space is needed to supply oxygen to organisms decomposing organic matter, humus, and plant roots. Pore space also allows the movement and storage of water and dissolved nutrients.There are four categories of pores:
    1. Very fine pores: < 2 µm
    2. Fine pores: 2-20 µm
    3. Medium pores: 20-200 µm
    4. Coarse pores: 200 µm-0.2 mm

20. **Temperature**: Soil temperature depends on the ratio of the energy absorbed to that lost. Soil has a temperature range between 20 to 60 °C. Soil temperature regulates seed germination, plant and root growth and the availability of nutrients.
21. **Colour**: Soil colour gives an indication of the various processes going-on in the soil as well as the type of minerals in the soil. For example, the red colour in the soil is due to the abundance of iron oxide under oxidized conditions (well-drainage) in the soil; dark colour is generally due to the accumulation of highly decayed organic matter; yellow colour is due to hydrated iron oxides and hydroxide; black nodules are due to manganese oxides; mottling and gleying are associated with poor drainage and/or high water table

B. Chemical Properties of the Soil

Soil pH, Acidity and Alkalinity

pH can be defined as the measure of the concentration of Hydrogen and Hydroxyl ion in the soil. It can also be referred to as the degree of acidity and alkalinity of the soil. The hydrogn ion concentration is called the acidity while the hydroxyl ion concetration is called the alkalinity. Any soil pH below 7 is acidic while pH above pH above 7 is alkaline. Soil wih pH of 7 is neutral. pH 2 is strongly acidic, pH 6 is slightly acidic, pH is neutral, pH 8 is slightly alkaline and pH 13 is strongly alkaline.

Denomination	pH range
Ultra-acid	< 3.5
Extreme acid	3.5–4.4
Very strong acid	4.5–5.0
Strong acid	5.1–5.5
Moderate acid	5.6–6.0
Slight acid	6.1–6.5
Neutral	6.6–7.3
Slightly alkaline	7.4–7.8
Moderately alkaline	7.9–8.4
Strongly alkaline	8.5–9.0
Very strongly alkaline	> 9.0

Soil Acidity

A Soil is acidic if its level of hydrogen ion concentration is below 7 when *measure* with PH scale i.e.

The causes of soil acidity are;

1. Leaching: Excess rainfall leaches base cation from the soil, thereby increasing the percentage of acidic ions in the soil.
2. Use of acidic fertilizer: Ammonium (NH_4^+) fertilizers react in the soil in a process called to form nitrate (NO_3^-), and in the process release H^+ ions.
3. Presence of acid parent materials.
4. Plants nutrient update.
5. Presence of Sulphur in the soil.
6. Removal of product from the farm or paddock
7. Weathering of Minerals
8. Inappropriate use of nitrogenous fertilizers

9. Buildup in organic matter

Soil acidity can be removed by using liming materials rich in calcium. Soil acidity can be corrected easily by liming the soil, or adding basic materials to neutralize the acid present.

It can be removed by the application of

- Limestone
- Slaked lime
- Quick lime
- Calcium Hydrogen Trioxocarbonate
- Wood ash
- Basic slag

Soil acidity can be determined by using

- litmus paper
- BDH universal soil indicator method
- Colourimetric method
- Electrometric method

Soil Alkalinity

This is caused by excess quantities of soluble minerals in the soil. Alkaline soils have a high saturation of base cations (K^+, Ca^{2+}, Mg^{2+} and Na^+). Soil alkalinity is also an accumulation of soluble salts which are classified as either:

1. Using acidic fertilizer
2. Application of Sulphur to the soil.
3. Use of irrigation to dissolve some of the salts.

C. Soil Composition

The typical soil consists of approximately 45% mineral, 5% organic matter, 20-30% water, and 20-30% air.

a. **Mineral matter** – obtained by the disintegration and decomposition of rocks;
b. **Organic matter** – obtained by the decay of plant residues, animal remains and microbial tissues;

c. **Water** – obtained from the atmosphere and the reactions in soil (chemical, physical and microbial);

d. **Air or gases** – from atmosphere, reactions of roots, microbes and chemicals in the soil

e. **Living Organisms –** both big (worms, insects) and small (microbes)

D. Importance of the Soil

1. Soil provides required nutrients for growth and development for plants.
2. Man plants his crops on the soil.
3. Man also builds his shelter on the soil.
4. Soil also serves as habitat for some animals and useful microorganisms.
5. Food and other biomass production
6. Environmental Interaction: Storage, filtering, and transformation
7. Biological habitat and gene pool
8. Source of raw materials
9. Physical and cultural heritage
10. Platform for man-made structures: buildings, highways

E. Soil Types

Soil type usually refers to the different sizes of mineral particles in a particular sample. Soil is made up in part of finely ground rock particles, grouped according to size as sand and silt in addition to clay, organic material such as decomposed plant matter.

Each component, and their size, play an important role. For example, the largest particles, sand, determine aeration and drainage characteristics, while the tiniest, sub-microscopic clay particles, are chemically active, binding with water and plant nutrients. The ratio of these sizes determines soil type: clay, loam, clay-loam, silt-loam, and so on.

In addition to the mineral composition of soil, humus (organic material) also plays an important role in soil characteristics and fertility for plant life. Soil may be mixed with larger aggregate, such as pebbles or gravel. Not all types of soil are permeable, such as pure clay.

There are three major types of soil which are;

1. Sandy soil

2. Clay soil
3. Loamy soil

Sandy Soil

Sandy soil is the result of the weathering and disintegration of a variety of rocks such as granite, limestone and quartz. This type of soil is easy to cultivate but since it allows for more drainage than needed, it is important to water it regularly, especially during summer days.

Sandy soils are dominated by sand particles, but contain enough clay and sediment to provide some structure and fertility. There are four different types of sandy loam soil that are classified based on the size of the sand particles in the soil. You can determine whether your yard has this kind of soil using a simple test.

Classification

Sandy loamy soils are broken down into four categories, including coarse sandy loam, fine sandy loam, sandy loam and very fine sandy loam. The size of the sand particles is measured in millimeters and their concentration in the soil is used to determine which category a soil falls under. Sandy loam soils are made of approximately 60 percent sand, 10 percent clay and 30 percent silt particles.

Characteristics

Sandy loam soils have visible particles of sand mixed into the soil. When sandy loams soils are compressed, they hold their shape but break apart easily. Sandy loam soils have a high concentration of sand that gives them a gritty feel. In gardens and lawns, sandy loam soils are capable of quickly draining excess water but cannot hold significant amounts of water or nutrients for your plants. Plants grown in this type of soil will require more frequent irrigation and fertilization than soils with a higher concentration of clay and sediment. Sandy loam soils are often deficient in specific micronutrients and may require additional fertilization to support healthy plant growth.

Identification

You can quickly identify sandy loam soil based on its physical characteristics. Pick up a handful of dry soil and slowly dribble water onto it. Work the water into the soil with your hand until it has a smooth consistency similar to putty. Hold the soil in your hand as though you are holding a pipe straight up and down and squeeze it. Sandy loam soils have a very gritty texture. If your soil is a sandy loam, it will form a cohesive ribbon of soil as it squeezes out between your thumb and finger that will fall apart before it reaches one inch in length.

Considerations

Plants that are grown in a sandy loam soil need frequent irrigation and fertilization to maintain healthy growth. The best way to improve a sandy loam soil for gardening is to mix organic matter into the soil. Incorporating a 2- to 4-inch layer of compost or peat moss over the area can significantly improve the ability of your sandy loam soil to hold nutrients and water.

Characteristics of Sandy Soil

- large sized particles from 2mm to 0.02mm
- particles consist chiefly of quartz
- particles are coursed grained, loose and gritty to touch
- well drained and aerated
- poor water holding capacity
- no structure therefore it is not suitable for growth
- easily heated up in the day and cools faster at night
- easy to cultivate
- large pore spaces

Clay soil

Clay is a kind of material that occur naturally and consists of very fine grained material with very less air space. Clay soil has the smallest particles among the three so it has good water storage qualities. It's sticky to the touch when wet, but smooth when dry.

Due to the tiny size of its particles and its tendency to settle together, little air passes through its spaces. Because it's also slower to drain, it has a tighter hold on plant nutrients. Clay soil is thus rich in plant food for better growth.

Clay soil is cold and in the spring, takes time to warm since the water within also has to warm up. The downside is that clay soil could be very heavy to work with when it gets dry. Especially during the summer months, it could turn hard and compact, making it difficult to turn. (When clay soil is worked while it's too wet though, it's prone to damage).

If moistened soil feels sticky, rolls up easily, and forms into a ball or sausage-like shape, then you've got yourself clay.

Though different soils have a wide range of colors, textures and other distinguishing features, there are only three types of soil particles that geologists consider distinct. The quality of soil depends on the amount of sand, loam and clay that it contains, because soils with differing amounts of these particles often have very different characteristics. Soil with a large amount of clay is sometimes hard to work with, due to some of clay's characteristics.

Particle Size

Clay has the smallest particle size of any soil type, with individual particles being so small that they can only be viewed by an electron microscope. This allows a large quantity of clay particles to exist in a relatively small space, without the gaps that would normally be present between larger soil particles. This feature plays a large part in clay's smooth texture, because the individual particles are too small to create a rough surface in the clay.

Structure

Because of the small particle size of clay soils, the structure of clay-heavy soil tends to be very dense. The particles typically bond together, creating a mass of clay that can be hard for plant roots to penetrate. This density is responsible for clay-heavy soil being thicker and heavier than other soil types, and clay soil takes longer to warm up after periods of cold weather. This density also makes clay soils more resistant to erosion than sand or loam-based soils.

Organic Content

Clay contains very little organic material; you often need to add amendments if you wish to grow plants in clay-heavy soil. Without added organic material, clay-heavy soil typically lacks the nutrients and micronutrients essential for plant growth and photosynthesis. Mineral-heavy clay soils may be alkaline in nature, resulting in the need for additional amendments to balance the soil's pH before planting anything that prefers a neutral pH. It's important to test clay-heavy soil before planting to determine both the soil's pH and whether it lacks important nutrients such as nitrogen, phosphorus and potassium.

Permeability and Water-Holding Capacity

One of the problems with clay soil is its slow permeability resulting in a very large water-holding capacity. Because the soil particles are small and close together, it takes water much longer to move through clay soil than it does with other soil types. Clay particles then absorb this water, expanding as they do so and further slowing the flow of water through the soil. This not only prevents water from penetrating deep into the soil but can also damage plant roots as the soil particles expand.

Identifying Clay

There are several tests you can use to identify clay soils. If rubbed between your fingers, a sample of clay soil often feels slick and may stick to your fingers or leave streaks on your skin. Rubbed clay soil often takes on a shiny appearance as well, as opposed to the rough texture you would see with other soils. Clay soils do not crumble well, and a sample of clay can typically be stretched slightly without breaking. When wet, clay soils become slick and sticky; the soil may also allow water to pool briefly before absorption due to the slow permeation. Visually, clay soils seem solid with no clear particles, and may have a distinct red or brown color when compared to the surrounding soil.

Characteristics of Clay Soil

- very small particles with diameter less than 0.002mm
- many pore spaces
- sticky to touch and swells when wet, shrink when dry
- forms aggregates or lumps
- high water holding capacity
- high mineral holding capacity
- large surface area because of its fine particles
- called heavy soil because it is difficult to cultivate
- particles are tightly parked hence there is poor drainage and circulation of air
- cooler soil with more uniform moisture content

Silty Soil

Silty soil has much smaller particles than sandy soil so it's smooth to the touch. When moistened, it's soapy slick. When you roll it between your fingers, dirt is left on your skin.

Silty soil retains water longer, but it can't hold on to as much nutrients as you'd want it to though it's fairly fertile. Due to its moisture-retentive quality, silty soil is cold and drains poorly.

Silty soil can also easily compact, so avoid trampling on it when working your garden. It can become poorly aerated, too.

Loamy soil: The soil consists of sand, silt and clay to some extent. It is considered to be the perfect soil. The texture is gritty and retain water very easily, yet the drainage is well.

Exercise – Section A

Soil, Texture, Porosity, Loamy soil, pH, Sandy soil, Clay soil, Structure, Soil acidity, Soil alkalinity, Silty soil, Soil type, Mineral matter, Organic matter, Density, Consistency, Litmus paper

Use the options above to answer questions 1 – 12 below

1. _____ is the result of the weathering and disintegration of a variety of rocks such as granite, limestone and quartz
2. _____ is the ability of soil to stick to itself or to other objects (cohesion and adhesion respectively) and its ability to resist deformation and rupture
3. _____ is used to test for acidity or alkalinity of the soil
4. _____ is the loose or thin layer on the surface of the earth on which the plants and animal's lives
5. _____ usually refers to the different sizes of mineral particles in a particular sample
6. _____ is obtained by the decay of plant residues, animal remains and microbial tissues
7. _____ is caused by excess quantities of soluble minerals in the soil
8. _____ has much smaller particles than sandy soil so it's smooth to the touch. When moistened, it's soapy slick. When you roll it between your fingers, dirt is left on your skin
9. _____ refers to the aggregation of primary soil particles into compound particles or cluster of primary particles which are separated by the adjoining aggregates by surfaces of weakness
10. _____ can be defined as the measure of the concentration of Hydrogen and Hydroxyl ion in the soil
11. _____ is obtained by the disintegration and decomposition of rocks
12. _____ refers to the relative proportions of particles of various sizes such as sand, silt and clay in the soil

Answers

1. Sandy soil
2. Consistency
3. Litmus paper

4. Soil
5. Soil type
6. Organic matter
7. Soil Alkalinity
8. Silty soil
9. Structure
10. pH
11. Mineral matter
12. Texture

Section B

- Define soil.
- List two importance of the soil to you

Week 3

Topic: FARM STRUCTURES AND BUILDINGS

Content:

Farm Structures

They are simple erections on the farm site which make farm operations easier and more efficient. Farm structures are common agricultural structures associated with an agricultural use such as growing and harvesting crops, and raising livestock.

These structures may include: • Barns • Cold storages for crops grown and raised on site • Riding arenas (riding academies) • Slaughterhouses • Hay or feed storage • Livestock shelter or shade structures • Feed or hay shelter structures • Loafing sheds • Poultry coop • Farm equipment storage

Types of Farm Structures

Farm structures are classified according to their functions and uses.

1. **Production Structures –** These are structures which facilitate production processes in the farm. Example are poultry battery cages, fish pond, shelter, rabbit hutches.
2. **Structures for Shelter** – They are simple farm buildings erected at different points in the farm to provide shelter for rest during heavy rain or when the intensity of the sun is too high. The structures are occasionally used as temporary storage.
3. **Processing Structures** – These are structures designed and constructed to speed up the processing of farm produce. Examples are smoking houses, shelling and hulling barns erected to accommodate processing machines such as grinding machines, feed mills and rice mills
4. **Storage Structures** – These are structures used for storing produce before they are ready for sale or used as inputs in the next planting season e.g. silos, cribs, barns, rhombus.
5. **Utility Structures** – These structures include well, canals, irrigations, pumping houses.
6. **Maintenance Structures** – This include workshops for maintenance of farm tools and machineries

Farm Buildings

These are bigger and more elaborate erections which are designed and constructed to serve different purposes.

Types of Farm Building and their Uses

1. Living Houses for the Farmer and Workers – These are houses which provide accommodation for the farmer and his workers. No serious farmer is expected to live outside the farm.
2. Production Houses – Buildings used for production. Examples – poultry house, hatcheries, pens.
3. Storage Houses – These are buildings used for storing farm tools, feeds, chemicals and fertilizers
4. Special Shelters – These building include milking parlor, sick bay, isolation sheds or quarantine houses, abattoir or slaughter houses

Maintenance of Farm Structures

Farmers need to regularly check on the condition of their buildings to maintain building stability and safety.

- Repairs should be carried out regularly once wear and tear is noticed
- Paints should be used for wooden and metal parts of farm structures that are constantly exposed to rain
- Preservatives should be applied to wood to protect it against insects such as termites

Practice Questions

1. _____ are simple erections on the farm site which make farm operations easier and more efficient.
2. Special shelters, storage houses and production houses are all examples of _____
3. Give 2 examples of each type of structure
   Storage Structures
   Utility Structures
   Maintenance Structures
   Processing Structure

Answers

1. Farm structure
2. Farm Buildings
3. Storage – silos, cribs, barns, rhumbas.
   Utility – well, canals, irrigations, pumping houses.
   Maintenance – This include workshops for maintenance of farm tools and machineries
   Processing – smoking houses, shelling and hulling barns erected to accommodate processing machines such as grinding machines, feed mills and rice mills

Week 4

Topic: Siting of Farm and Layout of Farm Structure

Introduction

Farm Structures and Buildings is the home of farm animals and a production center. They may be constructed with blocks, mud, zinc, thatch, wood or aluminums. Farmsteads may include

- living houses
- barns
- pens
- storage houses
- sheds/paddocks
- processing shed
- workshops

Factors to be Considered When Siting Farm Structures

1. Water supply – Water supply must be constant and regular
2. Topography – Shape and position of the land. A flat level area or land should be selected
3. Accessibility – Facilities should be located within walking distance.
4. Climate – Structures and buildings should be located in a way that there will be adequate ventilation
5. Soil types – They should be sited on poor soils but the soil should not be clayey to avoid water logging
6. Foresight – A farmer must have foresight ie. he should look at the possibility of expansion

Principles of Farm Layout

- Livestock pens and houses should not be sited close to the farm offices and living houses to avoid offensive odor

- Structures should be easily accessible
- Plant crops on the best soil in the farm
- Farm structures and buildings should not be located on slopes to prevent them from being washed away
- Buildings and Livestock houses should be located on the poorest soil in te farm

Importance of Siting Farm Structures

1. It facilitates farm operations
2. It increases efficiency and production
3. It brings about easy transportation within and outside the farm
4. It provides temporary storage points for produce before they are taken to the market for sale

Practice Questions

List 5 factors to be considered when siting farm structures.

