

**FIRST TERM Agricultural Science E-LEARNING NOTE****FIRST TERM E-LEARNING NOTE****SUBJECT: AGRICULTURAL SCIENCE****CLASS: SS 2****SCHEME OF WORK**

<b>WEEK</b>	<b>TOPIC</b>
1-2	Soil: Meaning, Types, Composition and Properties of Soil.
3	Farm Machinery and Implements: Types, Description, Uses and Maintenance.
4-5	Surveying and Planning of Farmstead; Meaning and Importance, Common Survey Equipment.
6	Irrigation and Drainage; Meaning, Importance, Types, Advantages and Disadvantages.
7	Environmental Factors Affecting Agricultural Production (Crops and Animals), Climatic Factors – Biotic factors – Edaphic factors.
8 - 9	Plant Nutrient and Nutrient Cycle. Macro and Micro Nutrients. Nitrogen, Carbon and Water cycles.
10	Factors Influencing Nutrient Availability in the Soil. Methods of Replenishing Soil Nutrients Farming Practices

**REFERENCE BOOK**

- Essential Agricultural Science for Senior Secondary Schools, by O.A. Iwena
- Prescribed Agricultural Science for Senior Secondary Schools by S.A. Omofuyi Ota
- WAEC Pack

**WEEK ONE****TOPIC: SOIL****CONTENT**

- Meaning of Soil
- Types of Soil
- Composition of Soil
- Properties of Soil

**MEANING OF SOIL**

Soil can be defined as the unconsolidated weathered materials found in the upper most layer of the earth surface on which plants grow. It provides support and nutrients for the plants.

**TYPES OF SOIL**

The three types of soil are; Sandy Soil, Clay Soil and Loamy Soil.

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### SANDY SOIL

A soil is said to be sandy if the proportion of sand particles in a sample of the soil is high. The particles are mainly quartz ( $\text{SiO}_2$ ).

#### PROPERTIES OF SANDY SOIL

1. Sandy soil is coarse, grained and gritty.
2. It is loose with large pore spaces.
3. It absorbs and loses water easily.
4. It is not sticky when wet and cannot form a cast or ribbon.
5. It is well aerated with low water holding capacity.
6. Percolation in sandy soil is high but capillarity is low.
7. Sandy soil heats up easily during the day and cools down quickly in the night.
8. It supports leaching, hence it is low in plant nutrients.
9. It does not support water logging and erosion.
10. Sandy Soil has grey or brownish colour.

#### METHODS OF IMPROVING SANDY SOIL

1. Planting of cover crops
2. Application of compost manure
3. Application of farm yard manure
4. Mulching the soil
5. Avoidance of bush burning

#### ECONOMIC IMPORTANCE OF SANDY SOIL

1. It is good for cultivation of cassava, cotton, groundnut etc.
2. It is good for building construction when mixed with cement.

#### EVALUATION

1. What is soil?
2. List the three types of Soil and state three characteristics of sandy soil.

### CLAY SOIL

A soil is said to be clayed if the proportion of clay in a sample of the soil is very high.

#### PROPERTIES OF CLAYED SOIL

1. The particles are fine, powdery and smooth when dry.
2. The parties are sticky and moody when wet.
3. The particles are tightly bound together with little pore (air) spaces.
4. It has a high water holding capacity.
5. It is poorly aerated.
6. Percolation in clay is low but capillarity is high.
7. It does not support leaching, hence it contain plant nutrients.
8. It is hard when dry and sticky when wet.
9. It can easily form a ribbon or cast when molded.
10. It supports water – logging and erosion.
11. It has a grey or brownish colour.

#### METHODS OF IMPROVING CLAYED SOIL

1. Liming

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2. Addition of organic manure

### EVALUATION

1. What is clay soil?
2. In a tabular form, give five differences between sandy and Clay soil.

### LOAMY SOIL

Loamy soil is a mixture of sand and clay particles with high proportion of organic matter.

### PROPERTIES OF LOAMY SOIL

1. Loamy Soil is moist, loose with moderate sized pore space.
2. The structure breaks easily when wet and friable when dry.
3. It has non-powdery and non-sticky texture.
4. It can easily be worked or cultivated.
5. It contains lots of organic matter (humus).
6. It does not support erosion and water logging.
7. It was well aerated and it can hold water.
8. It is the best soil for cultivation of crops.
9. It is dark brown or black in colour.

### EVALUATION

1. What is loamy soil?
2. List four properties of loamy soil.

### COMPONENT/COMPOSITION OF THE SOIL

The composition of the soil by percentage are:

- |                          |     |
|--------------------------|-----|
| 1. Soil mineral matter   | 45% |
| 2. Soil water            | 25% |
| 3. Soil air              | 25% |
| 4. Soil living Organisms | 5%  |

### GENERAL EVALUATION

1. List two methods of improving clay soil.
2. List the component of soil and their respective percentage composition.
3. List three ways of improving sandy soil.
4. List five properties of sandy soil.
5. List five properties of clay soil.

### READING ASSIGNMENT

Essential Agricultural Science for Senior Secondary Schools by O.A. Iwena pages 65-87.

### WEEKEND ASSIGNMENT

1. Particles of soil are closely packed together in \_\_\_\_ soil (a) sandy (b) clay (c) loamy (d) silt
2. Quartz is the major composition of \_\_\_\_ soil (a) clay (b) loamy (c) sand (d) silt
3. The soil which mostly support leaching is \_\_\_\_ (a) sand (b) clay (c) loamy (d) silt
4. The soil which supports water logging is \_\_\_\_ (a) sand (b) silt (c) clay (d) loamy

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5. The best soil for agriculture is \_\_\_\_\_ (a) sand (b) clay (c) silt (d) loamy

### **THEORY**

1. (a) What is a soil?  
(b) List the four component of soil.
2. (a) State four characteristics of clay soil.  
(b) What is weathering?



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### WEEK TWO

#### TOPIC: SOIL (CONTINUED)

#### CONTENT

- Factors of Soil Formation
- Process of Soil Formation
- Soil Structure, Texture and PH
- Experiments on Soil

#### FACTORS OF SOIL FORMATION

The five major factors which control soil formation are: climate, parent materials, topography, biotic factors and time.

1. **CLIMATE:** Climate is the average weather condition of a place over long period time. The elements of climate are: temperature, rainfall, wind and pressure.
  - (a) Temperature: The alternating cooling and heating of rocks results in continual expansion and contract which eventually make the rock to crack and breakdown to form Soil.
  - (b) Rainfall: The action of running water from rainfall causes gradual wearing away of rocks during erosion to form soil. Rain drops provide water for hydrolysis, rainfall also breaks down some parent rocks to form soil.
  - (c) Wind: Rocks collide during the time of high wind velocity in desert, this collision results in breakdown of rocks to form soil.
  - (d) Pressure: High pressure on hanging rock may cause it to fall down and break in pieces, resulting in soil formation.
2. **PARENT MATERIALS:** These are the materials (previously existing rocks) from which the soil is formed. The parent materials are igneous, sedimentary and metamorphic rocks. They determine the type, physical characteristic and chemical composition of the formed.
3. **TOPOGRAPHY:** This is the shape of the ground in relation to the underlying rock of the earth's surface. It affects soil formation in the following ways.
  - i. The shape of the land influences the movement and amount of water in the soil.
  - ii. Sloppy surfaces support erosion which encourages soil formation.
  - iii. More soils are formed in the valleys than on the hills.
4. **BIOTIC FACTORS:** The activities of soil living organisms help to speed up the process of soil formation in the following ways;
  - i. Termites, earthworm and rodents mix with the mineral and organic matter together to form soil.
  - ii. They aerate the soil, making air to react with rocks to form soil.
  - iii. The activity of man during tillage.
  - iv. Microorganism causes decomposition of organic matter to form soil.
  - v. The root of plants penetrates the rocks there by breaking them.
  - vi. Organism produces carbon dioxide which promotes weathering of rocks.
  - vii. Microbe helps in decomposition of organic matter.
  - viii. The leaves which fall from trees decay to increase the humus content of the soil.
5. **TIME:** all the above factors takes a lot of time to finally give rise to soil.
  - i. It takes a long time for small piece of rocks to disintegrate into grains of soil.
  - ii. It takes a long time for plants to decay to form soil.

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- iii. It takes short time to form immature soil.

### EVALUATION

1. List the factors of soil formation.
2. Explain how (i) topography (ii) wind and (iii) temperature results in soil formation.

### PROCESS OF SOIL FORMATION (WEATHERING)

Weathering is defined as the disintegration or breakdown of rocks into tiny particles called soil.

The processes of soil formation include:

1. Physical process
  2. Chemical process
  3. Biological process
1. **PHYSICAL PROCESS:** The agents of physical weathering are temperature, ice, wind, water and pressure
    - i. Temperature: The alternating heating and cooling of rocks produce pressure within the rock which makes them to break into smaller pieces.
    - ii. Wind: Solid materials carried by soil surfaces.
    - iii. Ice: The conversion of water inside the cracks of rocks into ice results in increase in volume. This results in more pressure on the rocks which eventually break into smaller pieces.
    - iv. Water: Running water carries some fragments of rocks in the river bed, thus breaking off small pieces of rocks.
  2. **CHEMICAL PROCESS:** Agents of chemical weathering include: solution, carbonation, hydration, hydrolysis and oxidation.
    - (i) Hydration: It occurs when water combines with or binds to some minerals e.g.
      - Calcium Sulphate changes to gypsum  $\text{CaSO}_4 + 2\text{H}_2\text{O} \rightarrow \text{CaSO}_4 \cdot \text{H}_2\text{O}$
      - Red Haematite changes to hydrated yellow Haematite or Limonite  $\text{Fe}_2\text{O}_3 + 3\text{H}_2\text{O} = \text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$
      - $\text{CuSO}_4 + 5\text{H}_2\text{O} = \text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
    - (ii) Carbonation: The carbondioxide released to the atmosphere combines with acid. This weak acid reacts with rocks to form soil.
    - (iii) Oxidation/Reduction: When minerals containing iron, manganese and sulphur are exposed to air and water, the famous iron is oxidized to the ferric state.
 
$$4\text{FeCO}_3 + \text{O}_2 = 2\text{Fe}_2\text{O}_3 + 4\text{CO}_2$$

(Iron II Carbonate)      (Iron Oxide)
    - (iv) Solution: reaction of water with soluble particles/minerals present in the rock and eventually displacing them given the slope of the soil.
    - (v) Hydrolysis: involves the breaking down of chemical bonds in rock minerals by water.
 