Week 5

Topic: Farm machines

Farm Machinery

Farm machinery are different type of machines and implements used in farming operations. These machines and implements are;

1. Tractors
2. Bulldozer
3. Planters
4. Sprayer
5. Sheller
6. Ridge
7. Ploughs
8. Harrows
9. Harvesters
10. Dryer
11. Incubator
12. Milking machines e.t.c

All these farm machines can be grouped into three

1. Primary machines
2. Intermediate machines
3. Tractor coupled or mounted implements

TRACTORS — these have large heavily treaded rear tyres used for pulling, pushing and lifting other farm implements or machinery. It uses either petrol or diesel as fuel to power it. A **tractor** is an engineering vehicle specifically designed to deliver a high tractive effort (or torque) at slow speeds, for the purposes of hauling a trailer or machinery used in agriculture or construction.

Most commonly, the term is used to describe a farm vehicle that provides the power and traction to mechanize agricultural tasks, especially (and originally) tillage, but nowadays a great variety of tasks.

Tractor

TYPES OF TRACTORS

The two (2) types of tractors are

1. The wheeled tractor
2. Track type tractor

Tractors-coupled or mounted implements

These are implements coupled or mounted on the tractor. Examples are

- Tillage implements like ploughs, harrows and ridges
- Planters
- Sprayers e.g. broom sprayer

Tractor coupled with Plough

Intermediate machinery – Farm machines powered by a tractor, generator or electricity. Some of these are;

1. Sheller's
2. Dryers
3. Incubators
4. Grinding machine
5. Milking machine etc.

Secondary Tillage Implements

These implements are used to level the soil and break large clouds of earth formed during ploughing. They are also used to stir the soil and to prevent and destroy weeds.

Disc harrow – used for breaking large clods of earth. Also used for levelling the soil, pulverization and weed control.

Spike tooth harrow – Used to smoothen and level soil after ploughing. Also used to fill air apaches in the soil and to cultivate corn, cotton and other row crops.

Uses of Farm Machinery

There are various farm machinery with their specific uses, These include:

Tractors: For pulling tillage like plough, barrow ridge, sprayer etc.

Tractor

Planters: A planter is an agricultural farm implement towed behind a tractor, used for sowing crops through a field. It is connected to the tractor with a draw-bar, or a three-point hitch. It is used for planting seeds. Planters lay the seed down in precise manner along rows. Seeds are distributed through devices called row units. The row units are spaced evenly along the planter.

Planter with Tractor

Sprayer: A sprayer is a piece of equipment that is used to apply herbicides, pesticides, fertilizers, agro-chemicals and water in irrigation farming on agricultural crops. Sprayers range in sizes from man-portable units (typically backpacks with spray guns) to trailed sprayers that are connected to a tractor, to self-propelled units similar to tractors, with boom mounts of 60–151 feet in length.

Sprayer

Sprayer with Tractor

Dryer: for drying harvested farm produce.

Farm Dryer

Sheller: To remove grains from cobs in maize, chaff from rice, millet etc.

Sheller

Grinding machines: For grinding harvested produce to pulp or powered form e.g. cassava, yam, melon, groundnut, tomato etc.

Incubators: For keeping fertilized eggs on right temperature and humidity and for hatching.

Incubator

Plough: Tillage is the basic operation in farming. It is done to create favorable conditions for seed placement and plant growth. This is done mainly with a

plough. To breakup or loosen the soil, kill insects and uprooting weeds. The basic components of the plough are a shoe, a share, a body, a handle and a beam.

Plough

Harvester: To harvest mature and ripe crops especially grains.

Harvester

Harvester

Milking Machine: Milking machines are used to harvest milk from cows when manual milking becomes inefficient or labor-intensive. Milking machines work in a way that is different from hand milking or calf suckling. Continuous vacuum is applied inside the soft liner to massage milk from the teat by creating a pressure difference across the teat canal (or opening at the end of the teat). Vacuum also helps keep the machine attached to the cow.

Milking Machine

Flail mower: A **flail mower** is a type of powered garden/agricultural equipment, which is used to deal with heavier grass/scrub which a normal lawn mower could not cope with.

Flail mower

Rice Huller: A **Rice huller** or **Rice husker** is an agricultural machine used to automate the process of removing the chaff (the outer husks) of grains of rice.

Rice Huller

Seed drill: A **seed drill** is a sowing device that precisely positions seeds in the soil and then covers them. Before the introduction of the seed drill, the common practice was to plant seeds by hand.

Sowing machine with seed drill concept

Maintenance of Farm Machinery

1. Lubrication of parts of engine with oil or grease to reduce friction
2. Tightening of Bolts and Nuts
3. Sharpening of Blunt tools especially cutting edges to avoid bluntness
4. Cleaning and Storage after use

Practice Questions

Tractor, Sprayer, Planter, Sheller, Seed drill, Rice huller, Milking machine, Harvester, Plough, Dryer, Harvester, Flail mower

Use the option above to answer Questions 1 – 8 below

1. A _____ is used for drying harvested farm produce
2. A _____ is a sowing device that precisely positions seeds in the soil and then covers them
3. The ____ is used harvest mature and ripe crops especially grains
4. A _____ is a type of powered garden/agricultural equipment, which is used to deal with heavier grass/scrub which a normal lawn mower could not cope with.
5. A ___ is used to remove grains from cobs in maize, chaff from rice, millet
6. A ___ is a piece of equipment that is used to apply herbicides, pesticides, fertilizers, agro-chemicals and water in irrigation farming on agricultural crops.
7. A ____ is an agricultural farm implement towed behind a tractor, used for sowing crops through a field

8. A ____ is used for pulling tillage like plough, barrow ridge, sprayer

Answers

1. Dryer
2. Seed drill
3. Harvester
4. Flail mower
5. Sheller
6. Sprayer
7. Planter
8. Tractor

Week 6

Topic: CROP PROPAGATION

Introduction

Crop propagation is the process by which plants are multiplied as independent units. There are two types of propagation – sexual and asexual.

Sexual Propagation

In this type of propagation, seeds are used for planting. A seed is a developed ovule which is formed as a result of union of the male and female gametes in a process called fertilization. Seeds maybe planted inset (directly into the field) e.g. Okra, Maize, Cowpeas or they may be raised in the nursery before transplanting them into the field e.g. tomato, pepper, tobacco, cocoa etc.

Asexual Propagation

This is the method of propagation in which plants are multiplied independent of seeds. Gamete cells are not involved in this propagation, only one parent is involved. This method is suitable for propagating plants which do not produce seeds but propagation is difficult with the seeds. e.g. plantain, sugar-cane, cassava and cocoyam.

Natural Method of Asexual Propagation

The methods include the following

- **Corms** – An underground stem which stores food in form of starch. It has buds and bears leaves which develop to become erect. e.g. cocoyam
- **Bulbs** – A bulb is an underground stem which does not store its food in the stem but stores food at the bases of old leaves. It has a short stem that bears adventitious roots. The leaves are covered by brownish membranous scales in between the auxiliary buds. e.g., Onion, Lily
- **Rhizomes** – An underground horizontal stem. It stores food in the stem and it develops thin scales and nodes. each node has bud with some adventitious roots. It has the ability to regenerate and therefore difficult to eradicate e.g. spear grass, ginger
- **Suckers** – Modified stems which produce lateral branches that end in terminal buds. e.g banana or plantain

- **Stem tubers** – These are swollen underground stems which store food in form of starch. Stem tubers have very tiny buds with vestigial scale leaves. e.g. Yam. Sweet potato
- **Runners** – Stems which are too weak to stand erect and therefore grow horizontally on the surface of the ground e.g. carpet grass, sweet potato

Artificial Method of Vegetative Propagation

This involves growing new plants by man from cut portions of the parent plant. It may also involve union of a bud with root stock or shoot with root stock as in budding and grafting. Artificial methods include cutting. budding, grafting, layering and marcotting.

- **Cutting** – A part of the mature plant is cut and used for propagation. Three common types of cutting are leaf cutting, stem cutting and root cutting.
- **Budding** – Process of uniting a bud with a stock. *Budding* is a form of asexual reproduction in which a new organism develops from an outgrowth or bud due to cell division at one particular site. The new organism remains attached as it grows, separating from the parent organism only when it is mature, leaving behind scar tissue.
- **Grafting** – *Grafting* is a technique used by farmers and *scientists* to attach the tissue of one plant to the tissue of another. It allows for asexual reproduction of plants, and for making some neat new decorations for your yard
- **Layering** – Bending a mature branch or shoot down to the soil without breaking it.

Advantages and Disadvantages of Propagation Methods

Advantages of Sexual Propagation

1. See is easy to carry, store, procure and plant
2. It increases the vigor of the plant
3. It gives rise to variations and better adaptability

Disadvantages

1. It reduces the quantity of seeds for consumption
2. Some seeds do not germinate due to dormancy
3. Pollination will not occur if pollinating agents are unavailable

4. Individuals with undesirable characteristics maybe produced

Advantages of Asexual Propagation

1. Produces individuals which show more resistance to diseases and pests
2. It produces individuals that mature early
3. New plants can withstand adverse weather and soil condition
4. New plants produced resemble their parents

Disadvantages

1. The new offspring's similar to the parents can carry undesirable characteristics
2. It gradually reduces the strength and vigor of succeeding generations
3. Vegetative organs are not easy to store

Practice Question

1. Explain the processes of Artificial method of propagation
2. List 3 natural methods of propagation and the plants involved

Answers

1. Available in note above
2. Corms – Cocoyam
   Suckers – Banana
   Stem tubers – Yam, Sweet Potato
   Runners – Carpet grass, Sweet potato
   Bulbs – Onion, Lily

Week 7

Topic: Cultural Practices

Introduction

The aim of the farmer is to get maximum yield from his farm operations. For this reason, he adopts a number of measures to get the best out of the soil.

Pre-planting Operations

This include all operations carried out in the farm before planting is done e.g. selection of site, bush clearing, stumping, farm layout, ploughing, harrowing, ridging.

1. **Selection of Site** – It is necessary to choose a good site. A flat well drained sandy-loamy soil should be chosen. This is ideal for most food crops.
2. **Bush Clearing** – This is the removal of bushes through Mechanical or Chemical means. Mechanically through manual cutting of bushes with crude implements e.g. Hoes and Cutlasses or through the use of machines. Chemically through the use of Herbicides (chemicals used to kill weeds) e.g Parquet.
3. **Stumping** – The removal of perennial roots and tree stumps present in the soil. It is an energy consuming operation
4. **Ploughing** – The primary purpose of ploughing is to turn over the upper layer of the soil, bringing fresh nutrients to the surface, while burying weeds, the remains of previous crops, and both crop and weed seeds, allowing them to break down. It also aerates the soil, allows it to hold moisture better and provides a seed-free medium for planting an alternate crop. It can be carried out using manually with a hoe or a plough. A plough is an implement used in **farming** for initial cultivation of soil in preparation for sowing seed or planting to loosen or turn the soil. As the **plough** is drawn through the soil it creates long trenches of fertile soil called furrows.
5. **Harrowing** – This is the breaking up and smoothing out the surface of the soil. This is a method for shallow cultivation of soil and care of *agricultural* crops. It is accomplished by toothed or disk harrows and revolving hoes. It is often carried out on fields to follow the rough finish left by ploughing operations. The purpose of this harrowing is generally to break up clods (lumps of soil) and to provide a finer finish, a good tilth or soil structure that is suitable for seedbed use.

6. **Ridging** – This involves making ridges for planting. This is a strip of ground thrown up by a plow or left between furrows where seeds can be planted.
7. **Seed Bed Preparation** – This involves making of ridges or nursery beds. A **nursery** is a place where plants are propagated and grown to usable size. Transplanting is the transfer or movement of ready seedlings from the nursery bed, seedling trays or pots to the main field. Transplanting is used in vegetable raising, fruit growing, forestry, tobacco *farming*, and flower raising. Seedlings are transferred from seedbeds,
hotbeds, hothouses, and nurseries topermanent sites, where they continue to gr ow and to produce a crop. For potatoes, tubers are planted; for onions, smallbul bs raised from seeds; for mint, rootstock cuttings; and for sugarcane, stemcuttin gs. To obtain the seeds of root crops, the root is planted.

Practice Questions

1. ___ is a place where plants are propagated and grown to usable size.
2. ____ is the breaking up and smoothing out the surface of the soil
3. ____ is the removal of perennial roots and tree stumps present in the soil
4. ____ involves making of ridges or nursery birds.

Answers

1. Nursery
2. Harrowing
3. Stumping
4. Seed bed preparation

Week 8

Topic: Cultural Practices – Planting Operations

Introduction

These are operations carried out while planting is done. Planting operations include spacing, seed selection, seed rate and planting.

Spacing – This refers to the distance between two plants. The distance between one plant and another along the same ridge or row is called Intra or Within the Row spacing while the distance between one plant and another on different ridges or rows is called inter or between row spacing. Different crops have different spacing depending on whether they branch extensively or not. Correct spacing encourages high yield.

Seed rate – This refers to the quantity of seeds or planting material required to cover the planting of an area of land. To determine the seed rate of a piece of land, the area of the land, the actual spacing and the number of seeds per hole must be known. Assuming we want to plant a crop in a piece of land which is 500m long and 200m wide, if the spacing is 2m x 2m and 3 seeds are planted per hole, then the seed rate is determined as follows

Area of Land = Length x Breadth = 500m x 200m = 100,000m^2

Spacing = 2m x 2m = 4m^2

Seeds per hole = 3

Number of stands along the side = 500/2 = 250 stands

Number of stands along the breadth = 200/2 = 100 stands

Total number of Stand – 250 x 100 = 25,000 stands

Thus seed rate = stands x number of seeds per hole = 25,000 x 3 = 75,000 seeds

Seed Selection – The quality of seeds affect the early life of the plants and has a direct effect on the type of crops produced. The following points must be considered when selecting seeds

- Large seeds should be selected in a group
- Seeds should be well filled and not wrinkled

- The seeds should be free from holes. The presence of holes in seeds signify insect attack
- Avoid using seeds that have been stirred for a long time.

Planting – Planting is the act of sowing the desired seeds on a prepared field. There are different fabricated machinery that could be used to achieve this, depending on the type of crop (planter). Sowing is the process of planting seeds. An area or object that has had seeds planted will be described as being sowed. Planting is the act or an instance of putting seeds or young plants into the soil**.** There are different methods of sowing and the crop to be sowed determines the method to be used. There are 6 sowing methods which differ in their merits, demerits and adoption. These are:
1. Broad casting
2. Broad or Line sowing
3. Dibbling
4. Transplanting
5. Planting
6. Putting seeds behind the plough.

Practice Questions

1. ___ refers to the quantity of seeds or planting material required to cover the planting of an area of land
2. The quality of seeds affects the early life of the plants and has a direct effect on the type of crops produced. This process is called ____
3. Calculate the spacing and seed rate for a piece of land which is 800m long and 600m wide, if the spacing is 4m x 3m and 4 seeds are planted per hole.
4. Calculate the number of stands along the side (length), if the seed rate is 160,000 seeds, the piece of land is 400m x 200m and the spacing is 2m x 2m. The number of seeds per hole is 4.

Answers

1. Seed rate
2. Seed selection
3. Area of Land = Length x Breadth = 800m x 600m = 480,000m^2
   Spacing = 4m x 3m = 12m^2
   Seeds per hole = 4
   Number of stands along the side = 800/4 = 200 stands
   Number of stands along the breadth = 600/3 = 200 stands

Total number of Stand – 200 x 200 = 40,000 stands
Thus seed rate = stands x number of seeds per hole = 40,000 x 3 = 120,000 seeds

4. Number of stands along the side (Length) = Length/ spacing = 400/2 = 200 stands

Week 9&10

Topic: Cultural Practices – Post Planting Operations and Harvesting

Introduction

Post planting operations in agriculture refers to all the other process that take place after planting. This includes watering, weeding, applying fertilizers, pruning, weeding etc.