$\text{CaSiO}_3$	$+ 2\text{H}_2\text{O}$	$\rightarrow \text{H}_2\text{SiO}_3$	$+ \text{Ca(OH)}_2$
Calciumsilicate	water	silica	calcium
(Wollastonite)			silicate
hydroxide			
  3. **BIOLOGICAL PROCESS:** This involves the activities of plants and animals in the breaking down of rocks to form soil. It can happen in the following ways;

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- (i) The root of plants penetrates the rocks to form soil.
- (ii) Earthworm and termites burrow into the rocks and break off fragments.
- (iii) Activities of man during soil tillage causes the rock to breakdown to form soil.

**EVALUATION**

- 1. What is weathering?
- 2. List and explain the three processes of weathering.

**SOME PROPERTIES OF THE SOIL**

- 1. Soil Structure: This refers to the ways in which the different particles of the soil are packed or arranged. Good Soil structure will promote good yield of crops. Soil Structure can be preserved in the following ways:
  - (a) Planting of cover crops
  - (b) Application of manure
  - (c) Avoidance of overgrazing
  - (d) Mulching
  - (e) Avoidance of clean clearing

The types of soil structures are:

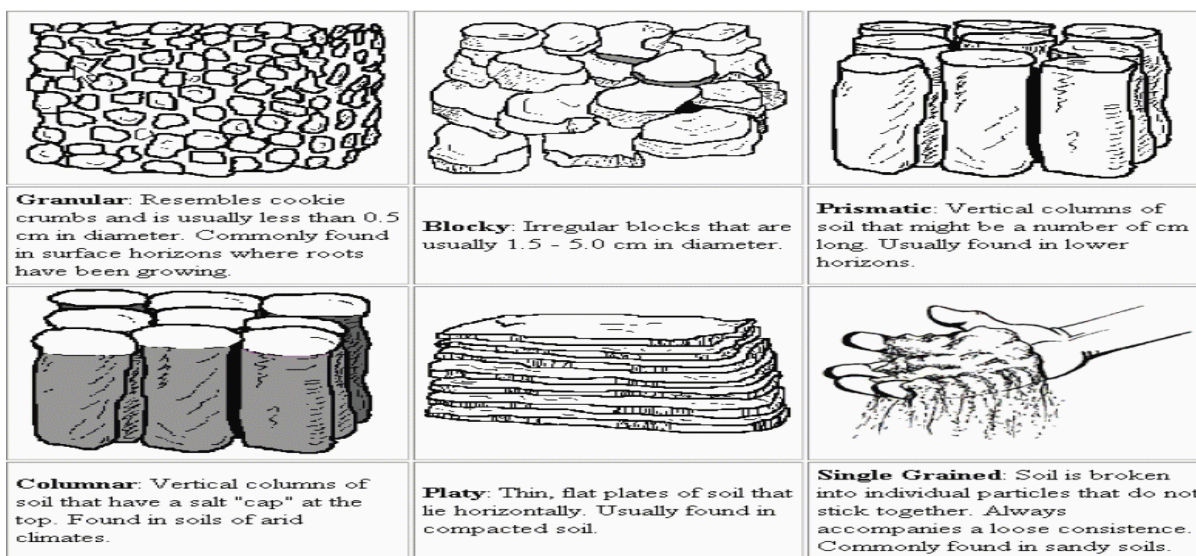
- (i) Single grained structure
- (ii) Crumb Structure
- (iii) Plate-like structure
- (iv) Spheroidal structure
- (v) Prismatic structure
- (vi) Block-like structure

**IMPORTANCE OF SOIL STRUCTURE**

- (i) It determines how fertile a soil is.
- (ii) A good soil structure supports aeration.
- (iii) It also prevents erosion and water logging.
- (iv) A good soil structure promotes the activities of soil microbes.
- (v) A good soil structure supports the growth of crops.



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2. **Soil Texture:** This is the relative proportion of various particles of the soil. It also refer to the degree of fineness or coarseness of the various soil particles. The particles which make up a soil sample include; gravel, sand, silt and clay are usually referred to as primary particles of the soil. The name and sizes of the various soil particles are shown in the table below;

Name of Particles	Range of Particle diameter
Clay	Below 0.002mm
Silt	0.002 – 0.02mm
Fine Sand	0.02 – 0.2mm
Coarse Sand	0.2 – 2.0mm
Gravel	Above 2mm

### METHOD OF SOIL TEXTURE DETERMINATION

- By feeling
- By mechanical analysis through sieving
- By sedimentation
- By moulding

### IMPORTANCE OF SOIL TEXTURE

- It is useful in evaluation of the ability of soil to supply mineral nutrients.
- It supports soil microorganism essential for crop growth.
- It determines the type of crop to grow on the land.
- It enables the farmer to know the type of soil on his farm.
- It determines the movement of air and water in the soil.

3. **SOIL TEMPERATURE:** This refers to the hotness or coldness within the soil.

### IMPORTANCE OF SOIL TEMPERATURE TO CROP GROWTH

- It determines the rate of formation and decomposition of organic matter.
- High temperature will impede the activities of micro-organisms.
- Optimum temperature promoted seed germination.
- It determines the population of soil microbes.
- It determines maturity and ripening of fruits.

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4. **SOIL PH:** This is the measure of the degree of acidity or alkalinity of the soil. It can also be defined as the measure of the concentration of hydrogen ions ( $H^+$ ) in the soil. A PH scale is use to determine soil acidity as shown below.

Note that;

- PH2 is strongly acidic
- PH6 is slightly acidic
- PH7 is neutral
- PH8 is slightly alkaline
- PH13 is strongly alkaline

**CAUSES OF SOIL ACIDITY**

1. Leaching
2. Use of acid fertilizers
3. Presence of acid parent materials
4. Nutrient uptake by plants
5. Presence of sulphur in the soil

**REMOVAL OF SOIL ACIDITY**

Soil acidity can be removed by the application of liming materials which are rich in calcium.

Examples of liming materials are:

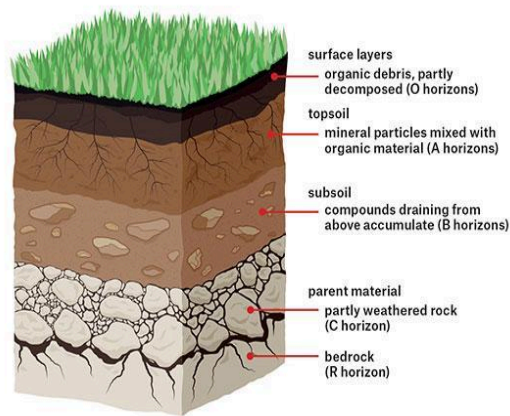
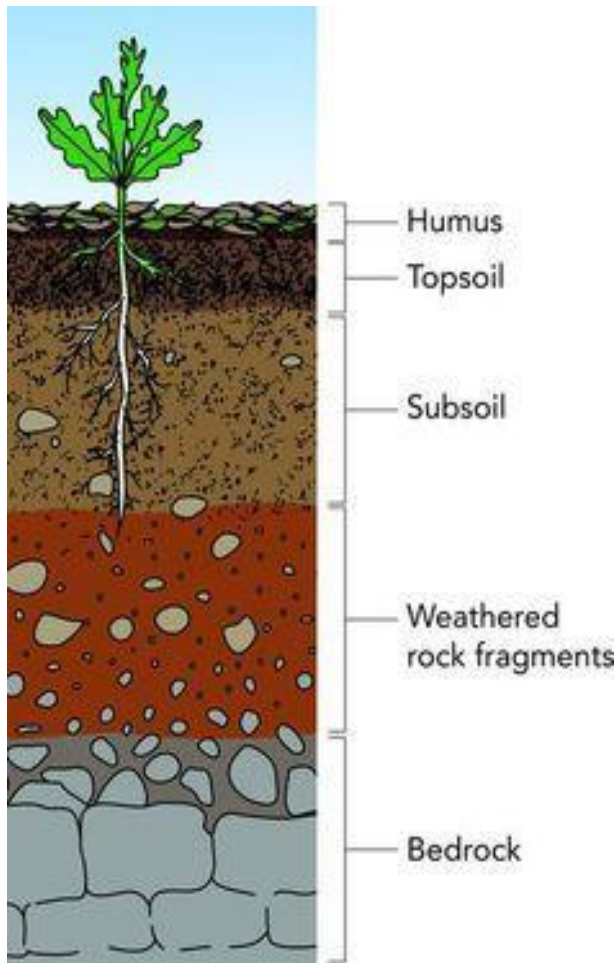
1. Slaked lime  $Ca(OH)_2$
2. Quick lime  $CaO$
3. Calcium bicarbonate  $Ca(HCO_3)_2$
4. Wood ash
5. Limestone  $CaCO_3$
6. Dolomite or Calcite
7. Basic slay
8. Gypsum

**SOIL PROFILE**

Soil profile is defined as the vertical section of the soil, showing series of horizontal layers of different types of soil. The horizontal layers are called HORIZONS



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### HORIZONS OF SOIL PROFILE

1. The A – Horizon: It is also called the top soil, it is rich in organic materials; most soil organisms reside here.
2. The B – Horizon: It is rich in minerals which are carried or leached down by percolating water.
3. Horizon C: It represent the type of material from which top soil and subsoil are derived.
4. The D – Horizon: It is called the bedrock.

### EXPERIMENTS ON SOIL

1. Sedimentation experiment.
2. Experiment to determine the moisture content of the soil.
3. Experiment to determine the porosity/water holding capacity of the soil.
4. Experiment to determine the capillarity of the soil.
5. Experiment to demonstrate the preserve of microorganism in the soil.
6. Experiment to determine the percentage of organic matter in a soil sample.

### GENERAL EVALUATION

1. What is soil?
2. List 5 factors of soil formation.

## FIRST TERM Agricultural Science E-LEARNING NOTE

3. What is weathering?
4. Explain the processes of physical weathering.
5. Define (i) Soil acidity (ii) Soil structure (iii) Soil texture.

### READING ASSIGNMENT

Essential Agricultural Science for Senior Secondary Schools by O.A. Iwena, Chapter 11, pages 65-87

### WEEKEND ASSIGNMENT

1. A soil with PH6 is \_\_\_\_ (a) neutral (b) strongly acidic (c) slightly acidic (d) alkaline
2. Which of the following is not a liming material (a) limestone (b) quicklime (c) slake lime (d) urea
3. The horizon which contain organic matter is \_\_\_\_ (a) A (b) B (c) C (d) D
4. The soil with particle size 0.002 to 0.02mm is \_\_\_\_ (a) clay (b) sand (c) silt (d) gravel
5. The breaking down of rock into smaller particles is called \_\_\_\_ (a) weathering (b) cracking (c) breaking (d) hut

### SECTION B

1. Describe sedimentation experiment with the aid of appropriate diagram.
2. (a) List five ways of removing soil acidity.  
(b) Define soil PH.

### WEEK THREE

#### FARM MACHINERY AND IMPLEMENTS

##### CONTENT

- Types of Farm Machinery
- Description of Farm Machinery
- Uses and maintenance of Farm Machinery

#### FARM MACHINERY

Farm machinery includes various types of machines and implements used in the farm. These include tractor, plough, harrows, cultivators, ridgers, planter, harvesters, shellers, dryer, sprayer, and incubators

1. **TRACTOR:** It is a powerful and expensive multipurpose motor vehicle used for lifting or pulling farm implements.

#### IMPORTANT PARTS OF THE TRACTOR

1. The power takes off shaft (P.T.O) shaft used in drawing farm implements e.g. plough, harrow etc.
2. The hydraulic control system which lifts mounted implements under the control.
3. Internal combustion engine which uses diesel or petrol without spark plug.
4. It has four wheels rubber tyres.

#### FUNCTIONS OF TRACTORS

1. For transportation of farm input and outputs when the trailer is attached.
2. It operates water pumps for irrigation or other farm purposes.
3. Lifting of couples implement by the hydraulic system.

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4. Pulling of farm implement attached.
5. Tilling the soil with appropriate implement attached.
6. Planting seeds when coupled with planter.
7. Spraying seedlings when coupled with sprayer.
8. Provision of electric power.
9. Harvesting crops when coupled with harvesters.
10. Can be used for mowing lawn with mowers.

### DAILY MAINTENANCE OF TRACTORS

1. Remove trash and mud after every operation.
2. Check water level and top if necessary.
3. Check tyre pressure daily before operation.
4. Check electrolyte of battery every day and top when necessary.
5. Adhere strictly to manual or manufacturer's instruction.

### EVALUATION

1. What is farm machinery?
2. List five functions of tractors.

### PERIODIC MAINTENANCE OF TRACTOR

1. Tractor should be serviced at regular intervals.
2. Worn out tyres should be replaced.
3. Nuts, screws or shield should be checked and tightened regularly.
4. Replace worn out parts.
5. Adhere strictly to manuals.
6. Routine and regular changing of the engine oil.
7. Air filter should be cleared when necessary.
8. Oil filter should be change during each service.

2. **BULLDOZERS:** They are powerful tractors and expensive machines with a broad steel blade or sheet at the front. It has tract type metal chains used for its movement , it has an internal combustion engine which uses petrol or diesel.

### USES/FUNCTIONS OF BULLDOZER

1. Bulldozer is used for clearing bushed.
2. Used for felling trees and stumps.
3. Used for leveling the ground.
4. Used for constructing road in the rural areas.
5. It is used for moving and collection of the earth.

### DISADVANTAGES OF USING BULLDOZER FOR LAND PREPARATION

- (i) It destroys the structure of the soil.
- (ii) It leads to reduction of soil fertility.
- (iii) It leads to reduction in soil fertility.
- (iv) It causes compaction of the soil.
- (v) It causes air pollution.
- (vi) It is costly.
- (vii) It can cause soil erosion and water logging.



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3. **TREE PULLERS:** They are machines such as tractors or bulldozers. They are usually used to remove trees instead of bulldozers.

### EVALUATION

1. List three periodic maintenance of a tractor.
2. List five disadvantages of using bulldozers in bush clearing.

### ADVANTAGES OF USING TREE PULLERS OVER BULLDOZERS

- (i) Tree puller does not compress the soil.
- (ii) It does not remove the fertile top soil.
- (iii) Land is less prone to erosion.
- (iv) The organic matter content of the soil is retained.
- (v) It leads to non-destruction of soil structure.
- (vi) It uproot the tree with minimal disturbance of the soil.

4. **SHELLERS:** These are machines operated electrically, mechanically or manually. Shellers are used to separate the seeds from the husk or cob. They are used for removing the hard outer covering of nuts and grains.

5. **DRYERS:** These are farm machines used to reduce moisture content of crop and animal products.

6. **INCUBATORS:** These are machines which are used for hatching fertilized eggs artificially.

7. **MILKING MACHINE:** This machine is used for milking or extracting fresh milk mechanically from the udder of cattle and other milk producing animals like sheep and goat.

### EVALUATION

1. List three advantages of using tree pullers over bulldozers.
2. State the functions of shellers, dryer and incubators.

### TRACTOR COUPLED IMPLEMENTS

These are implements which are coupled or attached to a tractor in order to enable it perform its work. They are also called intermediate farm machinery. Examples are ploughs, harrows, ridgers, planters, cultivators, harvester, sprayer, mowers, baler, fertilizer applicator and harvesters.

#### 1. THE PLOUGH

This is a primary tillage implement which is attached to a tractor. It is the first implement required in land preparation.

#### TYPES OF PLOUGH

- (a) Disc plough
- (b) Mould board plough

#### ACTIVITY:

Draw and list all the parts of both disc plough and mould board plough, state the functions of all the parts in your note.

**FIRST TERM Agricultural Science E-LEARNING NOTE****2. HARROWS**

These are secondary tillage implements which are used to break up the clods of soil formed after ploughing.

**3. SPRING TINE CULTIVATOR**

It is a type of harrow and a secondary tillage implement used for land preparation.

**FUNCTIONS OF SPRING TINE CULTIVATOR**

- (a) It breaks down the soil clod or lump after ploughing.
- (b) It aids the removal of weeds from the soil surface.
- (c) It helps in dragging roots and stone out of the soil.
- (d) It helps to stir soil without turning it over.

**4. RIDGERS**

It is a secondary tillage implement used for land preparation, it is used after harrow and before planter. The two types are disc ridgers and mould board ridgers.

**5. PLANTERS**

These are machines or implements designed primarily to plant seeds of crops such as cowpea, cotton and cereals.

**TYPES OF PLANTERS**

- (i) Broadcast crop planter
- (ii) Row crop planter
- (iii) Precision planter
- (iv) Grain drill planter

**6. HARVESTERS**

These are machines or implement designed primarily to facilitate the process of harvesting various crops.

**TYPES OF HARVESTERS**

- (i) Mower
- (ii) Forage harvesters
- (iii) Combine harvesters

**7. SPRAYERS**

These are types of equipment designed to spray certain chemicals in various farm operations.

**TYPES OF SPRAYERS**

- (i) Knapsack (Pneumatic Sprayer)
- (ii) Tractor mounted sprayer
- (iii) Helicopter-mounted sprayer

**FUNCTIONS OF SPRAYERS**

- (i) It can be used to control the growth of weeds.
- (ii) It can be used to control the effects of pest.
- (iii) It can be used to spray disinfectant.

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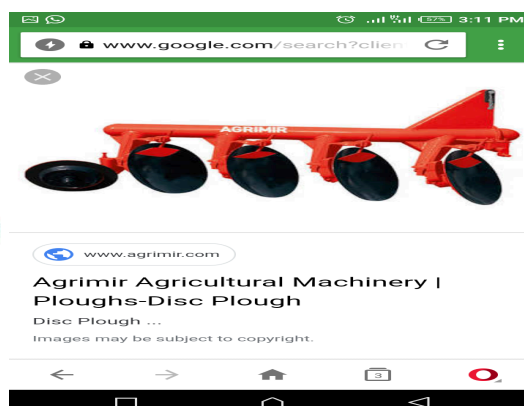
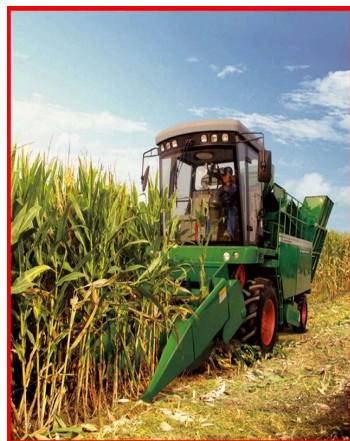
- (iv) It can be used for light irrigation.
- (v) It can be used to spray liquid fertilizer.