1. **Thinning and Supplying** – **Thinning** is a term used in agricultural sciences to mean the removal of some plants, or parts of plants, to make room for the growth of others. Selective removal of parts of a plant such as branches, buds, or roots is typically known as pruning. Supplying can be defined as the process of planting so many crops for the nursey stage of pre-planting process in other to make available crops for planting.
2. **Weeding** – This is the systematic removal of weeds. A **weed** is a plant considered undesirable in a particular situation, "a plant in the wrong place". Weeding should be done t intervals, 3 times per season.
3. **Rouging** – This refers to the act of identifying and removing plants with undesirable characteristics from **agricultural** fields. Rogues are removed from the fields to preserve the quality of the crop being grown.
4. **Fertilizer Application** – A **fertilizer** is any material of natural or synthetic origin (other than liming materials) that is applied to soils or to plant tissues (usually leaves) to supply one or more plant nutrients essential to the growth of plants. It is the adding of nutrients to the soil. The placing of organic or chemical manure to the soil helps to improve nutrients. Application of this substance is called Fertilizer Application.
5. **Mulching** – **Mulching** is the placing of dry grass, cardboard or plastic to keep soil moist and prevent soil erosion. This involves the use of either plant residue or mulching material, to cover the soil in a bid to prevent excessive moisture loss; or to reduce the effect of high temperature on germinating seedlings, plant root etc.
6. **Harvesting** – **Harvesting** is the process of gathering a ripe crop from the fields. Reaping is the cutting of grain or pulse for **harvest**, typically using a scythe, sickle, or reaper. On smaller farms with minimal mechanization, **harvesting** is the most labor-intensive activity of the growing

season. It is also is the act of removing a crop from where it was growing and moving it to a more secure location for processing, consumption, or storage.

7. **Processing** – This is the transformation of raw ingredients, by physical or chemical means into food, or of food into other forms.
   Food **processing** combines raw food ingredients to produce marketable food products that can be easily prepared and served by the consumer.

8. **Storage** – **Storage** is an important marketing function, which involves holding and preserving farm products from the time they are produced until they are needed for consumption. The **storage** of products, therefore, from the time of production to the time of consumption, ensures a continuous flow of goods in the market.

9. **Staking:** It is a situation whereby a stick is placed besides a plant to prevent it from bending or fruit from touching the ground. This help the efficient growth of the crop. Staking provides physical support so that plants don't break under the strain of fruit or inclement weather. Staking enables better air flow through plants, which results in less internal moisture that can result in disease. Crops like tomato, yam requires staking.

10. **Irrigation –** Irrigation is the method in which a controlled amount of water is supplied to plants at regular intervals for agriculture. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall. This is the watering of the plant for growth and development.

11. **Pruning** – It is the removal of branches of the center and end of plant to allow sunlight. The sunlight is very important in the growth of crops.

12. **Molding** – This is the gathering of soil around the plant to avoid soil erosion, and for proper aeration.

13. **Pest Management** – Pests are organisms that attack crops at different stages of growth, which often have adverse consequence on the productivity of the crop, and reduced output realizable from the farm. There are different approach to pest management which include: Pesticide based approach such as fungicide, insecticide, fungicide etc. Biological pest control approach: such as the use of trap crops, cover crops. Biotechnology-based approach: such as plant breeding and genetic modification.

14. **Disease management**: is the practice of minimizing disease in crops to increase quality or quantity of harvest yield. It involves making conscious decisions related to numerous agronomic factors over which control can be exercised. Plant diseases are caused by microorganisms such as fungi,

bacteria, viruses, nematodes. Various methods used to control pest includes: Developing new crop variety, Crop rotation, rouging etc.

15. **Marketing** – This is usually the last stage of farm operations. After harvesting and processing crops to be sold will be sent to the market. Farm products should be disposed of in time especially perishable products such as tomatoes, pepper, garden eggs.

Practice Questions

Thinning, Supplying, Disease management, Marketing, Harvesting, Staking, Ploughing, Pruning, Irrigation, Processing, Storage, Mulching, Rouging, Weeding, Molding, Pest management

Use the options above to answer the following questions

1. ___ is the systematic removal of weeds
2. _____ is the gathering of soil around the plant to avoid soil erosion, and for proper aeration.
3. _____ is the process of gathering a ripe crop from the fields
4. ____ is a situation whereby a stick is placed besides a plant to prevent it from bending or fruit from touching the ground.
5. _____ is a term used in agricultural sciences to mean the removal of some plants, or parts of plants, to make room for the growth of others
6. _____ is the transformation of raw ingredients, by physical or chemical means into food, or of food into other forms.
7. _____ refers to the act of identifying and removing plants with undesirable characteristics from agricultural fields.
8. ____ refers to the act of identifying and removing plants with undesirable characteristics from agricultural fields.
9. ____ is the practice of minimizing disease in crops to increase quality or quantity of harvest yield
10. ____ can be defined as the process of planting so many crops for the nursey stage of pre-planting process in other to make available crops for planting

Answers

1. Weeding
2. Molding
3. Harvesting
4. Staking
5. Thinning
6. Processing
7. Rouging
8. Irrigation
9. Disease management
10. Supplying

Week 11

Topic: Simple Experiment on Porosity, Percolation and Capillarity of the Soil

Soil Porosity

Soil porosity refers to the amount of pore or open space between soil particles. Pore spaces may be formed as a result of movement of roots, worms, and insects; expanding gases trapped within these spaces by groundwater; and/or the dissolution of the soil parent material. Soil texture can also affect soil porosity.

There are three main soil textures: sand, silt, and clay. Sand particles have diameters between .05 mm and 2.0 mm (visible to the naked eye) and are gritty to the touch. Silt is smooth and slippery to the touch when wet, and individual particles are between .002mm and .05 mm in size (much smaller than those of sand). Clay is less than .002 mm in size and is sticky when wet. The differences in the size and shape of sand, silt, and clay influences the way the soil particles fit together, and thus their porosity.

Soil porosity is important for many reasons. A primary reason is that soil pores contain the groundwater that many of us drink. Another important aspect of soil porosity concerns the oxygen found within these pore spaces. All plants need oxygen for respiration, so a well-aerated soil is important for growing crops. Compaction by construction equipment or our feet can decrease soil porosity and negatively impact the ability of soil to provide oxygen and water.

Materials

- 3 100ml graduated cylinders per group (or a measuring cup and two clear plastic bottles)
- Fine, playground-style sand and coarse, aquarium-style gravel
- Blank piece of paper and something to write on
- Pencil or pen
- Ruler
- Metal spoon or gardening spade

Procedure

1. Divide into small groups. On a piece of paper, make a data table like the one below for each group.

Soil particle type	**Volume of Water used (ml)**
gravel	
sand	

2. With each group taking 3 graduated cylinders, fill one cylinder with 100ml of sand, one with 100ml of gravel, and one 100ml of water.
3. Repeat step 4 with the sand and record the amount of water used in the data table.
4. Discuss the experiment: Which substance has more pore space: gravel or sand? How did you make this decision?
5. Before leaving the classroom, though, refill two of the graduated cylinders with 100ml of water. You will also need paper, pens, and pencils to record observations. Draw the data table below for each group.

Survey area	**Volume of Water used (ml)**

Soil Percolation Rates and Percolation Tests

The soil percolation rate indicates how quickly water moves through soil and helps evaluate the ability of the soil to absorb and treat effluent — waste water that has received preliminary treatment in a septic tank. The percolation rate is measured in minutes per inch (mpi). Soils with slower percolation rates, through which it takes longer for water to travel, need larger drain fields to handle a given amount of waste water than those with faster percolation rates. Soils with very slow percolation rates may be unsuitable for drain fields. In Nebraska, when soil percolation rates are slower than 60 mpi, consider installing a lagoon system if the lot is at least three acres. Otherwise, an engineer must design a specialized system.

The percolation rate is determined by conducting a percolation (perc) test. The percolation test measures the amount of time it takes for water in a test hole to drop 1 inch.

How to Conduct a Soil Percolation Test

1. Dig holes – Using a 4- to 8-inch hand auger, post hole digger, or shovel, dig at least three (preferably four) holes spaced evenly where the drain field is planned. If the soil type varies considerably, dig at least four (preferably six) holes, with two to three test holes per lateral or trench. Holes should be

between 4 and 12 inches in diameter, and as deep as the proposed trench. A good average depth is 24 to 30 inches. Do not conduct percolation tests on disturbed soil or frozen ground.

2. Roughen Sidewalls and Bottom – Because tools may have smoothed, compacted, or sealed the sides and bottom of the hole during digging, roughen or scratch the sides and bottom of the hole with a knife, or nails driven into a board. Remove all loose material and place about 2 inches of 1/4- to 3/4-inch clean gravel in the hole to prevent bottom scouring.

3. Presoak Soil – Carefully fill the hole with clear water to a point at least 12 inches above the gravel, being careful to avoid washing soil into the hole. Continue to add water until the soil becomes saturated. For most percolation tests, maintain a 12-inch water depth in the hole for at least four hours, and preferably overnight, before measuring the percolation rate. In clay soils, keep the hole filled at least 12 hours to allow the soil to swell. Soils with moderately slow permeability and/or containing more than 30 percent clay in the testing zone will require several days of saturation when the soil is dry in order to get an accurate reading. In sandy soils, soaking is unnecessary; if, after filling the hole twice with 12 inches of water, the water seeps completely away in less than 10 minutes, proceed with the test immediately.

4. Measure Soil Percolation Rate – Measure the percolation rate the day after the saturation process, except in sandy soils as previously discussed. Record the readings on paper and store with the onsite system records. As shown in Figure 1, the general measurement strategy is to place a board horizontally across the hole and anchor it firmly in position. Add or remove water as needed to maintain a depth of 6 inches over the gravel. One way to measure the depth is to slide a yardstick or pointed stick straight down until it just touches the water surface. Immediately record the time and depth (or draw a horizontal line on the measuring stick), using the horizontal board as a guide and reference point.

5. If water remains in the test hole after overnight saturation, add water to a depth to 6 inches over the gravel. Measure the drop in water level during an approximate 30-minute period.

6. If no water remains in the hole after overnight saturation, add clear water to a depth of 6 inches over the gravel. Measure the drop in water level at 30-minute intervals over a four-hour period, refilling the hole to a depth of 6 inches as necessary after each 30-minute period. Calculate the percolation rate based on the drop that occurs during the last 30-minute period.

7. In sandy soils or other soils where the first 6 inches of water seep away in less than 30 minutes, even after the overnight swelling period, use a 10-minute

interval between measurements, refilling the hole to a depth of 6 inches as necessary after each interval. Make six test measurements at 10-minute intervals. Calculate the percolation rate based on the drop that occurs during the last 10-minute period.

8. Calculate Percolation rate **–** The percolation rate is the average time in minutes required for water to fall 1 inch. Record the percolation test data from each hole. Divide the number of minutes elapsed by the drop in inches, using the last 30- or 10-minute reading taken for each hole. For example, the percolation rate for a hole where the water level drops 2 inches in 30 minutes is:

$$\frac{30 \text{ minutes}}{2 \text{ inches}} = 15 \text{ minutes per inch (mpi)}$$

Calculate field percolation rate. Determine the percolation rate for the entire field by averaging the last percolation rates of all test holes. However, if percolation test results for individual holes vary more than 20 mpi, there is considerable variation in the soil type. Under these circumstances, do not calculate an average for the entire field. Instead, design the system based on the slowest rate, or consider using a different location with less soil variation.

Example: The following percolation rates were calculated from data collected at a site:

Hole #	Last Test
1	14.9 mpi
2	20.4 mpi
3	20.9 mpi
4	18.7 mpi

To determine the percolation rate for the site, add the individual percolation rates for the last test and divide by the number of test holes. Although only

three test holes are required, the person conducting the test chose to use four holes to get a better idea of soil permeability at the site.

14.9 mpi + 20.4 mpi + 20.9 mpi +
18.7 mpi

4 holes

74.9 mpi

=

4 holes

= 18.7 mpi

Determine site suitability – If the percolation rate for the site is faster than 5 mpi, the soil is unsuitable for a drain field system. Waste water would travel too quickly through the soil to be treated properly. This could result in groundwater contamination, especially if the water table is shallow. When the percolation rate is faster than five mpi, dig the trench 1 foot deeper than the proposed trench depth. Using loamy sand soil with a percolation rate of 15 to 20 mpi, install a 1-foot thick soil liner in the bottom of the trench to improve soil characteristics. Base the trench size on the soil liner's percolation rate.

Likewise, if the percolation rate for the site is slower than 60 mpi, it is unsuitable for a traditional soil absorption system. This soil has a high clay content, resulting in slow permeability. Clay generally swells when wet, reducing permeability even more. Waste water would travel too slowly through the soil and could pond on or near the ground surface, or back up into the house. These situations could result in system failure, causing odor and the spread of disease.

Keep soil percolation test data on the premises – If a construction permit is required, the percolation test results must be submitted to NDEQ along with the permit application, alternative system plans, specifications, soil evaluation, and soil boring information. When the system is registered, keep a copy of the registration form with soil percolation data.

Summary

Soil varies from one location to another, even within short distances. Therefore, before selecting a site for an onsite waste water treatment system, measure soil permeability using a soil percolation test performed by a certified

onsite professional, registered environmental health specialist, or professional engineer. The percolation rate is used to select the most appropriate system, and to determine the proper size for the system.

Capillarity of Soils

Purpose

To compare the rise of water by capillarity in sandy, clayey, and loamy soil

Additional information

Capillarity is the phenomenon by which water rises in a cylindrical column. The narrower the column the higher the capillarity; similarly, the denser the substratum present in the column, the higher the capillary effect.

This is the reason why clayey and loamy soils are better options when it comes to growing healthy plants; along with being rich in nutrients it also retains moisture and helps water reach the transport channels of plants thereby helping them grow well.

Required materials

- Sandy soil sample
- Clayey soil sample
- Loamy soil sample
- 3 Glass tubes (open at both ends)
- Water
- Beaker to hold the glass tubes
- Glass wool to plug one end of each of the glass tubes

Estimated Experiment Time

Approximately 10 minutes to set up the apparatus and 1-2 days to carry out the observations

Step-By-Step Procedure

- **1.** Plug one end of the glass tubes using glass wool.
- **2.** Pack 3 long glass tubes tightly with dry sandy, clayey and loamy soil; clearly label each tube.
- **3.** Fill the beaker with water.

- **4.** Immerse the tubes vertically in the beaker with the plugged end towards its base.
- **5.** Make note of the levels of the water as it rises in the glass tubes containing each type of soil.

Observation

Initially the water rises fastest in the sand, followed by the loamy soil, and clayey soil. However, after a day or two, the water fails to rise any higher in the tube containing sand, whereas in those containing clay and loam continue to rise until it reaches the top of the tube. The level in the loam may rise and drop but usually stabilizes very close to the water level in the tube containing clayey soil.

Result

Clayey soil has the highest capillarity, followed by loamy and sandy soil.

Practice Question

What is Soil porosity?

Define capillarity?

Laboratory tests should be done in the laboratory

SECOND TERM

Week 1 & 2

Topic: SOIL FERTILITY

Contents:

A. What is Soil Fertility?

Soil fertility is the ability of the soil to apply all the necessary soil nutrients required by the plants for it growth and development in right proportion and absolve-able form.

Soil fertility refers to the ability of a soil related to plants its ease of tillage, fitness of seedbed, and impedance to seedling emergence and root penetration by providing nutrients and suitable soil structure to support the plants/trees growth.

The fertility of the soil can be considered in different ways, depending on land use. In intensively managed agricultural and horticultural systems, and even in forestry, soil fertility can be defined in terms of the value of products produced relevant to inputs used (including economic aspects of nutrient budgeting). Alternatively, the emphasis may be on quality or productivity.

i.e*. The fertility of soil is related to its capacity to produce a product.*

In many natural ecosystems, the value of land use may not be clearly defined, and a different definition of soil fertility may be more suitable.

i.e. The fertility of soil is related to its capacity to support a particular natural community of plants.

Another view might emphasize the concept of sustainability.

i.e. The fertility of a soil is related to its capacity to maintain consistent output with minimal input.

Thus, the concept of soil fertility is most useful when it is used in a specific context. However, in all contexts, soil fertility depends on physical, chemical and biological characteristics.

A fertile soil has the following properties:

- It is rich in nutrients necessary for basic plant nutrition, including nitrogen, phosphorus and potassium
- It contains sufficient minerals (trace elements) for plant nutrition, including boron, chlorine, cobalt, copper, iron, manganese, magnesium, molybdenum, sulfur and zinc.
- It contains soil organic matter that improves soil structure and soil moisture retention.
- Soil pH is in the range 6.0 to 6.8 for most plants but some prefer acid or alkaline conditions.
- Good soil structure, creating well drained soil, but some soils are wetter (as for producing rice) or drier (as for producing plants susceptible to fungi or rot, such as agave).
- A range of microorganisms that support plant growth.
- It often contains large amounts of topsoil.