### ACTIVITY

Draw the knapsack sprayer and state the functions of the label parts.

### GENERAL EVALUATION

1. State five precautions to take while using sprayers
2. List five maintenance of sprayings
3. List three types of planters
4. State three functions of tractors
5. List three types of harvesters



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[www.indiamart.com](http://www.indiamart.com)

### Nine Tine Cultivator (Heavy Duty) - Banaras Tractor House ...

Nine Tine Cultivator (Heavy Duty)

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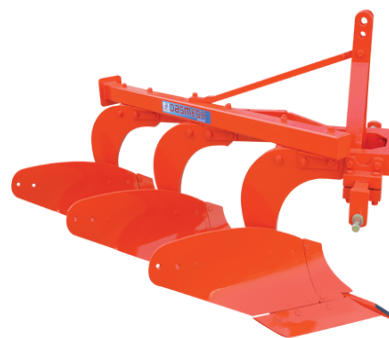
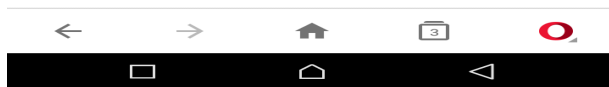


[www.deere.com](http://www.deere.com)

### 5M/5R/5 Series Specialty Tractors for sale | John Deere US

Studio image of 5075m Utility tractor

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### READING ASIGNMENT

Essential Agricultural Science for Senior Secondary Schools by O.A. Iwena, Chapter 12, pages 101-115

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### WEEKEND ASSIGNMENT

1. The most useful farm machinery among this is \_\_\_\_ (a) tractor (b) bulldozer (c) tree puller (d) mower
2. The part of tractor which is used for lifting implement is \_\_\_\_ (a) PTO shaft (b) hydraulic system (c) top shaft (d) combustion engine
3. The machines used for removing seeds from the husk is called \_\_\_\_ (a) shellers (b) mowers (c) tractor (d) bulldozer
4. The machines which are used for hatching eggs is \_\_\_\_ (a) incubator (b) mower (c) milking machine (d) candle
5. Which of these is not a tractor coupled implement? (a) plough (b) harrow (c) ridger (d) emasculator

### SECTION B

1. (a) List five daily maintenance of tractor.  
(b) List five periodic maintenance of tractor.
2. (a) What is farm machinery?  
(b) List five uses of tractor.

### WEEK FOUR AND FIVE

#### TOPIC: SURVEYING AND PLANNING OF FARM STEAD CONTENT

- MEANING
- IMPORTANCE
- COMMON SURVEYING EQUIPMENT

#### MEANING OF FARM SURVEYING

Farm surveying is defined as the process of measuring and mapping out the position, topography, size and boundary of an area of farm land. It can also be defined as the process by which measuring of land is made on the farm.

#### IMPORTANCE OF FARM SURVEYING

1. It helps to determine the farm land.
2. It is useful for the preparation of feasibility studies.
3. It ensures proper use of the farm land.
4. It helps in proper location of the farm building.
5. Farm maps or soil maps are useful in planning the farm stead.
6. The results of farm survey are used for soil classification.
7. It can be used to make projection of future yield.
8. It can be used as collateral for loan.
9. It can be useful for the acquisition of C of O.
10. It can be used to determine the gradient of the farmland.

#### EVALUATION

1. What is farm surveying?
2. List five importance of farm surveying.

#### SOME COMMON SURVEYING EQUIPMENT AND THEIR USES

1. **RANGING POLE**

## FIRST TERM Agricultural Science E-LEARNING NOTE

### DESCRIPTION

- (i) It is made up of wood or metal.
- (ii) It is of varying length e.g 1.8, 2.4, 3m.
- (iii) It is usually painted black, bright red and white to enable it to be seen from distance.
- (iv) It has a pointed end.

### FUNCTIONS

- (i) It is useful for making stations.
- (ii) It is also used for making a straight line.

## FIRST TERM Agricultural Science E-LEARNING NOTE

### 2. GUNTER'S CHAIN

#### DESCRIPTION

- (i) It consists of a series of dumb bell shaped links of steel wire joined together by three small rings.
- (ii) The length is normally 20.13m (66ft).
- (iii) The chain is entirely metallic.

#### FUNCTION

It is used to take short detailed measurement of length and breadth.

#### PRECAUTIONS WHEN CHAINING THE FARM LAND

- (i) Pull taut chains, tapes or ropes.
- (ii) Avoid errors of transporting figure on papers.
- (iii) All chains, tapes, ropes e.t.c must be properly aligned before taking measurement.
- (iv) Avoid errors of parallax when reading measurements.
- (v) Make sure the chain is not faulty before use.

### 3. MEASURING TAPE

#### DESCRIPTION

- (i) It is usually made of line or fine steel sheet.
- (ii) It is marked on one side with metric units and the other side with the imperial unit.
- (iii) The tape is normally wound in a small ease from where it is unwound for use.

#### FUNCTION

It is used for taking measurement of length breadth and height.

### 4. PRISMATIC COMPASS

#### DESCRIPTION

- (i) It is normally placed on a stand.
- (ii) It has a prism.
- (iii) It has a compass card marked in degrees, half degrees, minutes and seconds, in a clockwise direction.
- (iv) It has a straight slot.

#### FUNCTION

It is used in taking bearings. It is also used in measurement of angular, distances.

### 5. THEODOLITE

#### DESCRIPTION

- (i) It consists of tripod stand, made of wood or lightweight metal in solid or telescope legs.
- (ii) The tripod stand forms the base of the instruments.
- (iii) It has a lower plate which contains the graduated horizontal circle made of glass or brass.
- (iv) It has a spirit level which is used to define horizontal plain against, which angles of elevation or depression are measures.

#### FUNCTION

It is used to measure horizontal or vertical angles or planes.

### 6. ARROW OR PIN

#### DESCRIPTION

- (i) This is a thin pointed steel wires of about 30cm long with one end curved into a ring.



## FIRST TERM Agricultural Science E-LEARNING NOTE

- (ii) A red cloth is normally attached to the ring so that it can be seen from afar.

### **FUNCTION**

- (i) It is used during chaining for marking off chain length as measured.
- (ii) It can also be used for making stations.

### **7. OFFSET STAFF**

#### **DESCRIPTION**

- (i) This is graduated rod 3m long.
- (ii) A hook may be fitted at the top for the purpose of pulling a chain through a hedge.
- (iii) Each telescopic link is 0.3m (30cm) in length.

#### **FUNCTION**

It is used for taking short offset measurement.

### **8. BEACON OR PILLAR**

#### **DESCRIPTION**

- (i) It is made of rectangular block usually in concrete form.
- (ii) Marks are usually inscribed on top of the block.
- (iii) The beacons are always buried in the ground with the marked head raised a little above ground.

#### **FUNCTION**

- (i) It is used for marking point off measured.
- (ii) It is also used for recognition of the measured or surveyed area.

### **GENERAL MAINTENANCE OF SURVEYING**

- (i) All instruments must be cleaned after use.
- (ii) Keep instruments in dry and cool place.
- (iii) Metal parts should be oiled, greased or painted before storage.
- (iv) Keep them away from rain and heat to prevent rusting.
- (v) Replace worn out parts.
- (vi) Use the instruments only for the intended functions.
- (vii) Let competent surveyor handle and use the instruments only.

### **EVALUATION**

1. List seven surveying instruments and state their uses.
2. List five general maintenance of surveying instruments.

### **MEANING AND IMPORTANCE OF FARMING PLANNING**

Farm planning is a drawing or outline of a farm stead in order to put the land into use for which is best suited.

#### **IMPORTANCE OF FARM PLANNING**

- (i) It enables farmer to make proper use of land.
- (ii) It ensures proper siting of certain buildings or structures in certain locations within farm stead.
- (iii) It ensures the location of livestock building in relation to other farm building.
- (iv) It promotes neatness and prevents pollution within farm stead.

#### **FARM STEAD**

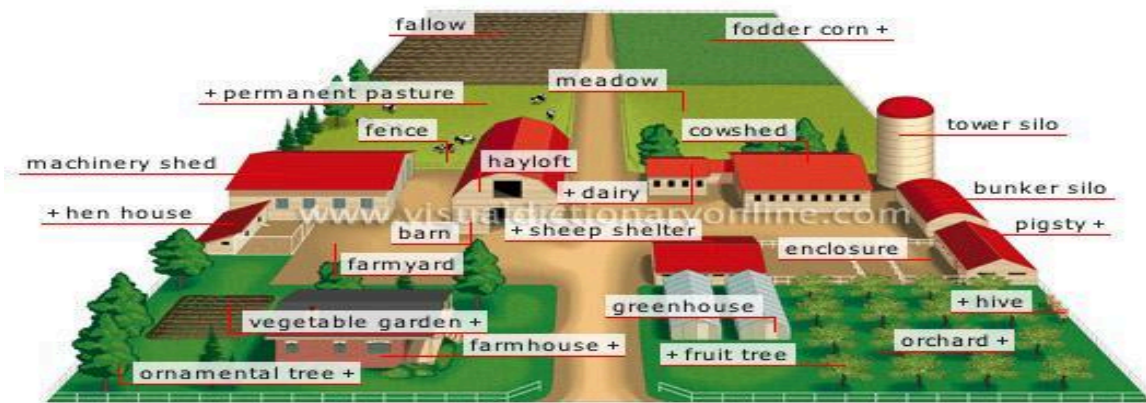
Farm stead can be defined as a farm house and all its production and processing structures. Farm stead is both a home and a production center.