B. Plant Nutrients

The mineral elements required by plant in large quantity are called macro nutrients, while these required in small quantities are called micro-nutrients e.g zinc.

Macronutrients

*Macronutrients can be broken into two more groups: **Primary** and **Secondary nutrients**.*

*The **Primary nutrients** are **nitrogen (N)**, **phosphorus (P)**, and **potassium (K)**. These major nutrients usually are lacking from the soil first because plants use large amounts for their growth and survival.*

*The **Secondary nutrients** are **calcium (Ca)**, **magnesium (Mg)**, and **sulfur (S)**. There are usually enough of these nutrients in the soil so fertilization is not always needed. Also, large amounts of Calcium and Magnesium are added when lime is applied to acidic soils. Sulfur is usually found in sufficient amounts from the slow decomposition of soil organic matter, an important reason for not throwing out grass clippings and leaves.*

Micronutrients

***Micronutrients** are those elements essential for plant growth which are needed in only very small (micro) quantities. These elements are sometimes called minor elements or trace elements, but use of the term micronutrient is encouraged by the American Society of Agronomy and the Soil Science Society of America. The micronutrients are **boron (B), copper (Cu), iron (Fe), chloride (Cl), manganese (Mn), molybdenum (Mo)** and **zinc (Zn)**. Recycling organic matter such as grass clippings and tree leaves is an excellent way of providing micronutrients (as well as macronutrients) to growing plants.*

C. Ways of Maintaining Soil Fertility

- Use of organic Manure-Green, animal, farmyard and compost manure
- Inorganic fertilizer application
- Bush fallowing
- Cover cropping
- Crop rotation
- Practice mixed cropping
- Alley Cropping

There are various ways of maintaining soil fertility. This includes: Use of organic Manure-Green, animal, farmyard and compost manure, Inorganic fertilizer application, Bush fallowing, Liming, Crop rotation and Alley cropping.

Use of organic Manure-Green, animal, farmyard and compost manure

Manure is organic matter, mostly derived from animal feces except in the case of green manure, which can be used as organic fertilizer in agriculture. Manures contribute to the fertility of the soil by adding organic matter and nutrients, such as nitrogen, that are trapped by bacteria in the soil. Higher organisms then feed on the fungi and bacteria in a chain of life that comprises the soil food web. It is also a

product obtained after decomposition of organic matter like cow dung which replenishes the soil with essential elements and add humus to the soil.

Inorganic Fertilizer Application

A fertilizer (or fertilizer in British English) is any material of natural or synthetic origin (other than liming materials) that is applied to soils or to plant tissues (usually leaves) to supply one or more plant nutrients essential to the growth of plants. Conservative estimates report 30 to 50% of crop yields are attributed to natural or synthetic commercial fertilizer.

Bush fallowing

A type of subsistence agriculture in which land is cultivated for a period of time and then left uncultivated for several years so that its fertility will be restored.

Manuring

Animal manures or farmyard manure (FYM). This is the use of dung, urine and bedding materials (if the animals are kept inside). FYM varies depending on type of animal, their age and condition, food consumed and how the manure is stored.

Characteristics of Farmyard Manure include:

- Low in mineral nutrients but high in organic matter
- Often low in Phosphorus, may need to combine with phosphate fertilizer
- Composition varied according to source

Animal waste. Including offal, dried blood and bone, unused hoof and horn. Often used in temperate climates by gardeners, care must be taken not to spread disease.

Human excreta and faeces and food waste. Latrine waste can be used after two years buried in a pit.

Green manure – Some crops are grown to provide organic matter. Leguminous crops fix nitrogen in the soil. When cut and composted into the soil or cultivated when they are young, they increase the organic matter content, improve soil structure, make phosphorus and certain trace elements available to plants, check erosion and leaching and help control weeds.

Crop rotation

Crop rotation is the practice of growing a series of dissimilar/different types of crops in the same area in sequential seasons.

Crop rotation gives various nutrients to the soil. A traditional element of crop rotation is the replenishment of nitrogen through the use of green manure in sequence with cereals and other crops. Crop rotation also mitigates the build-up of pathogens and

pests that often occurs when one species is continuously cropped, and can also improve soil structure and fertility by alternating deep-rooted and shallow-rooted plants. Crop rotation is one component of polyculture.

Compost Making

Composting is the rotting down of plant and animal remains before it is applied to the soil. The compost should be mixed with available manure and allowed to decompose together for a maximum of two months before applying to the soil. Composting is safer because the heat generated whilst the material breaks down kills diseases and weeds and seeds and the mixture has a better balance of all the soil needs.

Building a compost heap is done in four layers:

Bottom layer – the base is made of stones and sticks to allow drainage and aeration

- Next to bottom – crop residues, usually the bulk ingredient
- Next to top – can be made of animal dung, egg shells and cooking waste
- Top layer – made of soil about 25mm deep with wood ash, nitro chalk and super-phosphate if available.

The layers on top of the base need turning once or twice during the composting period. Compost needs to be kept moist, either by rainwater or watering if necessary, but must not become too wet or it will rot. Too much rain will also leach out the nutrients

Liming

Liming is the application of calcium and magnesium-rich materials to soil in various forms, including marl, chalk, limestone, or hydrated lime. This neutralizes soil acidity and increases activity of soil bacteria.

Mixed Cropping

Different crops are grown in the same field which helps prevent soil erosion and controls the spread of soil-borne plant disease. Leguminous plants will add nitrate to the soil which improves fertility. Deep rooted crops will help improve the soil structure.

Alley Cropping

This is where the crops are grown between rows of trees, some of which can fix nitrogen in the soil. The roots fix nitrogen, then the trees are cut back with the leaves being incorporated into the soil as green manure.

Practice Questions

1. The system in which crops are grown between rows of trees, some of which can fix nitrogen in the soil is called ____
2. _____ is the practice of growing a series of dissimilar/different types of crops in the same area in sequential seasons
3. _____ is the ability of the soil to apply all the necessary soil nutrients required by the plants for it growth and development in right proportion and absolve-able form.
4. The system where different crops are grown in the same field is called ____
5. A _____ is any material of natural or synthetic origin (other than liming materials) that is applied to soils or to plant tissues to supply one or more plant nutrients essential to the growth of plants.

Answers

1. Alley cropping
2. Crop Rotation
3. Soil fertility
4. Mixed Cropping
5. Fertilizer

Week 3

Topic: Feeds and Feeding

Introduction

Animals are fed with different kinds of feeds which vary in composition and uses. These feeds can be broadly classified into two: concentrates and roughages.

Concentrates

These are high energy giving foods with low fiber content and are therefore easily digested. Concentrate maybe high in energy or protein. Concentrates have high nutritive value because they are important sources of proteins, energy, minerals and vitamins.

Classification of Livestock Feed

Animal feeds are grouped into four main categories. These are

- **Carbohydrate concentrate / Energy feed/Basal Energy Feeds** – These are feeds that are high in energy or a starchy foor. E.g. maize, cassava
  Characteristics
  - Crude fiber content less than 18%
  - High in carbohydrates and fat
  - Low in protein and Fiber
  - Highly digestible
  - Low in Minerals
- **Protein Concentrate** – This is a type of feed that is high in protein
  Characteristics
  - Low in carbohydrates and fat
  - Low in fibre and has crude fibre less than 18%
  - Highly digestible
  - Low in minerals
- **Mineral/Vitamins Supplement**
  Characteristics
  - Required in small quantity
  - They supplement basal and protein concentrate
  - They are low in energy, protein and fibre

- High in vitamins and minerals
- They aid resistance to diseases
- They are necessary for growth and development
- They aid food digestion
- They include minerals, vitamins and essential amino acids

- **Roughages**
  Characteristics
  - Low in digestible carbohydrate and protein
  - High in Fiber, crude fiber is 18%
  - They have poor or low digestibility
  - Pasture lands such as grasses and legumes form roughages
  - They exist in different forms such as straw, hay, soilage and silage

  Hay – This refers to the aerial part of young and succulent grass or herbage cut and dried for feeding animals. Its nutritive value is higher than straw.
  Straw – This refers to the aerial part of grass or harvested crops cut and stored for future use. Straw is difficult to digest because the plants are cut after the crops have been harvested. Wet roughages are referred to as silage and soilage.

  1. Silage – This refers to the preservation of green and succulent forage under anaerobic conditions.
  Preparation of silage
  Dig a large pit according to your requirements
  – Cut pasture species at the right stage of maturity before flowering
  – Chop pasture in pieces
  – Line the inside of pit with palm fronds or banana leaves
  – Load the chopped and mixed pasture into pit
  – Compress each layer by rolling heavy substances over it
  – Sprinkle dilute mineral acid after each layer
  – Compress the heap after loading all layers
  – Spread polyethene sheet or banana leaves on the heap
  – Heap soil on the sheet and leave to ferment for 2 – 4 weeks.

  2. Soilage – This refers to process of cutting fresh and succulent grasses and legumes from the field and taking them to animals in their pens. They have high moisture contents and high nutrients. Soilage is also referred to as zero grazing.

Feeding Tools

These are tools used for feeding farm animals.

Feeders – They are also known as feeding troughs. They are containers used for supplying feed to farm animals to eat. Feeders are generally made of galvanized sheets, plastics or wood.

Waterers – These are containers made of metal, plastic or aluminums sheets which are used for holding water for farm animals to drink.

Practice Questions

- How can silage be made?
- Hay or straw, which is more nutritive?
- Spoilage is also referred to as ____

Week 4

Topic: Farming Systems

Introduction

“Farming system” therefore designates a set of agricultural activities organized while preserving land productivity, environmental quality and maintaining desirable level of biological diversity and ecological stability. The emphasis is more on a system rather than on gross output.

In other words, “farming system” is a resource management strategy to achieve economic and sustain agricultural production to meet diverse requirement of the farm household while preserving the resource base and maintaining high environmental quality.

Farming system consist of several enterprises like cropping system, dairying, piggery, poultry, fishery, bee, keeping etc. these enterprises are interrelated. The end product and wastes of one enterprise are used as inputs in others. The waste of dairying like dung, urine, refuse

Types of Farming System

Mixed Farming – This is a system of farming where a farmer raise both crops and animals on the same piece of land. In this system, the farmer may keep different animals for different purposes. For example, he can keep cow for milk production, sheep and goat for meet, poultry for eggs, horses as work animals. He can also plant different types of crops e.g. maize, cowpea, sorghum, rice, yam etc The remains of crops may be used by the farmer to feed his animals while the dung and droppings are in turn used to enrich the soil.

Advantages of Mixed Farming

1. Animal dung and dropping can be added to the soil in the form of manure to improve soil fertility
2. Remains of crops such as maize, rice, or sorghum may be used to feed the farm animals
3. It encourages efficient use of farm labour hence yield is often increased
4. The risk of total loss is reduced as both animals and crops will not fail

5. The sale of farm animals and crops provide additional source of income and prevents financial hardship for th farmer

Disadvantages of Mixed Farming

1. It is capital intensive
2. If the animals are not properly managed, they can break loose and destroy the crops
3. Animals can be expensive to maintain especially in terms of vaccination and treatment of diseases
4. Mixed farming requires great skill and if care is not taken, the farmer may not have enough time for both the animals and the crops

Shifting Cultivation – This is a system of farming in which a farmer abandons a plot of land after planting on it for two or more years. In this system, the farmer has no intention of coming back to the former piece of land.

Advantages of Shifting Cultivation

1. The soil regains lost nutrients without any effort by the farmer
2. Shifting cultivation helps to check the build up of insect pests and diseases

Disadvantages of Shifting Cultivation

1. It can only be practiced in areas where land is abundant and population is low
2. Much time, energy and money are wasted clearing new farm
3. The soil is exposed to danger of erosion and valuable soil nutrients and organic matter are lost during burning

Pastoral Farming – This is a system of farming in which a farmer keeps only livestock. Animals kept may include cattle, sheep, goats. Pastoral farming may be Nomadic herding or Ranching

Nomadic Herding (unsettled) – This is a system of pastoral farming which involves the movement of the herdsman with his animals from place in search of green pasture and water during the dry season.

Advantages of Nomadic Herding – Movement of herds prevent starvation and deathin areas where water and food are relatively scarce

Disadvantages of Nomadic Herding

- Irregular supply of food and water to animals
- Animals are exposed to insect and pest diseases

- Poor quality animals resulting from poor and unplanned breeding
- The dungs and droppings of the animal could have formed an excellent source of manure if they were on a farm land instead it is wasted
- The herdsman an animals are exposed to the risk of being killed

Ranching – this is a settled form of pastoral farming for livestock production. In this system, the pasture is managed properly to provide feed for all the animals all year round.

Advantages of Ranching

- Pasture and water are available all year round
- Low death rate and production of high quality animals
- Low incidence of pest and diseases as a result of good management of the animals and proper breeding.

Disadvantages of Ranching

- Expensive to practice
- Overstocking will reduce the pasture available to each animal which may bring about the death of weaker animals
- Risk of total loss of animals if attacked by disease

Practice Questions

1. _____ designates a set of agricultural activities organized while preserving land productivity, environmental quality and maintaining desirable level of biological diversity and ecological stability.
2. ____ is a settled form of pastoral farming for livestock production. In this system, the pasture is managed properly to provide feed for all the animals all year round.
3. One of the following is not an advantage of Ranching
   a. Pasture and water are available all year round
   b. Low death rate and production of high quality animals
   c. Expensive to practice
   d. Low incidence of pest and diseases
4. ____ is a system of farming in which a farmer abandons a plot of land after planting on it for two or more years.
5. One of these is an advantage of mixed farming
   a. It is capital intensive

b. Animal dung and dropping can be added to the soil in the form of manure to improve soil fertility
c. If the animals are not properly managed, they can break loose and destroy the crops
d. Animals can be expensive to maintain especially in terms of vaccination and treatment of diseases

6. ____ a system of farming in which a farmer keeps only livestock.
7. One of the following is an advantage of Shifting cultivation
   a. It can only be practiced in areas where land is abundant and population is low
   b. Much time, energy and money are wasted clearing new farm
   c. The soil is exposed to danger of erosion and valuable soil nutrients and organic matter are lost during burning
   d. The soil regains lost nutrients without any effort by the farmer

Answers

1. Farming system
2. Ranching
3. C
4. Shifting cultivation
5. B
6. Pastoral farming
7. D

Week 5

Topic: Cropping Systems

Introduction

The various systems used by farmers for crop production include

Mono-cropping (Sole Cropping) – This is the practice of growing one type of crop and harvesting it before planting another on the same piece of land. In this system, annual crops are mostly planted and the same type of crop may not necessarily be planted every year.

Advantages of Mono-cropping

1. It leads to specialization as the farmer becomes an expert in all farming operations involved in the process
2. It makes room for efficient use of farm labour
3. It is easy to mechanize the crop production
4. It is easy to apply fertilizers and control pest and diseases

Disadvantages of Mono-cropping

1. It is a risky system in that if there is an outbreak of an epidemic, the farmer will lose all
2. The crop may be over produced which leads to fall in price
3. The land may be exposed to erosion after harvest
4. If the crop is produced for export, the farmer's economic status will depend on the world market price

Mixed Cropping

This is a system where a farmer grows more than one type of crop on a piece of land at the same time. A farmer may plant maize, yam, groundnut, cowpea, tomato, vegetables and cassava on the same piece of land. It can be practiced in two ways – Interplanting and Intercropping

Interplanting – This is a system in which two crops are planted at different dates and the crop planted first is harvested first and the second one is harvested later. E.g. A maize can be interplanted with Yam, the maize can be harvested first while the yam is harvested later.

Intercropping – The crop planted first is harvested last and the crop planted last is harvested first. E.g. Cowpea can be intercropped with Yam, Cowpea is planted after Yam is planted but Cowpea is harvested first.

Advantages of Mixed Cropping

1. It provides a kind of insurance against crop failure because all crops cannot fail
2. It helps to improve the soil fertility especially if legumes are planted
3. Mixture of crops covers the surface of the soil thereby preventing erosion
4. It helps to reduce the growth and spread of weeds
5. The incidence of pests and diseases are considerably reduced

Disadvantages of Mixed Cropping

1. It is difficult to mechanize the farm
2. It is difficult to control pest and diseases
3. Fertilizer requirements and suitable methods of application are difficult to determine since there are different crops
4. The soil may lose its fertility quicker since many crops are taking nutrient at the same time
5. Serious competition among crops, struggling for water, sunlight, space and nutrients.

Continuous Cropping

This is the practice of growing the same crop on a piece of land year after year.

Advantages of Continuous Cropping

1. It saves time, energy and money as new farmland is not cleared every year
2. It saves land and can be practiced where population is high
3. It is easy to mechanize the farm and apply fertilizer
4. There may be high demand for cultivated crop and this will lead to increased price
5. The system encourages specialization since only two types of crops are planted from year to year

Disadvantages of Continuous Cropping

1. The soil is often exposed to agents of erosion
2. A lot of money is spent on fertilizer needed to replenish the lost nutrients
3. It may lead to total failure if the crop is attacked by disease
4. It encourages the buildup of insect pests and diseases and therefore causes damage with time.