## FIRST TERM Agricultural Science E-LEARNING NOTE

### FACTORS INFLUENCING THE SITING OF FARMS OR FARM STEAD

These factors include:

1. Topography
2. Soil type
3. Accessibility
4. Water supply
5. Health /Hygiene
6. Nearest to market
7. Drainage



### REASONS FOR PLANNING FARMSTEAD

1. It allows for proper utilization of resources without wastage.
2. It makes farmer to be more responsive to market demand.
3. It encourages the efficiency of farm activities.
4. It makes coordination and control of farm operation easier.

### PRINCIPLE OF FARMSTEAD LAYOUT

1. Plant crops on the best soil within the farm.
2. Livestock building should be located in the poorest soil within the farm.
3. Buildings should be located in easily accessible areas.
4. Farm buildings should not be located on slope to avoid erosion.
5. Residential and office buildings should be located far away from livestock building to avoid noise and unpleasant smells.

### EVALUATION

1. What is farm planning?
2. List five factors influencing the siting of farmstead or farm.

### CALCULATIONS OF AREA OF FARMLAND AND PLANT POPULATION

- (a) Area of farmland: This is the area of shape of the farm e.g.  $L \times B$  for rectangular,  $\frac{1}{2}bh$  for triangle.
- (b) Number of plant stand /plant population: This is the number of plants in an area of farm land.

## FIRST TERM Agricultural Science E-LEARNING NOTE

Mathematically:

$$\text{Plant population} = \frac{\text{Area of farm land (m}^2\text{)}}{\text{Spacing (m}^2\text{)}} \times \frac{\text{Area of farm land (m}^2\text{)}}{\text{Spacing (m}^2\text{)}}$$

- (c) Spacing: This is the distance between one crop plant and the next plant e.g. 60cm by 30cm.

Note that one hectare = 100,000m<sup>2</sup>

Example:

If the length and width of a farmland are 60m x 30m.

Calculate

- (a) the area of the farmland
- (b) the plant population (tomatoes) in the given area
- (c) the total population if there are two plants per stand

Solution

- (a) Area of the farmland  
= Length x Width  
= 60m x 30m  
= 1800m<sup>2</sup>

- (b) Spacing of crop = 30cm x 30cm  
Or 0.3m x 0.3m

Area of 1 stand of crop = 0.3m x 0.3m  
= 0.09m<sup>2</sup>

$$\begin{aligned} \text{No of stand/crop} &= \frac{\text{Area of farm land (m}^2\text{)}}{\text{Spacing (m}^2\text{)}} \times \frac{\text{Area of farm land (m}^2\text{)}}{\text{Spacing (m}^2\text{)}} \\ &= \frac{1800\text{m}^2}{0.09\text{m}^2} \times \frac{1800\text{m}^2}{0.09\text{m}^2} \\ &= 20,000 \text{ crops stands} \end{aligned}$$

The plant population of tomatoes is 20,000 stands

- (c) Since there are two plant population  
= 20,000 x 2  
= 40,000 tomatoes plants

### GENERAL EVALUATION

1. What farm survey?
2. List five surveying equipment and state their uses.
3. What is farmstead?
4. List five factors influencing the siting of farmstead.
5. List five factors coupled implements.

### READING ASSIGNMENT

Essential Agricultural Science for Senior Secondary Schools by O.A. Iwena, Chapter 22, pages 214 - 222

### WEEKEND ASSIGNMENT

1. The surveying equipment used for taking bearings and angular distances is \_\_\_\_\_  
(a) tape (b) ranging pole (c) offset staff (d) prismatic compass
2. The instrument used for measuring horizontal and vertical angles for planes is \_\_\_\_\_  
(a) theodolite (b) pins (c) beacon (d) tape
3. Which of these is not a factor influencing the siting of farmstead (a) topography

## FIRST TERM Agricultural Science E-LEARNING NOTE

- (b) soil type (c) accessibility (d) weather
4. One hectare is \_\_\_\_ square meters (a) 1000 (b) 10,000 (c) 100,000 (d) 1 million
5.  $\frac{1}{2}(A+B)H$  is the area of \_\_\_\_ (a) triangle (b) square (c) trapezium (d) rhombus

### SECTION B

1. (a) What is farm surveying?  
(b) List four surveying equipment and state their uses.
2. (a) Define a farmstead.  
(b) Enumerate the importance of farm surveying and planning in agriculture.

## **FIRST TERM Agricultural Science E-LEARNING NOTE**

### **WEEK SIX**

#### **TOPIC: IRRIGATION AND DRAINAGE**

#### **CONTENT**

- Meaning
- Types
- Advantages and Disadvantages

#### **IRRIGATION**

This is the artificial application of water to soil or land for farming purposes.

#### **FACTORS THAT DETERMINES IRRIGATION SYSTEM**

1. Availability of water.
2. Slope of the land.
3. Soil type.
4. Type of crop.
5. Size of the farmland.

#### **IMPORTANCE OF IRRIGATION IN CROP PRODUCTION**

1. Irrigation softens the soil for tillage operations.
2. It provides moisture in the soil for root absorption.
3. It reduces the amount of salt accumulated in the top soil which could be injurious to the crops.
4. It cools the soil, thereby reducing soil, thereby reducing soil temperature.
5. It enables crops to do well.
6. It increases crop productivity and yields.
7. It assists in production of crops all-round the year.
8. It helps in microbial decomposition and nutrient release to the soil.
9. It dissolves soil nutrient for root absorption.

#### **NEGATIVE EFFECTS OF IRRIGATION**

1. It provides humid environment which favours the buildup of pests and diseases.
2. It encourages the spread of weeds seeds.

#### **EVALUATION**

1. What is irrigation?
2. List two negative effects of irrigation.

#### **TYPES OF IRRIGATION SYSTEMS**

The three types of irrigation systems are:

1. Surface irrigation
2. Sub-surface irrigation
3. Overhead irrigation

#### **SURFACE IRRIGATION**

In this system, water from rivers, dams or stream flows along the surface of the land to the farmland. This can be in form of channels, flooding, contour ditch, furrow, basin etc. This type of irrigation requires a gentle slope to be successful.

#### **ADVANTAGES OF SURFACE IRRIGATION**

## **FIRST TERM Agricultural Science E-LEARNING NOTE**

1. It removes excess water caused by heavy rainfall.
2. It is easier to establish or setup.
3. It is cheap to maintain.
4. It prevents accumulation of alkali.
5. It increases activities of microbes in the too soil.

### **DISADVANTAGES OF SURFACE IRRIGATION**

1. It cannot be practiced where land is hilly.
2. It cannot be successful in a sandy soil.
3. The volume of water, especially in flooding may be difficult to control.
4. Some crops may not tolerate heavy flooding.

### **SUB SURFACE IRRIGATION**

In this system, water is applied below the soil surface. It involves the use of perforated pipes to deliver the water within the soil. This water gets to the root through capillary action.

### **ADVANTAGES OF SUBSURFACE IRRIGATION**

1. It is possible to maintain water at optimum depth for crop need.
2. Water used efficiently.
3. It ensures low evaporation loses from the soil.
4. It does not create obstruction when carrying out cultural practices.

### **DISADVANTAGES OF SUBSURFACE IRRIGATION**

1. Water with high salt content cannot be used.
2. It requires some level of expertise or technical-know-how.
3. It is a bit expensive.

### **OVERHEAD IRRIGATION**

In this system, water is supplied to the farmland above the surface of the soil.

### **PROBLEMS ASSOCIATED WITH OVERHEAD IRRIGATION**

1. Wind can cause uneven distribution of water by distorting sprinkler pattern.
2. The spray force can damage ripening of soft fruits.
3. A stable water supply is needed for economic use of the equipment.
4. The initial investment is usually high.
5. Power requirement for pumping water is high.
6. Requires technical-know-how.
7. It can spread diseases.
8. Laterals pipes hinder the movement of farm machines.
9. High cost of maintenance, repair and spare parts.

There are two types of overhead irrigation:

- i. Drip irrigation
- ii. Sprinkler irrigation

### **SPRINKLER IRRIGATION**

In this system, water is sprayed from the air and allowed to fall on the ground like rain through nozzle under pressure.

## **FIRST TERM Agricultural Science E-LEARNING NOTE**

### **ADVANTAGES OF SPRINKLER IRRIGATION**

1. The amount of water supplied is regulated.
2. It economises the use of water.
3. It is suitable for arid lands with high evapo-transpiration rate.
4. It can be used for all crops except tree crops.
5. Soluble fertilizers and herbicides can be applied through the irrigation water.

### **DISADVANTAGES OF SPRINKLER IRRIGATION**

1. Sprinkler irrigation is costly to operate.
2. High wind velocity may prevent distribution of water.
3. A stable water supply is required.
4. It requires high power to produce the high pressure needed to pump water into pipes.
5. There is lack of sufficient technical know-how on sprinkle irrigation.

### **DRIP IRRIGATION**

Drip irrigation is a method whereby water is discharged through nozzles called emitters or drippers at selected spacing to deliver water to the soil surface near the base of the plant.

### **ADVANTAGES OF DRIP IRRIGATION**

1. It is economical in the use of water.
2. It reduces salt concentration in the root zone.
3. Fertilizers can be applied through the system.
4. It operates with slower and arid areas.

### **DISADVANTAGES OF DRIP IRRIGATION**

1. It is very expensive to set up and maintain.
2. Water cannot be distributed in a sloppy farmland evenly.
3. Water with high salt content can be used.