Ley farming – This involves the planting of forage crops and food crops in alternation. The forage crops are legumes, grasses and other plants acceptable to farm animals as food while food crops maybe maize, rice, cowpea etc

Crop Rotation

Crop rotation can be defined as the sequence planned of growing different crops on a piece of land after a year. Crop rotation is practiced where intensive farming systems are used especially where land is scarce. This is the system of cropping in which different crops are planted on a piece of land in such a way that the crops follow themselves in a definite cycle to return nutrients to the the soil.

Advantages of Crop Rotation

- It facilitates efficient and economic use of land.
- It helps to reduce the risk of serious diseases and pests.
- It helps to check water erosion since the soil is not exposed
- It adds nitrogen to the soil if legumes are included
- It saves time, land, energy and money

Disadvantages of Crop Rotation

- If the rotation is poorly planned, it will reduce yield because nutrients are depleted
- Valuable sum of money is spent to purchase fertilizers

An example of a four year crop rotation

Years	Plot A	Plot B	Plot C	Plot D
1st year	Maize	Yam	Beans	Cassava
2nd year	Yam	Beans	Cassava	Maize
3rd year	Beans	Cassava	Maize	Yam
4th year	Cassava	Maize	Yam	Beans

Principles of Crop Rotation

1. Shallow rooted crops should be alternated with deep rooted crops.
2. Crops requiring different cultivation practices should follow one another.
3. Crops that are attacked by similar pests and diseases should not follow one another.

4. A good rotation includes a follow period of at least one year.

Practice Questions

Intercropping, Mono-cropping, mixed cropping, Ley farming, Crop rotation, Continuous cropping, Crop rotation, Mixed cropping, Sole cropping

1. ____ is a system where a farmer grows more than one type of crop on a piece of land at the same time.
2. ____ can be defined as the sequence planned of growing different crops on a piece of land after a year.
3. ____ is the practice of growing the same crop on a piece of land year after year.
4. ___ involves the planting of forage crops and food crops in alternation.
5. In _____ the crop planted first is harvested last and the crop planted last is harvested first
6. ____ is the practice of growing one type of crop and harvesting it before planting another on the same piece of land.

Answers

1. Mixed cropping
2. Crop rotation
3. Continuous cropping
4. Ley farming
5. Intercropping
6. Mono-cropping

Week 6

Topic: Fishery

Introduction

A **fishery** is an entity engaged in raising or harvesting fish. Fish are the most plentiful of all aquatic animals. They are specifically adapted to live all their lives in water and therefore cannot be raised on land without water. The streamlined shape of their bodies help them to move easily in the water and their swim bladder helps them to keep afloat and maintain balance in water.

Classification of Fish

Classification based on habitat – two groups

Fresh water fishes – They live in fresh water (water without salt). Examples of fresh water are ponds, streams, lakes, rivers. Examples of fish are tilapia, carp, trout, mudfish.

Salt water fishes – They live in salt water (water that contains salt). Examples of salt water are lagoons, seas, oceans. Examples of fishes are mackerel, tilapia, shark, rays, eels.

Classification based on body structure – two groups

Bony fishes – They possess bony structure. Examples are tilapia, mudfish, salmon, catfish, perch, herring, and trout. Most of them are found in fresh water

Cartilaginous fishes – They possess soft bones composed of cartilage. Examples are shark, dolphin, rays and dogfish. Most of them are found in salt water.

Other Aquatic Food Organisms of Agricultural Importance

They are subdivided into Vertebrates and Invertebrates.

The Vertebrates include Amphibians e.g Frogs, and Toads, Reptiles e.g. crocodiles, alligators and turtles, Mammals e,g, seals, hippopotamus and dolphins

The Invertebrates include Mollusks e.g Oysters, squids, periwinkles and Octopus, Arthropods e.g Crabs, lobsters, crayfish, shrimps.

Uses of Fish and Fish Products

1. Fish are important source of animal protein, minerals and vitamins, all of which are essential for normal growth of the body
2. The skins of some aquatic organisms such as crocodile, alligators and turtles are used as fine leather for making bags and shoes

3. Fish and its parts maybe crushed and processed into fish meal which is an essential ingredient in animal feeds
4. The shells of oysters and periwinkles are used for decorating walls of some buildings
5. Fish pond provides entertainment for people
6. Fish production provides raw materials for industries engaged in foor protein meals and consequently enhances employment opportunities

Methods of Fishing

The Wounding Equipment – These are equipment designed for injuring big fish in water. They are thrown into the water aiming at the fish and when its wounded, it cannot escape. Example – harpoons, knives and arrows.

Fishing Nets – Nets are made from cotton or nylon thread. They are thrown into water to catch fish. The edges of the nets are lined with stones to enable the net sink to the bottom of the water. The different types of nets are:

Clap Nets – This consists of a pair of fishing nets used for catching fish in rivers, streams, creeks and lakes.

Cast Nets – This method is used commonly by Nigerian Fishermen for catching fish in rivers, lakes, streams, lagoons. The method requires a boat or canoe and the net is cast into the river by the fishermen in the boat.

Gill Nets – This type of net is used in shallow streams or lakes. It involves suspending the net vertically in the water till the next day so that the fish trying to swim across can be trapped.

Fish Traps – Many traps are used by fishermen for catching fish. Examples are funnel entrance traps, triggered traps, hooks, fences and poisoned baits.

Practice Questions

1. A ____ is an entity engaged in raising or harvesting fish

2. Name and explain the 2 classes of fish

3. List 3 fishing equipment's

4. List 3 uses of fish and its products

5. What method of fishing can be used to capture big fishes

Answers

1. Fishery

2. Bony and Cartilaginous fish. Bony fish possess bony structure while cartilaginous fish possess soft bones composed of cartilage.

3. – Fish traps
   – Gill nets
   – Clap nets
   – Fishing nets
   – Cast nets

4. Fish are important source of animal protein, minerals and vitamins, all of which are essential for normal growth of the body
– The skins of some aquatic organisms such as crocodile, alligators and turtles are used as fine leather for making bags and shoes
– Fish and its parts maybe crushed and processed into fish meal which is an essential ingredients in animal feeds
– The shells of oysters and periwinkles are used for decorating walls of some buildings

Week 7

Topic: Farm Animal Husbandry

Introduction

Animal husbandry is the management and care of farm animals by human beings, in which genetic qualities and behavior, considered to be advantageous to humans, are further developed. Animal husbandry is the proper management of farm animals to maximize production. This includes proper housing, feeding, and health care management. Animal husbandry is the agricultural practice of breeding and raising livestock.

Importance of Animal Husbandry

1. To increase the production of milk
2. To increase the production of eggs
3. To increase the production of meat
4. To increase the production of fish
5. To utilize the animal wastes properly

Housing

Ruminants such as cattle, sheep and goats can thrive well on pasture with little or no other feed supplement. They therefore do not require special housing arrangement. However, in intensive system, they may be provided with sheds which are designed to protect them from adverse weather conditions such as severe cold, heat, wind and rain. Sometimes ruminants may be confined to a fenced area called paddocks to provide shade for the animals.

In pig production, there are both intensive and extensive systems. In intensive system, pigs are clean because their movement is restricted. The floor of the house is made of concrete to control internal parasites.
In poultry production, housing is intensive, semi intensive and extensive. In intensive system, two types of housing are used – battery cage and the deep litter system. For battery cage, the poultry birds are confined to cages which may be metal or wood. In deep litter, birds are kept in well ventilated houses made of concrete floor which is then covered with saw dust or wood shavings. The roof is made of iron or asbestos sheet. In semi intensive, birds are kept in fixed solid houses with grass runs attached where the birds can get exercises, sunlight and green feeds. In extensive system,

birds are kept in portable house which are moved at frequent intervals to avoid parasite build up or they may be allowed to move freely to fend for themselves.

Feeding

Farm animals require good feeding for optimum production. All farm animals require carbohydrates and fats for energy, protein for growth and repairs, vitamins and minerals for maintenance of good health. Different feeds are dependent on

1. the purpose for which the animals are kept i.e. meat, egg or milk
2. their digestive system
3. age

Ruminants generally thrive well on pasture and this is because of their complex stomach. They should therefore be provided with a rich pasture of grasses and legumes. Pigs feed on both plant and animal matter because they are omnivores and they feed mainly on cereal grains such as maize, rice ban and protein concentrate. The ultimate aim of any poultry farmer is to raise birds that either for egg or meat. For this reason, birds require a different kind of feed depending on the purpose of production.

1. chicks mash – fed to day old chicks until they are about 8weeks old
2. growers mash – fed to growers from about 8wks to 16wks
3. layers mash – fed to pullets (layers) from 16wks of age until they are sold or culled due to old age or low productivity
4. broiler starter – fed to broilers from 9wks old to 14wks
5. broiler finishe – fed to broilers from 14wks of age until when they are big enough for sale

Rabbits eat any type of green vegetable

Weaning

Young animals e.g. mammal receive milk from their mother and should be allowed to nurse them until they are no longer satisfied wilk breast milk. The animals are then fed independently of their mothers. The process of separating the young animal from the mother so that it can feed independently is called Weaning.

Practice Questions

Explain the kind of feeding for Poultry Birds.

List three importance of Animal husbandry

What is Weaning?

Week 8

Topic: Management Requirement in Animal Husbandry

Introduction

Housing – Ruminants such as cattle, goat and sheep can thrive well on pasture with little or no other feed supplement. They do not require special housing arrangement. In an intensive system, they may be provided with sheds which are designed to protect them from adverse weather condition. In pig production, there are both intensive and extensive systems. In intensive system, pigs are housed well in houses called pens. In this system, pigs are clean because their movement is restricted. The floor is made of concrete to control internal parasite. The roof may be thatched or asbestos sheet.

In other systems, pigs maybe kept in fenced areas with pasture to graze or they may be allowed to freely roam about freely to search for their foods. In poultry production, there are intensive, semi intensive and extensive system of management. In intensive two types of houses are used, the battery cage and the deep litter cage. In battery cages, poultry birds are confined to cages which may be metal or wood. Feeding and drinking troughs are attached to the cages to allow food and water.

In deep litter system, birds are kept in well ventilated concrete floor houses covered with saw dust. The roof is made of iron or asbestos sheet. The walls and roofs are covered with wire gauze to prevent predators.

In semi-intensive system, birds are kept in fixed solid houses with grass runs attached where birds can get exercises, sunlight and green feeds.

In extensive system, birds may be kept in portable houses which are moved at frequent intervals to avoid parasite build up or they may be allowed to move freely to fend for themselves.

Rabbits require well ventilated and properly lighted houses to provide protection from cold, heat and rain. The roof maybe covered with corrugated iron or asbestos sheets.

Feeding – Farm animals require feeding for optimum production. All farm animals require carbohydrates, fats and oil, energy and protein.

Ruminants generally can thrive well on pasture. This is because of their complex stomach and the presence of microorganisms in their rumen which can digest grasses. They would therefore be provided with rich pasture of grasses and legumes. Pasture should be supplemented with concentrates as well as salt licks.

Pigs feed on both plant and animal matter because they are omnivores. They feed mainly on cereal grains such as maize, rice bran and protein concentrates such as ground nut and mineral supplements like bone meal, blood meal and oyster.

Birds are raised for egg or meat production. Birds require different types of feeds depending on the purpose of production

- Chicks mash – fed to day old chicks until they are about 8weeks old
- Growers mash – fed to growers from about 8weeks to 16weeks
- Layers mash – fed to pullets (layers) from 16weeks to the age at which they are sold
- Broiler starter – fed to broilers from 9weeks to 14weeks
- Broiler finisher – fed to broilers from 14weeks until they are big enough to be sold

Rabbits feed almost on any type of green vegetable. Legumes of high quality such as groundnut, stylosanthes, cowpea, mucuna are commonly used for feeding rabbits. The above feeds should be supplemented with cereal, grains, potato leaves, ripe mangoes, carrot peels and mineral salt. Rabbits require regular supply of clean water.

Weaning – Young animals receiving milk from their mothers should allowed to be nursed until when they are no longer satisfied with breast feeding.

Hygiene – All farm animals should be properly provided with clean and well ventilated housing as well as dry bedding. They should be vaccinated at regular intervals against certain diseases during their stages of growth. Feed additives should be added to their feed to protect them. Examples are drugs, antibiotics and vitamins. Sick animals should be separated from the healthy ones to prevent spread of diseases.

Rearing of Farm Animals to maturity – Rearing is the sum total of all the processes and activities involved in bringing farm animals to maturity. In includes the provision of suitable housing, feeding and health care. After birth, farm animals like ruminant pigs and rabbits are allowed to feed on the milk from their mother's mammary glands and then they are weaned. After weaning, they are separated from the dam or doe and introduced to solid feeding. They are housed separately from the adults. Ruminants can feed on roughages on their own while pigs and rabbits are provided with their feeds. Routine livestock management practices like dehorning, tattooing, branding, castration should be done when necessary.

In poultry production, pullets that will eggs are kept in deep litter houses after brooding. They are fed with balanced diet containing about 18% protein until they start to lay eggs at about 16 – 20 weeks. Layers should be culled when they are too

old or when production is low. Broilers are reared in deep litter houses and they are first fed with broiler starter then broiler finisher. Properly managed broilers should weigh 2.5 to 3kg between 9 and 12 weeks of age. Cattle grow to market size from 12 – 20 months with live weight of 200 – 360kg, goat 10 – 14months with live weight of 40 – 60kg, pigs 7 months with weight of 60 – 70 kg, sheep 8 – 12 months with live weight of 35 – 45kg.

Marketing of Livestock – In Nigeria, the northern part supplies the major quantity of meat which is consumed in the south. The producers sell the animals to the middlemen who in turn sell them to customers in the south. Live animals are slaughtered and sold fresh for consumption.

ASSESSMENT

-What are the management requirement in Animal Husbandry and can you explain each of them?

Week 9

Topic: Soil Conservation

Introduction

Conservation can be defined as a wisely planned use of any natural resources in order to avoid exploitation, destruction and neglect. It aims at providing maximum returns from a resource by avoiding waste and depletion through restoration and improvement at all times

Soil Conservation refers to the intelligent use of soil so that enough plant nutrients are available to plants for growth and production at all times. It prevents or reduces loss of plant nutrients from soil erosion, excessive leaching and other poor land management practices.

Importance of Soil Conservation

1. It brings about the wise use of natural resources which will help protect the natural environment from indiscriminate destruction
2. It helps to prevent soil erosion
3. It helps to support the growth of valuable wood for building and furniture
4. Soil is important for farming activities
5. Soil supports wild life
6. Buildings are erected in the soil
7. Soil is the home of microorganisms which help to decompose organic matter
8. Mineral resources are obtained in the soil

Methods of Conserving Soil

1. Prevention of bush burning which will expose the soil to erosion
2. Adoption of better farming practices like crop rotation which will replenish the soil nutrients, and prevent leaching
3. Avoidance of overgrazing which may expose the soil to erosion
4. Prevention of deforestation and indiscriminate felling of trees which may expose the soil to erosion
5. Avoidance of clean clearing
6. Avoidance of land pollution which may kill soil microorganisms

Ways in Which Plant Nutrients Are Lost in the Soil

1. Soil erosion – This is the gradual washing away of the top soil by agents of denudation such as water, wind and ice. The extent of the erosion is determined by the intensity and duration of rainfall, slope of the land, degree of exposure and the structure/texture of the soil
   Water Erosion – This is the detachment and transportation of soil particles by rain water, melting or melted ice. It can be divided into three; sheet erosion, rill erosion, gully erosion.
   Wind Erosion – This type of erosion is common in arid lands where there is little or no rainfall. Soil particles are loosely arranged so that it is possible for wind to remove the particles which are then carried into greater heights for hundreds of kilometers.
   Methods of Controlling Water Erosion
   - Establishment of vegetation cover such as trees, shrubs, cover crops and grasses
   - Avoidance of Bush burning which destroys the dense vegetation and leaves which cover the soil surface
   - Avoidance of Excessive grazing
   - Terracing is the leveling of a hilly or sloppy land in the form of step
   - Construction of water channels along a steep slope so that running water will not affect the slope
   - Ridges may be constructed across the slope to reduce the speed of run off
   - Strip cropping involves dividing the land into strips with the result that some strips are uncultivated between the cultivated ones.
2. **Plant Uptake** – Different crops require different nutrients for growth and development. These nutrients are usually supplied by the soil. If planting continues on the same piece of land without replenishing the lost nutrients, it will result in poor growth and low yield
3. **Leaching** – This is the removal of plant nutrients by percolation and infiltration of rain as it carries nutrients to a depth beyond the reach of plant roots. Leaching can be reduced by planting cover crops, addition of organic matter
4. Burning – This is normally done to save labor and to ease farm operations. Burning produces ash which contains plant food and therefore increases the fertility of the soil. It increases the humus content and organic matter of the

soil. However, burning exposes, the soil to agents of erosion and it also kills soil microorganisms.