### **EVALUATION**

1. Describe surface and sub-surface irrigation.
2. Discuss the two types of overhead irrigation.

### **PROBLEMS ASSOCIATED WITH IRRIGATION**

1. Inadequate water supply for irrigation.
2. Irrigation equipment is expensive.
3. Pests from surrounding may invade irrigated areas and damage crops.
4. Disease causing organism increase with increased humidity.
5. Vectors eg. Snails and tsetse flies breed freely in irrigation areas.
6. Lack of technical-know-how.
7. Excessive dissolution of salt affects crops.
8. It disturbs free movement of farm machinery.

### **HOW TO REDUCE DISEASE BUILD UP IN IRRIGATION FARM**

1. Use of disease-resistant varieties.
2. Crop rotation.
3. Use of appropriate chemicals.
4. Use of clean tools.

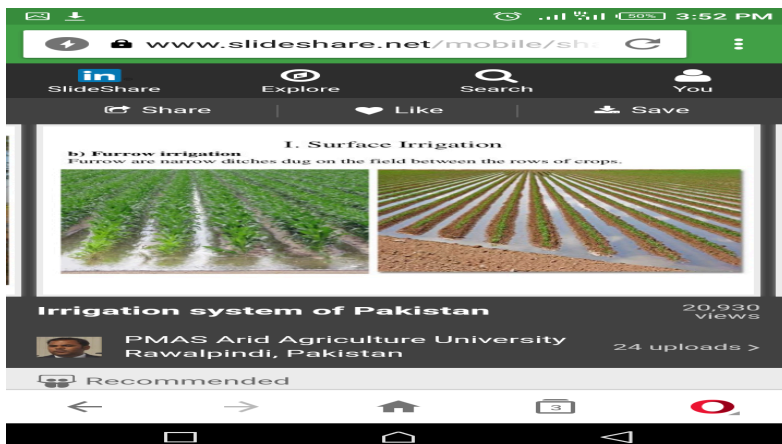
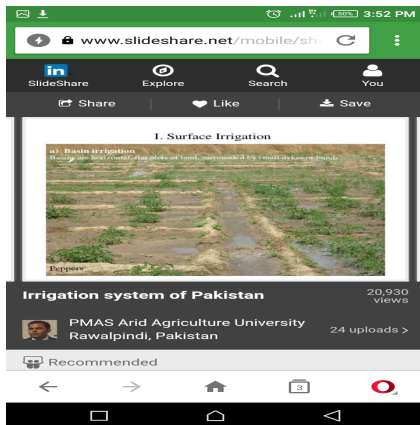
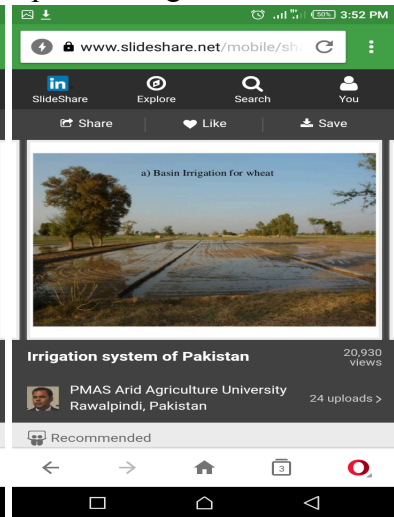
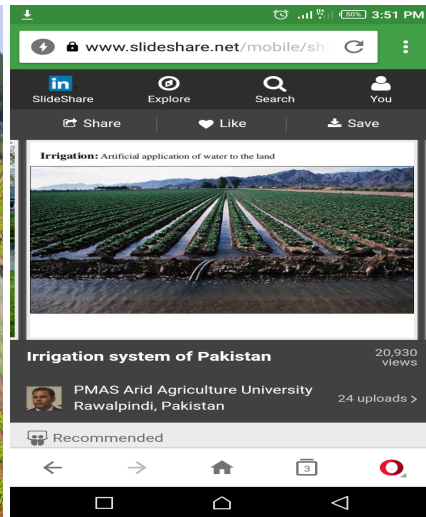


## FIRST TERM Agricultural Science E-LEARNING NOTE

5. Use of clean or healthy planting materials.
6. Destruction of infected crops to prevent spread of diseases.
7. Avoidance of excessive irrigation.
8. Weed control.

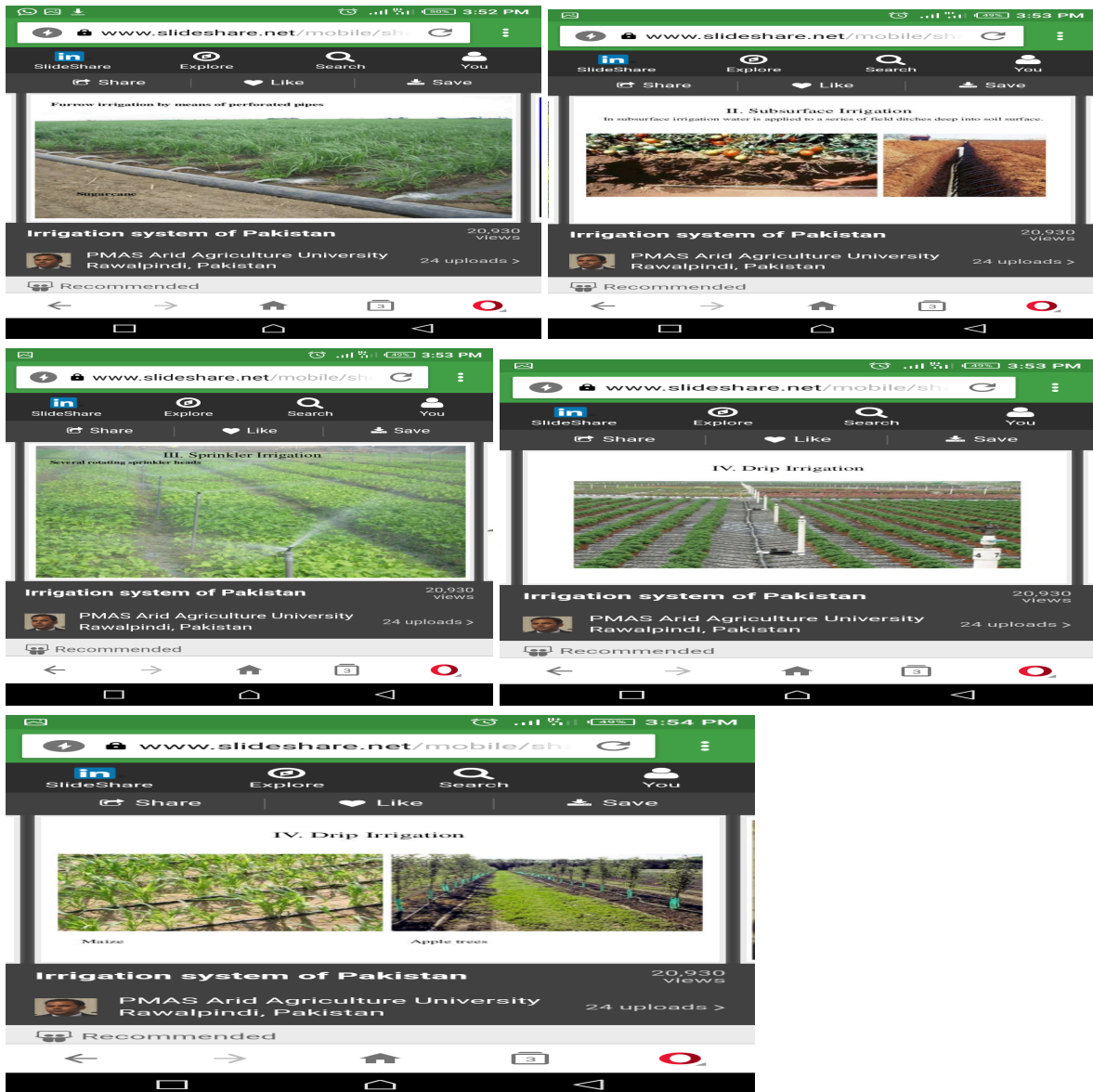
### EVALUATION

1. List five problems associated with irrigation.
2. List four things that can be done to reduce disease build up in an irrigation farmland.

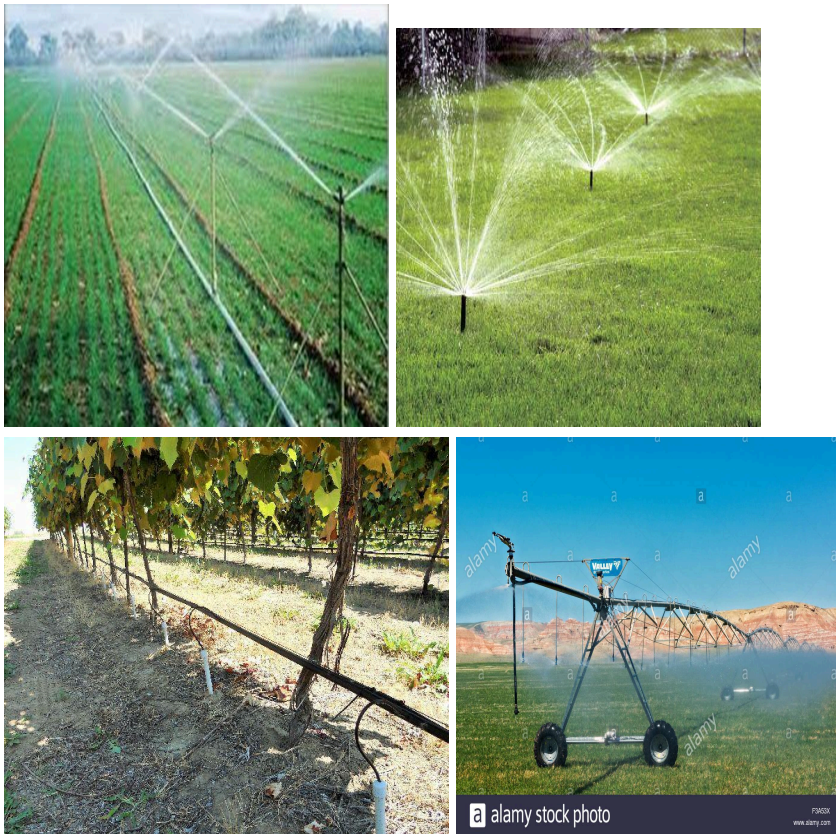




## FIRST TERM Agricultural Science E-LEARNING NOTE



## FIRST TERM Agricultural Science E-LEARNING NOTE



### DRAINAGE

Drainage is the process whereby excess water in the soil is removed artificially to promote good farming activities.