Human Activities that lead to loss of Soil Fertility

1. **Bush burning** – Setting of fire on the bush to clear out the vegetation. Bush burning destroys the organic matter of the soil, soil organisms and exposes soil to erosion
2. **Tillage** – This is the process of working up and breaking the soil to loosen it for the penetration of plant root. Tillage encourages leaching.
3. **Over-grazing** – When more animals than the carrying capacity of a rangeland are put there. This leads to poor growth and low regenerative capacity of the soil
4. **Fertilizer application** – The application of chemical substances to the soil to improve its fertility. Excessive application can cause soil acidity
5. Deforestation – This is the destruction of the forest by humans. Deforestation reduces the organic matter content of the soil.

Problems of Soil Conservation

1. Soil erosion
2. Land pollution
3. Overgrazing caused by animals
4. Indiscriminate bush burning and felling of trees
5. Adoption of poor farming practices
6. Problem of oil spillage which pollutes the rivers

Practice Questions

Conservation, Soil erosion, Leaching, Soil Conversation, Deforestation, Tillage, Bush Burning

Use the options above to answer the following options

1. When animals overgraze the soil, ____ is lost.

2. ____ is the destruction of forest by humans.

3. ____ is the removal of plant nutrients by percolation and infiltration of rain as it carries nutrients to a depth beyond the reach of plant roots.

4. _____ is the gradual washing away of the top soil by agents of denudation such as water, wind and ice.

5. _____ is the process of working up and breaking the soil to loosen it for the penetration of plant root.

Answers

1. Soil fertility
2. Deforestation
3. Leaching
4. Soil erosion
5. Tillage

Week 10

Topic: Farm

Animal Parasites

Introduction

A parasite is an organism which live in and derive all its nourishment such as food, shelter and protection from another organism called the host giving back nothing in return. Only the parasites derives benefit from the association while the host suffers inconveniences or it may be injured or harmed in the process. A parasite is an organism living in or on another organism called the host. The host is usually bigger and stronger than the parasite. The parasite derives benefits from the host while the host is harmed or injured during the association. Endoparasite are parasites that live inside the host e.g. tapeworm, liver fluke while Ectoparasite lives outside the host e.g ticks, lice, mites.

Classification of Farm Animal Parasite

Classification is into two – endoparasites and ectoparasites.

Endoparasite

These are parasites that live inside the body of farm animals and obtain food, shelter and protection. They live mostly in the intestine, bile duct, muscle or heart of farm animals. Examples are tape worm, liver fluke, bladder worm, round worm.

Example of Endoparasite

Liver Fluke – This is a flattened, leaf like organism. It is brown in colour about 2cm long. An endo parasite of farm animals like cattle, sheep and goat. Farm animals are primary host while snail is a secondary host

Life Cycle

Fertilized eggs are passed out with faces. During favorable conditions, the egg hatch into small ciliated larvae called miracidia. Each miracidium swims in water and its usually attracted to water snail which is the secondary host. It enters into the body of the snail during which it loses its cilia and changes to a sporocyst and reproduces asexually to give new larvae called rediae. The redial comes out of the sporocyst and goes to the digestive gland where it develops into a minute worm called cercariae. This leaves the body of the snail and swims about in water until it finds a suitable host when the animal drinks contaminated water.

How to prevent Liver fluke from completing its life cycle

- Eliminate all snails which are their secondary host
- Provide clear, uninfected water and feed for animals

– Control weeds along river side

Economic Importance of Liver fluke

– It causes a disease called bilharzia
– It leads to loss of blood and it also causes anemia
– It obstructs bile duct
– It causes liver rot
– It leads to digestive disturbance

Control

– Drain pasture properly
– Use lime on pasture
– Introduce ducks and geese to eat up the snail

Ectoparasite

These are parasites found outside the body of farm animals. They cling to the skin of farm animals and suck their blood. Examples of ectoparasites are ticks, lice, mites and fleas.

Ticks – Body is divided into 2 – head and abdomen. It has four pairs of tough leathery integument and possesses a toothed hypostone. Life cycle is from Egg (a mature female tick after sucking blood from its host drops down and lays her eggs) – larva (the egg hatches into larvae with six legs. The larva crawls into the grass and attaches itself to the skin of the animal) – Nymph (The larva moults into a nymph with eight legs and attaches itself to a second host – Adult (The nymph finally moults into an adult tick which crawls into the the grass and attaches itself onto a third host).

Economic Importance

– They cause great annoyance and irritation to their host
– Damage of the skin
– Loss of blood and weight
– They cause injuries and wounds on their host
– They act as vectors of diseases

Control

– Animals should be kept in a clean surrounding
– Animals should be dipped in insecticide solutions regularly
– Rotational grazing should be practiced
– Ticks should be handpicked off animals
– Animal bedding should be changed regularly

Effects of Parasites on Farm Animals

1. Loss of appetite

2. Anemia
3. Loss of condition and weight
4. Diarrhea
5. Low production
6. Coughing
7. Skin lesions
8. Fever
9. Thriftiness
10. Breathing difficulty

Methods of Preventing and Controlling Farm Animals

1. Farm animals should be vaccinated regularly so as to be able to resist the invasion of diseases
2. All sick animals should be isolated and not allowed to mix with healthy ones
3. Disease resistant stocks should be bred
4. New stock introduced into the farm should be quarantined
5. Good and proper hygiene measures should be put in place
6. Animals should be fed balanced diet
7. Regular deworming
8. Maintain healthy stock
9. Washing and disinfection of farm houses regularly
10. Good sanitation measures
11. Breaking of their life cycle
12. Regular spraying and dipping of farm animals
13. Faeces should be regularly removed to avoid feed and water contamination

Practice Questions

1. ____ live inside the body of farm animals and obtain food, shelter and protection

2. The ____ is an organism which live in and derive all its nourishment such as food, shelter and protection from another organism called the host giving back nothing in return

3. List 4 effects of parasites on farm animals

4. One of the following is an endoparasite
a. ticks
b. lice
c. mites
d. liver fluke

5. One of the following is not an endo parasite
a. liver fluke
b. round worm
c. tick
d. tape worm

Answers

1. Endoparasite
2. Parasite
3. Loss of appetite, Anemia, Loss of condition and weight, Diarrhea, Low production, Coughing,
   Skin lesions
4. D
5. C

Week 11

Topic: Disease Causing Organisms

Introduction

Disease causing organisms are living organisms which are capable of causing disease in other living organisms. They are generally known as pathogens.

Diseases can be defined as the absence of normal health due to infection, nutritional deficiency and imbalance, hereditary and functional disorders as well as injuries. Diseases can also be described as any disturbance in the normal life or body function of an organism which may affect a particular organ or the whole body and sometimes leads to reduced growth, production or premature death.

Types of Diseases

1. Peracute disease – one that lasts only for a short time with no noticeable symptoms
2. Acute disease – This shows noticeable symptoms and manifests maximum causality
3. Sub – acute disease – This lasts more than acute with one or more symptoms of the disease
4. Chronic disease – This is the type that keeps on longer causing loss of growth and production but no resulting death of the animal

Causes of Disease

- Virus
- Bacteria
- Fungi
- Protozoa
- Malnutrition or metabolic disorder

Signs of disease in farm animals

1. unthriftiness
2. Lack of appetite
3. Dullness
4. Rough coat

5. Ruffled feather in poultry
6. Wasting
7. Diarrhea or water stool
8. Premature abortion
9. Increased mortality rate
10. Discharge from mouth and eyes
11. Decrease in activities
12. Loss of weight
13. Blood stains in faeces
14. Reduced production

Groups of Disease Causing Organisms

Fungal Disease

Aspergilosis
Animals affected – cattle, poultry birds, pigs and sheep
Caused by Aspergillus fumigatus
Symptoms
– Loss of weight
– High body temperature
– Loss of appetite
– Difficulty in Breathing
– Skin irritation
– Respiratory disorder
Method of Transmission
Via contaminated (moldy) feed, moldy litter and contaminated incubator
Control –
– Regular disinfection of pens and equipment
– Avoid moldy feed
– Good sanitation
– Spry with fungicides

Protozoan Disease

Trypanosomiasis

Animals affected – Resistant breeds of cattle are N'Dama, Muturu and Keteku while susceptible breeds are White Fulani, Red Bororo, Kuri Chad, Sokoto Gudali and Boran.

Causal Organism
It is caused by a protozoan called *Trypanosoma spp.*
Symptoms are
– Rise in body temperature
– dullness in appearance
– anemia
– sleepiness
– weakness
– dry coat
– nervous disorder
– loss of appetite and weight
Method of Transmission
Spread by blood sucking tsetse fly.
Control
i. Clearing of bush around farm to remove the fly's habitat
ii. Biological control of insect vectors
iii. Treatment of infected animals with drugs such as antimosan, trypanosomide
iv. Eradication of wild species or animal carriers in and around pasture

Viral Disease

Foot and Mouth Disease
Animals affected are – cattle, sheep and goat
Causal Organism – Virus
Symptoms
– Formation of blisters on the mucous membrane of the mouth and skin, hoofs
– Salivation
– Loss of weight
– Lameness
– Inflammation of teats and udder
Method of Transmission – Via infected materials like urine, faeces and milk.
Mechanical means by farmers
Control
Isolation of infected animals. Burning and burying of contaminated materials. Regular vaccination

Bacterial Disease

Anthrax – affects cattle, sheep, goat and pigs.
Causal organism – *Bacillus anthraxis*
Symptoms
– high fever
– Depression
– Blood oozes from nose, mouth and anus

– Loss of weight
– Lack of appetite
– Staggering and sudden death
_ Method of transmission – via contaminated feed, water, equipment and infected animals
Control
– Regular Vaccination
– Proper Sanitation
– Isolation of infected Animals

Practice Questions

1. Explain the types of diseases

2. Mention 3 causes of diseases

3. List symptoms of diseases in Animals

Answers

1. Peracute disease – one that lasts only for a short time with no noticeable symptoms
Acute disease – This shows noticeable symptoms and manifests maximum causality
Sub – acute disease – This lasts more than acute with one or more symptoms of the disease
Chronic disease – This is the type that keeps on longer causing loss of growth and production but no resulting death of the animal

2. Bacteria
Fungi
Protozoa
Malnutrition or metabolic disorder
Virus

3. Unthriftiness
Lack of appetite
Dullness
Rough coat
Ruffled feather in poultry
Wasting
Diarrhea or water stool
Premature abortion

Increased mortality rate
Discharge from mouth and eyes

THIRD TERM NOTES ON AGRICULTURE

Week 1 & 2

Topic: Storage of Farm Produce

Introduction

After harvesting, farm products are subject to attack by insect pests and micro-organisms if they are not properly kept. To reduce the incidence of pests and to avoid spoilage, agricultural products are kept in special places either for long or short periods depending on when they are sent to the market or used as input during the next planting season. The process of effectively keeping away pests and microorganisms from harvested agricultural products to avoid spoilage is called storage.

Objectives of Storage

1. To reduce to the barest minimum food spoilage caused by pests and microorganisms so that enough food will be available for consumption all year round.
2. To maintain or preserve the quality of food. Poor quality products will lead to a reduction in the price of such products.
3. To make food available at places where such food is not produced with good storage facilities, food produced in one locality can be transported to another place.
4. To ensure that some food crops are available throughout the year.
5. To preserve planting materials for the next planting season

Methods of Storage

In order to keep farm, produce in good condition after harvesting, a number of methods are employed to store the farm produce. The unavailability of good storage facilities to peasant farmers make it difficult for the farmers to keep large quantities of farm produce during the harvesting period of each cropping season. They are therefore forced to dispose off their produce as fast as the produce is harvested. The following are methods of storage

1. **Barns –** This is the most common and one of the oldest methods of storing yams and cocoyam's. The barn consists of big woods placed horizontally and small wooden holes placed vertically and close to themselves. The roof maybe covered with grasses or palm fronds. Yam tubers are tied to the vertical pole from the base to the top by means of ropes or they may be stored in heaps.

2. **Rhumbas** – These are storage structures designed and constructed locally for storing threshed grains such as maize, millet, and sorghum in the Northern part of the country. Rhumbas are cylindrical in shape and have their walls made of mud or dry grass and the comical roofs are made of thatch.
3. **Cribs** – These are storage facilities constructed from local materials and are used for storing maize in the Southern Nigeria. Maize cobs are harvested when they are still wet and stored in the cribs. Cribs maybe rectangles or cylindrical in shape and are poorly constructed because in most cases cobs are exposed to attack by insects and rodents.
4. **Silos** – These are storage facilities which are used for storing grains in bulk after shelling, some silos have the capacity for holding over 50 tons of grains. Silo may be rectangular or cylindrical in shape. Most silos are air tight with nitrogen which helps to reduce the amount of oxygen in the containers and consequently reduces the chances of survival of insects and spoilage by microorganisms.
5. **Bagging** – Sometimes the movement of grains from one place to another will demand grains be put in reasonable quantities in bags. The bags are kept in stores or warehouses. The bags are kept in stores or warehouses. This method is called bagging. Such bags are lined with leaves to keep them fresh. The advantage of bagging is that it makes transportation easier.
6. **Canning** – This is the method by which agricultural products are preserved in airtight containers e.g. fish, meat, fruit juices, milk etc. The containers are first cleaned and sterilized by heating them i boiling water. Then the product is heated to temperature high enough to destroy all microorganisms.
7. **Cold stores** – Low temperature do not favor the activities of micro -organisms and storage pasta which cause food spoilage. The refrigerators and freezers are built to store food at a very low temperature to prevent activities of spoilage organisms.

Factors Affecting Storage of Farm Produce

1. **Quality of Agricultural Produce** – Poor quality products do not store well even if the best method pf storage is used.
2. **Temperature** – Different products are stored with different temperature range. If a product is stored below or above the average temperature, the quality of the product will deteriorate which may eventually have led to spoilage.
3. **Moisture content** – All agricultural products contain a percentage of moisture which differ in various products. Some products require reduced moisture content before they can store well. e.g. grains. The higher the moisture content

of an agricultural product, the more liable it is to attack by the spoilage micro-organisms

4. **Relative Humidity** – This is defined as the amount of water or moisture in the atmosphere. The amount of water in the environment can affect the storage of farm produce because it determines the types of product to be stored in the environment. Environment with relatively low humidity will encourage high evaporation of water from the produce to the atmosphere.

Practice Questions

- _____ is used to store maize
- _____ is the method by which agricultural products are preserved in airtight containers
- Barn is used for storing ____
- ____ are storage facilities which are used for storing grains in bulk after shelling
- _____ is built to store food at a very low temperature

Answers

- Crib
- Canning
- Yams, Cocoyam's
- Silos
- Freezer, Refrigerator

Week 3

Topic: Crop Plant Diseases

Introduction

Generally, disease can be defined as an infection or unfavorable condition caused by living organisms (pathogens) or non-living things expressed in characteristic conditions known as symptoms and harmful to the organism or its parts or it may simply reduce the market value.

Plant Disease

A plant disease may be defined as a departure or deviation of the plant from the normal state of health, presenting marked symptoms or outward visible signs. In other words, disease is an unfavorable condition caused either by the pathogens present within a living organism or by nutritional deficiency. It usually results in physiological and anatomical abnormalities expressed in characteristic symptoms. The harmful effects of a disease to the plant or to any its parts and products generally result in the reduction of the economic value of the plant.

Causes of Diseases

The primary causes of diseases can be classified into two groups, pathogens and pathological factors.