### IMPORTANCE OR EFFECTS OF DRAINAGE

1. It helps in regaining water logged soil for crop production.
2. It improves soil structure and water holding capacity of the soil.
3. It improves soil aeration for good root respiration.
4. It gives suitable condition for the growth of microbes which helps in decomposition.
5. It helps to increase soil temperature.
6. Drainage leaches excess salt from the soil which prevent poisoning and death of the plants.
7. It makes tillage operation easier.
8. It reduces incidence of crop diseases.
9. It enhances harvest of crops e.g swamp rice.
10. It enhances early planting of crops.
11. It makes land preparation easier.
12. It reduces soil acidity.
13. It increases soil temperature.
14. It increases crop production.
15. It makes soil workable soil and light.
16. It reduces soil salinity.

### TYPES OF DRAINAGE

1. Surface drainage
2. Sub-surface drainage

**FIRST TERM Agricultural Science E-LEARNING NOTE****SURFACE DRAINAGE**

This involves the orderly removal of excess water artificially from the surface of the land using constructed open ditches, field drains and land grading.

**ADVANTAGES OF SURFACE DRAINAGE**

1. It is relatively easy to construct.
2. It is cheaper than the sub surface drainage system.

**DISADVANTAGES OF SURFACE DRAINAGE**

1. It occupies good land (space) that could have been use for planting.
2. It hinders the passage of machines like tractor.
3. It is prone to gully erosion.
4. It requires frequent maintenance.
5. It increases the cost of production.
6. Farm mechanization is impaired.
7. It is expensive and difficult to establish.

**SUB SURFACE DRAINAGE**

This is the orderly removal of excess water from the land using tiles or moles or perforated pipes dug under the ground, it is also called underground drainage.

**ADVANTAGES OF SURFACE DRAINAGE**

1. It does not pose any threat to machines.
2. High values of crops are grown.
3. It leaves the field free from surface obstruction.
4. More land is made available for cultivation.
5. Cost of maintenance is low.
6. Drainage is faster and more efficient.

**DISADVANTAGES OF SUBSURFACE DRAINAGE**

1. It is very expensive to operate.
2. It cannot easily be constructed.
3. It is difficult to maintain.
4. It needs very deep excavation of the soil.

## FIRST TERM Agricultural Science E-LEARNING NOTE



### GENERAL EVALUATION

1. What is irrigation?
2. List four importance of irrigation in crop production.
3. List the three types of irrigation system.
4. What is farm machinery?
5. List five tractor couple implements.

### READING ASSIGNMENT

Essential Agricultural Science for Senior Secondary Schools by O.A. Iwena, Chapter 19, pages 204 - 208

### WEEKEND ASSIGNMENT

1. Artificial application of water to the farmland is \_\_\_\_ (a) irrigation (b) wetting (c) drainage (d) harvesting
2. Excess water is conducted away from the soil through \_\_\_\_ (a) irrigation (b) wetting (c) drainage (d) planting
3. The type of irrigation which can be done on a gentle slope is \_\_\_\_ (a) surface irrigation (b) subsurface irrigation (c) overhead irrigation (d) Sprinkler
4. The machine which is used to hatch eggs is \_\_\_\_ (a) tractor (b) incubator (c) milking machine (d) plough
5. The tool used in transplanting is \_\_\_\_ (a) cutlass (b) hoe (c) hand trowel (d) tractor

### SECTION B

1. (a) Define the term irrigation?  
(b) Discuss six problems associated with irrigation.
2. State and explain the two systems of drainage.

## **FIRST TERM Agricultural Science E-LEARNING NOTE**

### **WEEK SEVEN**

### **TOPIC: ENVIRONMENTAL FACTORS AFFECTING AGRICULTURAL PRODUCTION**

#### **ENVIRONMENTAL FACTORS AFFECTING AGRICULTURAL PRODUCTION**

These factors are grouped into three,

- a. Climatic factor
- b. Biotic factor
- c. Edaphic factor

#### **CLIMATIC FACTORS AFFECTING AGRICULTURAL PRODUCTION**

Climate is the average weather condition of a place over a long period of time. The elements of climate are: rainfall, humidity, light, temperature, drought, wind, sunlight, humidity e.t.c.

#### **RAINFALL**

Rainfall is defined as the release of excess condensed water vapour in the atmosphere into the earth.

1. It determines the distribution of crops and animal.
2. It is necessary for seed germination.
3. Excessive rainfall leads to leaching.
4. It helps to dissolve nutrients, making it available for the plants.
5. It determines the types of vegetation in an area.
6. It determines seasons in Nigeria.
7. Insufficient rainfall causes crop failure and poor yield.

#### **DROUGHT**

This is defined as lack of or insufficient rainfall in the area.

#### **EFFECTS**

1. It causes delay in flowering and flower abortion.
2. Poor crop establishment.
3. It leads to reduction in leaf area.
4. It reduces physiological process due to protoplasm dehydration.
5. Decrease in production of green matter.
6. Reduction in photosynthesis.
7. It causes wilting.
8. It causes death of plant and plant failure.

#### **TEMPERATURE**

This is the degree at hotness and coldness of a place.

1. Temperature is necessary for germination of seeds.
2. It affects the distribution of crops and the animals.
3. Too hot or too cold temperature does not favour plants and animal growth.
4. Unfavourable temperature may result in dormancy.
5. High temperature affects evapotranspiration and reduces the performance of livestock.
6. It affects wilting of field crops, ripening and maturity of crops.
7. It affects microbial activities in relation to mineralization.



## **FIRST TERM Agricultural Science E-LEARNING NOTE**

8. High temperature leads to loss of soil minerals by vitalization.
9. High temperature causes abortion in farm animals.
10. High temperature will cause heat stress and egg drop in poultry.

### **WIND**

Wind is defined as air in motion.

1. High wind velocity may cause wind erosion.
2. It aids seed and fruit dispersal.
3. It can aid pollination and spread of diseases.
4. It helps in the distribution of rainfall and changes in seasons.
5. High wind velocity causes damage to crops eg. Lodging.
6. It affects evapotranspiration.

### **SUNLIGHT/SUNSHINE/ SOLAR RADIATION**

Sunshine is the amount of heat and the period the sun's rays are received at a place.

1. Sunlight is necessary for photosynthesis.
2. It affects evapotranspiration.
3. It affects productivity of crops due to the length of day i.e photoperiodism.
4. Light affects the rising and roosting of animals.
5. It affects the rate of production in poultry.
6. It determines the productivity of cultivated crops.
7. Solar radiation is a source of farm power.
8. It assists in drying of crops.
9. It assists in photosynthesis in crops.
10. High intensity causes heat stress in animals.

### **RELATIVE HUMIDITY**

Relative Humidity is defined as the amount of moisture in the atmosphere.

1. It results in formation of rain.
2. It affects the performance of plants and animals.
3. It causes mouldiness of feeds and litters.
4. Low humidity causes aridity or dryness.
5. It determines the type of crops grown in an area.
6. Low humidity leads to heat stress in animals e.g cattle, poultry, pig.
7. It determines the type of crops grown in an area.
8. High humidity favours the growth of pathogens.
9. It affects feed and water intake in animals.

### **EVALUATION**

1. List five climate factors affecting agricultural production.
2. State two effects of rainfall.

### **BIOTIC FACTORS AFFECTING AGRICULTURAL PRODUCTION**

#### **SOIL ORGANISMS**

1. These include bacteria, fungi, earthworms, rodents and termites.
2. Bacteria and fungi can cause diseases.
3. Some aid aeration of soil, percolation and fertility.
4. Root nodules of bacteria can fix nutrients directly to plants and soil.
5. Help in decomposition of plant materials to form humus.

## **FIRST TERM Agricultural Science E-LEARNING NOTE**

### **PESTS**

1. These includes insects, rodents, birds and some mammals.
2. They reduce the yield of crops and animals.
3. They reduce the quality of crops and animals.
4. Some are vectors or carriers of diseases.
5. They reduce the income of farmers.
6. They increase the cost of production.

### **PARASITES**

1. They include tick, liverflukes, tapeworms, dodder, mistletoe and like.
2. Some transit diseases.
3. They reduce the quantity or yield of production.
4. They reduce the quality of yield.
5. They cause the death of plants and animals.
6. They reduce the production capacity of livestock or crops.
7. Cost of control increases the cost of production.
8. They reduce farmers' income.

### **EVALUATION**

1. List four biotic factors affecting agricultural production.
2. List two effects each of soil organism pests, parasites and diseases on agricultural production.

### **EDAPHIC FACTORS AFFECTING AGRICULTURAL PRODUCTION**

#### **SOIL PH**

1. It affects the growth of plants.
2. It also affects the availability of soil nutrients to plants.
3. It affects the presence of soil microorganism.
4. It causes toxicity to plants and animals in the soil.