1. **Pathogens** – Theses are disease inducing living organisms or agents which pass through a regular cycle of development and reproduction. Examples are – Viruses, Bacteria, Fungi and Nematodes.
2. **Physiological Factors** – They may be physical, chemical or environmental. Many of them are essential for normal growth of plants, but when they are deficient or present in excess, they cause diseases. These are factors which are essential for normal growth and development of plants. Excess or deficiency may cause diseases. Examples are
   a – Nutritional deficiency
   b – Heat
   c – Inorganic salts
   d – Water

Classification of Plants disease

The disease spreads through seed, soil, or through wind. Plant disease may be grouped as

1. Seed borne

2. Soil borne
3. Air borne

NAME OF DISEASE	CAUSAL ORGANISM	METHOD OF TRANSMISSION	SYMPTOMS AND ECONOMIC IMPORTANCE	PREVENTION AND CONTROL MEASURES
Maize Smut	Fungus *Ustilago maydis*	Airborne Fungus spores deposited on fruits	– Reduced yield – Galls on ears, leaves and tarsels which later turn black	– Destroy diseased plant – Use resistant varieties – Seed treatment
Rice Blight	Fungus *Piricularia oryzae*	Airborne spores on leaves	– Small longitudinal red spots on leaves which turn grey or brown – Reduced yield	– Use clean seeds – Avoid heavy use of nitrogen fertilization – Use resistant varieties
Maize rust	Fungus *Puccinia polysora*	Airborne spores on leaves	– Red spots on leaves – Reduced yield – Death of crop	– Early planting – Crop rotation – Use resistant varieties
Rosette disease of Groundnut	Virus	Piercing and sucking insects transmit disease (Aphid)	– Yellow leaves with mosaic mottling – Stunted plant with curled leaves – Wilting and death of plants	– Early planting – Crop rotation – Use insecticides – Uproot and burn infected plants

Cassava Mosaic	Virus	– Through piercing and sucking insect (white fly) – Infected plant cuttings	– Mottling of leaves – Distortion of leaves and stems – Vein clearing – Stunted growth – Yellowish pale areas on leaves	– Uproot and burn infected plants – Use resistant varieties – Use disease free stem cuttings – Farm sanitation – Spray with insecticides
Cocoa black pod disease	Fungus *Phytophthora palmivora*	– Rain splash – Insect	– Brown spots on pod – Rottening of pods – Low yield	– Remove and destroy infected pods – Regular weeding – Avoid overcrowding – Spray with fungicides
Coffee leaf rust	Fungus	– By wind – By rain splash	– Yellow or brown spots on leaves – Reduction in yield – Orange powdery mass on leaves – Dropping of leaves	– Plant seeds from healthy plants – Use resistant varieties – Spray with copper fungicides
Root knot of tomato	Nematode	Nematodes in soil	– Knotting or galling of roots – Retarded growth and death of plant	– Soil sterilization – Crop rotation

			– Reduction in yield	– Use resistant varieties – Uproot and burn infected crops
Onion twister disease	Fungus	– Infected soil – Water splash – Infected bulb	– Twisting of leaves – Grey patches on leaves – Reduction in yield – Death of plant	– Crop rotation – Use resistant varieties – Early planting – Spray with fungicides

Practice Questions

Define Plant Disease

List 4 Physiological factors that causes Diseases

Week 4

Topic: Development of Agriculture in Nigeria

The Historical development of Agriculture

The early man as a hunter, in the quest of securing food, the early man moved from place to place hunting and gathering wild animals and fruits.
Around 1200Bc, the early man discovered that discarded seeds they have eaten grew around were they were gathered from this period, he learns to secure food by planting desirable seed locally. Also he found out that some young animals hunted and taken to their camp mate with the female kinds and produce offspring then he decided to spare some of the heal of their animals and rare them.

Instead of the hoes and machetes made out of sticks and stones and plough drawn by animals and hoes and machete are now constructed with metals and woods, plough are operated manually

Agriculture is based on the cultivation of domesticated plants and the keeping of domestic animals. Domestication, then, is a key social practice that defines agriculture, but agriculture is more than domestication. In the same way, domestication is more than an economic process of managing the reproduction of plants and animals and changing their characteristics through selective breeding.

Agriculture began when man started to exist on earth. The early men lived by gathering wild fruit and hunting wild animals because they are wanderers. The type and quantity available at that time was irregular and uncertain and was subject to the prevailing weather and luck.

They continued with this nomadic life until large population of the families and properties necessitated the building of huts, so they changed from their nomadic way of life to a more settled life.

Agriculture and its practices i.e. farming started by accident about 12,000 years ago, when the early men discovered that seed and other propagative parts of remains of their food germinate, grow to maturity and reproduce their kinds, they also discovered that certain animals were friendly, so they began to domesticate them. Moreover, crops and animals from different parts spread to other countries by the early missionaries, explorers and traders.

Agriculture has undergone significant developments since the time of the earliest cultivation. The Fertile Crescent of Western Asia, Egypt and India were sites of the earliest planned sowing and harvesting of plants that had previously been gathered in the wild. Independent development of agriculture occurred in northern and southern China, Africa's Sahel, New Guinea, parts of India and several regions of

America. Agricultural techniques such as irrigation, crop rotation, the application of fertilizers were developed soon after the Neolithic Revolution but have made significant strides in the past 200 years. The Haber-Bosch method for synthesizing ammonium nitrate represented a major breakthrough and allowed crop yields to overcome previous constraints.

In the past century, agriculture in the developed nations, and to a lesser extent in the developing world, has been characterized by enhanced productivity, the replacement of human labor by synthetic fertilizers and pesticides, selective breeding, and mechanization. The recent history of agriculture has been closely tied with a range of political issues including water pollution, biofuels, genetically modified organisms, tariffs, and farm subsidies.

The scale below provides an indication of how recent the phenomenon of farming started:

- The world was formed ca 4, 600 million years ago.
- Eukaryotic life forms: ca. 1,000 million years ago
- First hominid life forms 4 million years ago (hunter gatherers)
- First human farmers: about 12,000 years ago.
- Global Agricultural Evolution: 1650 – 1850 AD
- Modern Agricultural Evolution: 1950 – present

The progress of farming in Medieval Europe

- Improvements of the plough
- Horses replace oxen
- New crop rotations
- Feeding for the winter
- New sources of power
- Climate change

Global Agricultural Evolution 1650- 1850

Characterized by:

- New rotations with leguminous and root crops
- Scientific method employed in agricultural research
- Use of fossil fuels, increased yields and labour productivity

- Invention of mechanized farm equipment
- Beginning of food-processing industries
- Transfer of crops and livestock from lands of origin as part of the era of European exploration

Summary of Agricultural Development

1. History indicates that the early men were hunters and fruit gatherers during the Stone Age. The ruminants of these fruits that were thrown away later germinated. The early men later began to plant some of the fruits and that was how agriculture started. With an increase in population, fruits later became scarce and men had to walk long distance away from their huts to get food or fruits. Therefore, the early men made the first attempt of planting crops and domestication of animal to be assured of what to eat.
2. The early men became subsistence farmers and their first farming practice was shifting cultivation.
3. The practice of shifting cultivation gradually gave way to land rotation or bush fallowing. This was as a result of population pressure.
4. In the later years, due to decline in soil fertility and increase in population, farmers then employed crop relation practices. The method helped in boosting agricultural production and maintained soil fertility.
5. Lastly, commercial farming evolved. This led to production of farm produce on a large scale, and machines were used to carry out various agricultural activities. The agricultural systems that were employed ensured the use of land more intensively and scientifically. It is worthy to note that improvement on agriculture has been achieved through the help of agricultural extension services and education in which the roles of science and technology in mechanizing farm
operations are substantive.

Agriculture has passed through some development stages like every other sector of the economy.

In Nigeria

The colonial masters (British) forced the peasant farmers to engage in cash production such as groundnuts, cocoa, palm produce, cotton etc. The exchange cash crops with exotic goods like radio, cars, bicycles etc. This is helped to improve the living standard of Nigerians.

The government developed agriculture by the following way

- Establishment of research station
- Establishment of experimental farms
- Establishment of agricultural department in Government organizations

Development in modern times

In modern development time Agriculture was abandoned because of oil boom. The government took bold steps to re-emphasize agriculture and reduce importation of food. This was done in the following ways

- **Operation Feed the Nation** in (OFN) 1976 by gen Olusegun Obasanjo to increase food production between 1976 and 1979

Objectives

1. To facilitate Agricultural development in all parts of the country
2. To Popularize Agriculture
3. To provide food for all Nigerians
4. To increase food production

- **Green Revolution**: Launched by Shehu Shagari in 1979 and 1983 by the Federal Government

Objectives

1. To produce cash crops for export purposes
2. To produce abundant food crops for local consumption
3. To encourager large scale farming

- **National Agricultural Insurance Scheme**: The programme was also set up by the federal Government of Nigeria.

Objectives

1. To provide security against risks, uncertainties and hazards in Agriculture for farmers

- **Agricultural Development Programme (ADP)**: This project started in 1975.

Objectives

- To develop small scale ago-based industries
- To provide rural infrastructures that would facilitate food production
- To construct infrastructures, such as feeder roads and earth dams

- To bring Agricultural services closer to the farmers in rural area

The Role of Science and Technology

Science and Technology has played an important role in the development of agriculture in many countries. These roles are:

1. **Implements and Machinery** – Science and technology has aided the development of implements and machineries such as tractor, harrower, milking machines, seed planters, shellers, planters ro replace crude tools such as hoe, cutlass, rake and shovel. These implements help farm operations to be easier and faster.
2. **Pests and Disease control** – Through the aid of Science and Technology, chemicals like insecticides, pesticides, avicides, fungicides, nematicides and fumigants have been developed to combat against problems caused by pastes and other disease causing pathogens such as bacteria, virus et.c
3. **Animal and Pland Breeding** – Various breeds of animals and varieties of plants have been developed through the application of genetics and cross breeding. As a result of these, plants with exceptional characters are now developed. Plants and animals now exhibit early maturity, high yield resistance to pest and diseases and other traits specifically required by the farmer.
4. **Animal Nutrition** – Feeds have been formulated to meet the nutritional demands of animals in order to enhance rapid growth and maturity.
5. **Transport Network** – The transport network has been developed through the construction of roads, railways, waterways, ship and airways. All these transportation channels have aided the movement of farm produce from rural to urban areas at a great speed including exportation.
6. **Processing Machines** – Science has helped to develop special machines like incubators, milking machines, grinders, millers, shellers which have made the processing of food easier and faster within a short period.
7. **Weather and Climate** – With the help of Science and Technology, Farmers have been able to understand the weather and climatic condition of their area, and by so doing, helps them to understand the type of crop to be grown at a particular season in a particular area.
8. **Development of Fertilizer** – The development and application of fertilizers have helped to increase crop yields. Through the help of science and technology, farmers have been able to know and determine soil fertility level before planting. They are also able to determine nutrient deficiencies, organic matter content, water holding capacity e.t.c and the type of crop that can do well on a particular soil

9. **Farm Building and Structure** – Technology has helped the farmer in designing and constructing farm houses, farm structures like poultry houses, pig pens and cattle pens for livestock animals. Farm storage structures like barns and silos are equally built.
10. **Development of Irrigation Practices** – Science and Technology has also helped to develop irrigation practices in which water is applied to the soil artificially, especially during the dry season.
11. **Provision of Storage Facilities** – Science and Technology has also develop storage facilities for the preservation of harvested products. e.g. Silos
12. **Development of Farm Management System** – Improved farm management systems have also been developed with the aid of science and technology e.g crop rotation and mixed farming.

Practice Question

List and explain 5 roles of science and technology to Agriculture

Week 5

Topic: Employment Opportunities in Agriculture

Introduction

One of the problems facing most young people is that of choosing a career. It is generally believed by most people especially in the developing countries that agriculture simply means farming. Agricultural science is one of the subject which prepares an individual to earn living either on a regular paid job or through self-employment.

Steps in Choosing a Career in Agriculture

1. The nature of the occupation
2. The necessary qualities, interests and aptitudes needed for success in the occupation
3. Education and training required
4. The opportunities for securing employment
5. Job satisfaction
6. Financial reward
7. Benefits of such career in the society

Field of Study in Agriculture

Animal Science

- Animal production and management
- Animal nutrition
- Animal health and veterinary
- Animal physiology
- Animal breeding and genetics
- Feed composition and utilization
- Forage production and management

Crop Science

- Crop production
- Crop breeding

- Crop protection
- Weed science
- Seed production
- Horticulture
- Crop physiology and nutrition

Soil Science

- Soil physics
- Soil chemistry
- Soil testing
- Soil microbiology
- Soil survey and classification
- Farm surveying and design
- Pedology

Agricultural engineering

- Tractor repairs and maintenance
- Farm mechanization
- Engineering management
- Equipment servicing
- Wood products engineering

Agricultural economics and extension

- Agricultural policy and planning
- Agricultural business and financial management
- Agricultural marketing
- Agricultural finance and accounting
- Agricultural insurance and risk
- Agricultural extension and rural sociology

Forestry and Wild Life

- Forest biology

- Forest biometrics
- Forest economics and management
- Wood science

Fishery

- Fisheries management
- Fish processing and preservation
- Fish marketing

Agricultural education

- Agricultural research
- Curriculum evaluation

Week 6

Topic: Forest and Forest Uses

Forest

A forest can be defined as an area of land set aside for the production of timber and other forest products. It consists of a group of trees and community of many other living organisms including animals. Forest can be defined as a large area of land covered with trees and brushes, either growing wild or planted for some purposes. A **forest** is a large area dominated by trees. The forest is a complex ecosystem consisting mainly of trees that buffer the earth and support a myriad of life forms. The trees help create a special environment which, in turn, affects the kinds of animals and plants that can exist in the forest. Trees are an important component of the environment. They clean the air, cool it on hot days, conserve heat at night, and act as excellent sound absorbers.

The branch of study which deals with the application of scientific knowledge, skills and techniques to the production and management of timber and other forest products for the benefit of mankind is known as forestry.

Forestry is the art of planting, tending and managing forests, including the utilization of their products, silviculture is the the study of forest trees and other related trees. Managing forests sustainably means increasing their benefits, including timber and food, to meet society's needs in a way that conserves and maintains forest ecosystems for the benefit of present and future generations.

Types of Forest

Tropical forests (rainforests but also others) occur near the equator and are the most ecologically rich of all forest types. They regenerate very rapidly but they are the most threatened forests, primarily by logging (reforestation is rare but it has been successfully achieved in some places) and clearance for agriculture (which is often permanent and leads to soil erosion).

They are characterized by 25-35 m tall trees with a multi-layered and continuous canopy, a highly diverse flora, and a fauna including numerous birds, bats, small mammals, and insects.

There are four tropical forest types: evergreen rainforest, seasonal rainforest, semi-evergreen forest and moist/dry deciduous forest.

Temperate forests occur in eastern North America, northeastern Asia, and western and central Europe. Regeneration is slower because the growing season is short. Their total area has not changed much in recent years but plantations have steadily replaced old-growth forests.

Temperatures vary from −30°C to 30°C and precipitation (75-150cm) is evenly distributed throughout the year. The soil is fertile and the canopy moderately dense. There are some 3-4 species of flora per square kilometer and fauna is represented by squirrels, rabbits, birds and deer among others.

There are five temperate forest types: moist conifer forest, dry conifer forest, and Mediterranean forest, temperate coniferous and temperate broad-leaved rainforest.

Boreal forests, or taiga, represent the largest terrestrial biome. They are found in areas with shorter, warm summers and long winters. Hence the growing season is very short, and regeneration occurs slowly. There are boreal forests in Europe, Asia, Siberia, and North America. Because of the cold climates, plant life in the boreal forest is sturdy, consisting mainly of evergreens and other resilient vegetation. The forest canopy is so dense that little light reaches the forest floor. Annual precipitations (mostly snow) range from 40 to 100 cm. The soil is nutrient-poor and acidic. Flora is mostly cold-tolerant evergreen conifer and fauna includes woodpeckers, bear, lynx, fox and wolf among others.

Importance or Uses of forest

- Provision of food
- Provision of fuel
- Provision of medicinal herbs
- Provision of employment
- Forest serves as wind-break
- Formation of rain
- Prevention of soil erosion
- Purification of air
- Prevention of excessive leaching
- Addition of nutrients to soil
- Home of wild animals

- Forest serve as tourist centre
- Provision of foreign exchange
- Provision of timber
- Provision of pulp
- It beautifies the environment
- Reduces atmospheric pollution
- Sources of raw materials

Uses of Forest Products

1. Timber – used for building houses, canoes, local bridges and furniture. It is also exported to other countries and this earns the country valuable foreign exchange
2. Fuel – Firewood, coal and charcoal got from forest trees form excellent source of fuel
3. Source of Employment – It provides source of employment for many categories of workers such as forest guards, game wardens, hunters, sculptors.
4. Medicines – The trees of some forests can serve medicinal purposes e. eucalyptus, calabar bean
5. Food – Forests form excellent source of food to majority of people. Wild fruits, roots, stems, antelopes, grass cutters can be obtained from the forest.
6. Tourist attraction – The forest and game reserves are great tourist attraction and is also suitable for recreation.
7. Raw materials for Industries – certain trees provide raw materials such as fibre, ropes, dyes, resins, gums which are used by some industries as raw materials
8. Home for wild animals
9. Education – Forests provides opportunities for teachers as well as students in the department of forestry and wild life.

Human Activities that Affect Forest

Deforestation

Deforestation is the continuous removal of forest stands (trees)either by bush burning or indiscriminate feeling without replacing them. Economic trees such as iroko, obeche, mahogany, etc. are cut down to so they can be used for various purpose

Causes of deforestation

- Unfavorable climatic factors
- Man's farming activities
- Timber exploitation
- Natural disaster
- Government policy

Effects of Deforestation on the Environment

The effects of deforestation include:

1. Destruction of windbreaks which gives way for adverse wind attack.
2. Soil erosion which causes destruction to farmland and buildings.
3. Global warming caused by large concentration of CO2
4. Intense evaporation of soil water and soil nutrients due to exposure of the soil.
5. Danger to wildlife and possible extinction of some species of plants and animals.
6. Shortage of food due to drought.
7. Destruction of arboreal habitat.
8. Leads to loss of forest resources.

Afforestation

Afforestation is the process of establishing forest plantation in any area.it involve the complete removal of natural vegetation before planting new forest species.

Practice Questions

1. ____ is the continuous removal of forest stands (trees)either by bush burning or indiscriminate feeling without replacing them
2. ____ is the process of establishing forest plantation in any area.it involve the complete removal of natural vegetation before planting new forest species
3. A ___ can be defined as an area of land set aside for the production of timber and other forest products
4. ___ and ____ are causes of deforestation
5. Forest products can be used for _____, _____ and _____

Answers

1. Deforestation
2. Afforestation
3. Forest
4. Unfavorable climatic factors
   Man's farming activities
   Timber exploitation
   Natural disaster
   Government policy
5. Timber – used for building houses, canoes, local bridges and furniture. It is also exported to other countries and this earns the country valuable foreign exchange
   Fuel – Firewood, coal and charcoal got from forest trees form excellent source of fuel
   Source of Employment – It provides source of employment for many categories of workers such as forest guards, game wardens, hunters, sculptors.
   Medicines – The trees of some forests can serve medicinal purposes e. eucalyptus, calabar bean
   Food – Forests form excellent source of food to majority of people. Wild fruits, roots, stems, antelopes, grass cutters can be obtained from the forest.
   Tourist attraction – The forest and game reserves are great tourist attraction and is also suitable for recreation.
   Raw materials for Industries
   Home for wild animals

Week 7

Topic: Farm Animal Diseases (I)

Diseases

Diseases can be defined as the absence of normal health due to infection, nutritional deficiency and imbalance, hereditary and functional disorders as well as injuries. Diseases can also be described as any disturbance in the normal life or body function of an organism which may affect a particular organ or the whole body and sometimes leads to reduced growth, production or premature death.

Infectious Diseases – these are diseases which can affect an animal without the animal coming in contact with the infected animal. Transmission of this type of disease is through air, water, dust. Examples are fowl cholera, anthrax, tuberculosis.

Contagious Diseases – A disease is said to be contagious if the mode of transmission is by a healty animal coming in physical contact with an infected animal with the diseases being transferred. Examples of such diseases are Foot and Mouth Disease, Newcastle disease

Types of Diseases

1. **Per acute disease** – one that lasts only for a short time with no noticeable symptoms
2. **Acute disease** – This shows noticeable symptoms and manifests maximum causality

3. **Sub – acute disease** – This lasts more than acute with one or more symptoms of the disease
4. **Chronic disease** – This is the type that keeps on longer causing loss of growth and production but no resulting death of the animal

Causes of Disease

- Virus
- Bacteria
- Fungi
- Protozoa
- Malnutrition or metabolic disorder

Fungal Diseases

1. **Ringworm** – animals affected are poultry birds, pigs
   Causal Organism – fungus
   Symptoms
   – Lesions on the skin
   – Skin irritation
   – Loss of appetite and weight
   Method of Transmission
   Through infected animals, contact with infected brushes, feeders and drinkers.
   Control
   – Disinfection of all pens and equipment
   – Infected parts of animals should be treated every two to six days with mixture of Sulphur and Vaseline
   – Old scabby area can be scrapped off and iodine solution applied.
2. **Aspergilosis**
   Animals affected – cattle, poultry birds, pigs and sheep
   Caused by Aspergillus fumigatus
   Symptoms
   – Loss of weight
   – High body temperature
   – Loss of appetite
   – Difficulty in Breathing
   – Skin irritation
   – Respiratory disorder
   Method of Transmission
   Via contaminated (mouldy) feed, mouldy litter and contaminated incubator
   Control –

- Regular disinfection of pens and equipment
- Avoid mouldy feed
- Good sanitation
- Spry with fungicides

Protozoa Diseases

1. **Trypanosomiasis**

Animals affected – Resistant breeds of cattle are N'Dama, Muturu and Keteku while susceptible breeds are White Fulani, Red Bororo, Kuri Chad, Sokoto Gudali and Boran.
Causal Organism
It is caused by a protozoan called *Trypanosoma spp.*
Symptoms are
- Rise in body temperature
- dullness in appearance
- anaemia
- sleepiness
- weakness
- dry coat
- nervous disorder
- loss of appetite and weight

Method of Transmission
Spread by blood sucking tsetse fly.
Control
i. Clearing of bush around farm to remove the fly's habitat
ii. Biological control of insect vectors
iii. Treatment of infected animals with drugs such as antimosan, trypanosomide
iv. Eradication of wild species or animal carriers in and around pasture

2. **Coccidiosis** – animals affected are poultry birds, domestic fowl, turkey, goose, rabbit
   Causal Organism – protozoa
   Symptoms
   - Loss of appetite
   - Dropping wings
   - High Mortality
   - Emaciation
   - Huddling
   - Dullness
   - Loss of hair
   - Blood stained diarrhea
   - Rough Feathers

Control
- Changing of Litter
- Drugs such as amprolium, nitrofurazone should be administered
- Avoid wet litters and feed
- Proper sanitation

3. Red water fever
Animals affected – sheep, goat, cattle, pig.
Caused by babesia spp
Symptoms
- Emaciation and death
- Loss of weight and appetite
- Diarrhea
- Increase in body temperature

Mode of Transmission
Through bite of infected animal by vector called blue tick
Control
- Spray with insecticides to kill disease vector
- Inject animals with drugs like babesan, trypan blue and acaprin

Viral Diseases

1. **Foot and Mouth Disease**
   Animals affected are – cattle, sheep and goat
   Causal Organism – Virus
   Symptoms
   - Formation of blisters on the mucous membrane of the mouth and skin, hoofs
   - Salivation
   - Loss of weight
   - Lameness
   - Inflammation of teats and udder

   Method of Transmission – Via infected materials like urine, faeces and milk. Mechanical means by farmers
   Control
   Isolation of infected animals. Burning and burying of contaminated materials. Regular vaccination.

2. **Newcastle Disease**
   Animals Affected – Fowl, turkey. Ducks, goose and guinea fowl
   Causal Organism – Virus
   Symptoms
   - Respiratory symptoms include sneezing, coughing nasal discharge
   - Nervous symptoms include paralysis, muscle tremor, somersaulting and

cycling movements
– Digestive symptoms include lack of appetite and diarrhea

3. **Rinder Pest Disease or Cattle Plague**
   Animals affected are cattle, sheep and goat
   Causal Organism – virus
   Symptoms
   – high fever
   – weakness and fatigue
   – high mortality
   – loss of appetite and weight
   – blood stained diarrhea

Bacterial Diseases

1. **Anthrax** – affects cattle, sheep, goat and pigs.
   Causal organisam – *Bacillus anthraxis*
   Symptoms
   – high fever
   – Depression
   – Blood oozes from nose, mouth and anus
   – Loss of weight
   – Lack of appetite
   – Staggering and sudden death
   Method of transmission – via contaminated feed, water, equipment and infected animals
   Control
   – Regular Vaccination
   – Proper Sanitation
   – Isolation of infected Animals

2. **Tuberculosis** – animals affected are cattle, poultry birds, pigs and sheep
   Causal Organism – *Mycobacterium tuberculosis*
   Symptoms
   – difficult breathing
   – loss of weight and appetite
   – soft and moist cough
   – milk reduction
   – high mortality
   – constant coughing
   – emaciation

   Method of Transmission
   Via inspiration of germs, contaminated water, feed, litters and droppings

Control
- regular sanitation
- slaughter infected animals
- proper sanitation

3. **Brucellosis or Contagious Abortion**
   Animals affected are – Pigs, sheep, cattle and goat
   Symptoms
   - High fever
   - Diarrhea
   - Dysentery
   - Inflammation of the uterus, scrotum
   - Infertility in male animals
   - Reduction in milk production
   - Still birth and premature abortions
   - Posterior paralysis

   Method of Transmission – Through contaminated feed and water
   Control
   - Proper sanitation
   - Regular Vaccination
   - Isolation of infected animals

   Treatment – No effective treatment

Practice Questions

1.____ can be defined as the absence of normal health due to infection, nutritional deficiency and imbalance, hereditary and functional disorders as well as injuries.

2. Brucellosis affects the following animals except
a. poultry
b. cattle
c. sheep
d. goat

3. ____ is not a bacterial disease

a. Brucellosis
b. Anthrax
c. Rinder pest
d. Tuberculosis

4. One of this is a viral disease
a. Foot and mouth disease
b. Tuberculosis

c. Red water fever
d. Tuberculosis

5. ____ disease is one that lasts only for a short time with no noticeable symptoms
a. Acute
b. Sub-acute
c. Terminal
d. Per-acute

Answers

1. Disease
2. A
3. C
4. A
5. D

Week 8

Topic: Farm Animal Diseases (II)

Signs of Disease in farm animals

1. Unthriftiness
2. Lack of appetite
3. Dullness
4. Rough coat
5. Ruffled feather in poultry
6. Wasting
7. Diarrhea or water stool
8. Prematu
9. re abortion
10.
11. Increased mortality rate

12. Discharge from mouth and eyes
13. Decrease in activities
14. Loss of weight
15. Blood stains in faeces
16. Reduced production

Economic Importance of Animal Disease

1. Poor growth of animals
2. Diseases lead to poor feed utilization due to loss of appetite
3. Low yield of products
4. Low income to farmers due to reduced quantity and quality of products
5. Money is spent on curing the animal

Factors that can predispose animals to disease

1. Health status of the animal
2. Poor nutritional diet – Animals who are poorly fed are prone to diseases
3. Poor sanitation – When the environment is dirty, Animals can contract diseases
4. Poor management of the animals – Non administration of vaccines and drugs at appropriate doses and time
5. Poor housing of the animals
6. Unfavorable climatic conditions – Extreme temperature, winds and rainfalls can affect animals
7. Poor breeds of animals

General Principles of Preventing and Controlling Animal Diseases

- Farm animals should be provided with clean and well ventilated houses as well as dry beddings.
- All newly purchased animals should be quarantined and isolated for at least two weeks before joining the old stock. All sick animals should be isolated and treated.

- Farm animals should be vaccinated at different stages of their growth to prevent certain diseases
- Use resistant breeds where appropriate
- Sometimes infected animals should be eliminated and slaughtered instead of being treated as some diseases are stubborn and might not be cured even when the animals have been treated
- Regular dipping and spraying stock with appropriate insecticides will destroy ectoparasite
- Regular deworming of farm animals

Practice Questions

1. List 4 symptoms of diseases in Animals
2. Give 3 economic importance of Animal diseases

Week 9

Topic: Preservation of Farm Produce for Marketing

Introduction

One of the greatest problems facing most Nigerian farmers is how to preserve their farm produce after harvesting. Most of the farm produce whether livestock or crops are perishable. To reduce wastage due to spoilage, farmers employ different methods to preserve their products until they are consumed or sent to market for sale.

Preservation of farm produce is one of the greatest problems facing farmers in Nigeria. This is so because of the nature of farm produce (livestock or crops) which is their high perish ability. They are highly perishable because of their high moisture content which in turn promotes the activities of microorganisms which bring about spoilage. The needs for preservation of the farm produce are to reduce wastage due to spoilage until such products are consumed or sent to the market for sale. Preservation can be defined as, the process of keeping farm produce from decay and spoilage (by maintaining the quality) until they are consumed or sold.

Principles on which Preservation Methods are Based

1. Reduction of moisture content
2. Temperature manipulations
3. Exclusion of micro organisms

Methods of Preserving Farm Produce

1. **Drying** – This is the process of removing as much water as possible from the produce to prevent spoilage by micro – organisms. The produce is placed on a tray or mat in the sun for them to dry. Maize grains, pepper, cowpea beans and melon are examples. Also hides and skins and fish are sun dried. Examples of fish which are sun dried are stock fish and cray fish
2. **Smoking** – A traditional method of preserving fish in Nigeria. This is done by making fire in a mud oven or in a container. Wire gauze is placed on top of the oven and fish to be smoked are placed on top of the wire gauze. To prevent burning, fish is turned frequently during smoking. The smoke particles from the fire help to enhance the flavuor of the produce and inhibit bacterial growth on the surface of the product.
3. **Refrigeration/cold storage** – The products such as fruits and vegetables are kept at temperature lower than that of the room temperature in refrigerators. The temperature operative in the refrigerators will not allow the spoilage organisms from growing and the products are preserved.
4. **Freezing** – products are stored at a temperature below $O^{O}C$. This completely hinders the activities of microorganisms and frozen foods are preserved for a long time. It should be noted that freezing does not kill most microorganisms. Therefore, if frozen food is brought back to warmer temperature, the microorganisms become active again thereby resulting in food spoilage. This method is used for meat. Fish and meat products.
5. **Pasteurization** – This is the process of subjecting milk to a very high temperature for a brief period of time but long enough to kill all the microorganisms in it. Pasteurized milk is then stored in refrigerator.
6. **Salting** – this is addition of salt to produce to preserve them. The salt dehydrates the farm produce i.e. absorbs much of the water from the produce thereby preserving them.
7. **Canning** – a process of storing food products in hygienically sealed containers. The containers are washed and sterilized by heating them in boiling water (at a temperature of 100 0c). The product is then heated to temperature high enough to destroy all microorganisms in it. The containers are then sealed and allowed to cool after their content has been poured into it. Canning is used for preserving fish, meat, fruit juice, milk, groundnut oil etc.

8. **Frying** – some products such as fish, eggs, meat as well as flour, can be preserved by frying them in oils. The oil help to protect the surfaces from attack by spoilage organisms and also help to reduce moisture content of the produce thereby preserving the produce.
9. **Fermentation** – during the process of fermentation, protein is broken down in the presence of high salt concentration by the enzymes in the produce. This method is used for preserving mainly fish and leguminous produce such as soya beans and cowpea.

Specific Preservation Methods for Livestock

Livestock

- Refrigeration
- Drying
- Salting
- Canning
- Frying

Crop Produce

- Drying
- Milling
- Canning
- Refrigeration

Fish

- Drying
- Salting
- Smoking
- Canning
- Refrigeration

- Frying

Practice Questions

1. ____ is the process of subjecting milk to a very high temperature for a brief period of time but long enough to kill all the microorganisms in it
2. When salt is applied to farm produce, ____ occurs and much of the water from the produce is absorbed thereby preserving them.
3. During fermentation process, _____ is broken down in the presence of high salt concentration by the enzymes in the produce.
4. ____ is done by making fire in a mud oven or in a container.
5. ____ is the process of removing as much water as possible from the produce to prevent spoilage by micro – organisms.
6. In freezing process, products are stored at a temperature below ___ °C

Answers

1. Pasteurization
2. Dehydration
3. Protein
4. Smoking
5. Drying
6. 0 °C

WEEK 10

Topic: Husbandry of Selected Crops

1. Meaning of Crop Husbandry
2. Selected crops (maize)

Crop Husbandry simply means careful management of the establishment, growth and harvesting of crops

1. **Cereals – Maize;** Botanical Name: Zea mays

Land Preparation

1. Clearing of land
2. Stumping should be done
3. Land should be harrowed
4. Ridges can also be prepared

Propagation

1. It is propagated by seed
2. May be planted manually
3. May be planted mechanically

Climatic requirement: It requires a temperature of about 20Oc – 30Oc. Rainfall should be between 75cm – 150cm annually

Soil requirement: Well drained loam and silt loam with fine tilt.

Planting date: Early planting type is planted between March and April. Late maize can be planted anytime depending on the rate of rainfall in the north and south.

Seed Rate

1. 25 – 20kg maize seed per hectare.
2. 2 -3 seeds per hole

Spacing

1. 25cm along the row and 75cm between rows
2. 30cm x 60cm along and between the rows respectively.
3. 90cm x 60cm at two seeds per hole

Cultural Practices

Supplying: This is the process of filling the in-germinated spaces

Thinning: Removal of weak or excess plants per hole in a farmland e.g. thin maize one or two per hole.

Fertilizer application

1. Apply N.P.K 15:15:15 at about 200kg or 4 bags per hectare.
2. Apply farmyard /poultry dropping/organic manure by side dressing or by broadcast method.

Weeding

1. Weed farmland regularly
2. Use manual Methods e.g. hoe and cutlass
3. Use chemical or mechanical method

Maturity period: 3 – 4 months or 90 – 120 days after planting

Harvesting

1. Maize can be harvested either green or dry

2. Mostly harvested when dry
3. Harvested on a small scale by plucking the cobs and on a large scale by machines such as corn-picker
4. We can also use sickle to harvest maize

Storage

1. Store above fire-place.
2. Store in air-tight container
3. It can also be stored in flour form

Yield

1. About 3,500kg/hectare for improved varieties
2. About 600 to 1,200kg/hectare for local varieties
3. Processing: The husks can be removed from the cobs
4. Shelling should be done to remove grains from the Cobs
5. Winnowing is done to remove dirt from the grain.

Pest of Maize

1. Stem Borer: It is a field pest which larva destroys young stems
2. Maize Weevil: It is both filed and store pest. The adult and larva destroy the grains
3. Grasshopper: It destroys the vegetative parts of the plant

Control of Pests

1. Plant resistant variety
2. Early planting
3. Fumigate the store with BHC Powder or posturing tablets
4. Early harvesting

Practice Question

What is the first thing you do on a land when you want to plant?

Answers

Land clearing