#### **SOIL TEXTURE**

1. It determines the type of soil in an area.
2. It determines the level of soil fertility.
3. It determines the type of crop to be grown.
4. It affects the level of leaching and erosion.

#### **SOIL STRUCTURE**

1. It determines the fertility of the soil.
2. It determines the water holding capacity of the soil.
3. It determines the level of soil organism.
4. It determines the level of soil aeration and percolation.

#### **TOPOGRAPHY**

This is the shape of the land in relation to the underlying rocks of the earth surface.

1. Steep gentle slope gives rise to soil erosion.
2. Steep gentle slope may also aid the weathering of rocks.
3. Even or flat slope can lead to accumulation of soil.
4. Even and flat slopes can be better sites for intensive farm.

## **FIRST TERM Agricultural Science E-LEARNING NOTE**

### **SOIL FERTILITY**

1. Fertile soils aid the production of food and cash crops.
2. A fertile soil produces better forage crops.
3. It minimizes the use of fertilizer.
4. It leads to multiplication of beneficially soil organism.
5. Fertile soil leads to reduction in the cost of production.

### **SOIL TYPES**

1. The types include sandy, clay and loamy soil.
2. Loamy soil is the best for agriculture.
3. Sandy soil does not contain enough nutrients, hence it cannot support plant growth.
4. Sandy soil encourages leaching.
5. Clayed soil prevents leaching but encourages water logging.

### **GENERAL EVALUATION**

1. List five edaphic factors affecting agricultural production.
2. List five biotic factors affecting agricultural production.
3. List three effect of solar radiation on agricultural production.
4. State five problems associated with irrigation.
5. State five effects of temperature on agricultural production.

### **READING ASIGNMENT**

Essential Agricultural Science for Senior Secondary Schools, Chapter 9, pages 48 – 59

### **WEEKEND ASSIGNMENT**

1. The following are climate factors except (a) soil types (b) humidity (c) temperature (d) light
2. Which of the following is not an edaphic factor (a) soil PH (b) soil fertility (c) soil water (d) topography
3. The following are types of erosion except \_\_\_\_ (a) splash (b) rill (c) sheet (d) mulch
4. The washing away of soil nutrients down beyond the reach of the root is \_\_\_\_ (a) erosion (b) leaching (c) mulching (d) staking
5. High humidity is responsible for \_\_\_\_ (a) dryness (b) water logging (c) rainfall (d) erosion

### **SECTION B**

1. Discuss four biotic factors affecting agricultural production
2. State two effects each of soil PH, soil texture and rainfall on Agricultural production

## **WEEK EIGHT**

### **TOPIC: PLANT NUTRIENTS AND NUTRIENT CYCLES**

#### **CONTENT**

- Classify plant nutrients
- Functions and deficiency symptoms of nutrients
- Nutrient cycles

### **PLANT NUTRIENTS AND NUTRIENT CYCLES**

Plant nutrients are classified into two, these includes macronutrient and micronutrient.



## FIRST TERM Agricultural Science E-LEARNING NOTE

### MACRONUTRIENTS

These are mineral elements or nutrients required by crops in large quantities. Examples are: nitrogen, phosphorus, potassium, magnesium, calcium and sulphur.

### MICRONUTRIENT OR TRACE ELEMENTS

These are mineral elements or nutrients required by crops in small quantities. Examples are: Zinc, Copper, boron, molybdenum, Iron, Chlorine and Manganese.

### FUNCTIONS AND DEFICIENCY SYMPTOMS OF PLANT NUTRIENTS

S/N	ELEMENT	FUNCTION	DEFICIENCY SYMPTOMS
1.	Nitrogen	<ul style="list-style-type: none"> <li>i. Aids plant's growth and reproduction</li> <li>ii. Promotes vegetative and short system growth</li> <li>iii. Excess Nitrogen delay maturation and fruiting</li> <li>iv. Promotes chlorophyll formation</li> <li>v. Necessary for synthesis of plant hormones</li> </ul>	<ul style="list-style-type: none"> <li>i. Stunted growth</li> <li>ii. Yellowing of leaves</li> <li>iii. Leaves tend to drop</li> <li>iv. Poor formation of fruits and flowers</li> </ul>
2.	Phosphorus	<ul style="list-style-type: none"> <li>i. It aid enzyme reactions</li> <li>ii. It is a constituent of cell division</li> <li>iii. Increases soil resistant to diseases</li> <li>iv. Helps in ripening of fruits</li> <li>v. Help in root development and seed germination</li> <li>vi. Aids seed germination</li> </ul>	<ul style="list-style-type: none"> <li>i. Logging results in cereal crops</li> <li>ii. Stunted growth</li> <li>iii. Leaves turn purple and brownish in colour</li> <li>iv. Poor root development</li> <li>v. Immature fruit drop</li> </ul>
3	Potassium	<ul style="list-style-type: none"> <li>i. Important constituent of plant tissues</li> <li>ii. Aids synthesis of carbohydrates</li> <li>iii. Activates various plant enzyme reactions</li> <li>iv. Promotes development of young plants</li> <li>v. Helps in nitrate uptake in the soil</li> </ul>	<ul style="list-style-type: none"> <li>i. Weak slender stems</li> <li>ii. Delayed growth</li> <li>iii. Premature loss of leaves</li> <li>iv. Brown colour at margin of leaves</li> </ul>
4	Calcium	<ul style="list-style-type: none"> <li>i. Strengthens plant cell with calcium pectate</li> <li>ii. Helps in translocation and storage of carbohydrate and proteins in seeds and tubers</li> <li>iii. Necessary for normal growth of root tips</li> <li>iv. It controls toxicity of aluminum, manganese and sodium ions</li> </ul>	<ul style="list-style-type: none"> <li>i. Causes stunting of root system</li> <li>ii. Weak slender plants</li> <li>iii. Pale yellow colour of leaves</li> </ul>

## FIRST TERM Agricultural Science E-LEARNING NOTE

		v. It improves soil PH	
5	Magnesium	i. It is important in the synthesis of carbohydrate as it is a constituent of chlorophyll ii. It assists in transportation of phosphate for fruit seeds development iii. It enhances plant growth iv. It is required for normal cell division v. Necessary for synthesis of soil in plants	i. Chlorosis along leaf veins ii. Stunted growth Premature leaf fall

### EVALUTION

1. Give five examples each of macro and micro nutrients.
2. State the functions and deficiency symptoms of sulphur, iron, manganese copper, zinc, boron and molybdenum.

### NITROGEN CYCLES

Nitrogen cycles refer to the circulation of certain nutrients like nitrogen, carbon and water in nature.

Nitrogen cycle is the nature's way of regulating the amount of Nitrogen in the soil and air

#### Ways by which Nitrogen is added to the soil in Nitrogen Cycle

1. Direct fixation by lightening during rainfall.
2. Incorporation into the soil by free living bacteria or non-symbolic bacteria.
3. Nitrogen fixing bacteria in the root nodules.
4. Decomposition of organic matter.
5. Application of Nitrogen fertilizer.
6. Ammonification.
7. Nitrification.

#### Soil can gain Nitrogen through the following ways

1. Symbiotic Nitrogen Fixation
2. Electrical discharge
3. Non symbiotic Nitrogen Fixation
4. Ammonification and Nitrification
5. Application or organic manure and Nitrogen fertilizers

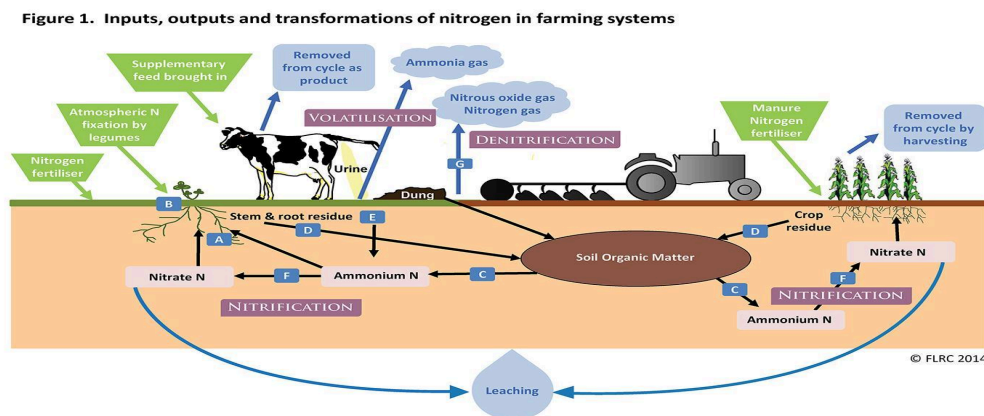
#### Ways by which nitrogen is lost from the soil are:

- i. By Denitrification
- ii. Soil erosion
- iii. Leaching
- iv. Soil PH
- v. Bush burning
- vi. Crop removal
- vii. Volatilisation
- viii. Oxidation reaction
- ix. Reduction reaction

## FIRST TERM Agricultural Science E-LEARNING NOTE

### Processes that lead to formation of Nitrate from organic matter in Nitrogen Cycle

1. Putrefaction: Delay of plant and animal remains into similar nitrogenous compounds by microorganism
2. Amminization: Products from putrefaction reactions converted to simple amino compounds and animal
3. Ammonization: Conversion of amino compounds and amines into ammonium compounds
4. Nitrification: Oxidation of ammonium compounds into nitrites and Nitrates



### CARBON CYCLE

This involves the series of processes which contribute to the circulation of carbon in nature.

#### Explanation

- i. Carbondioxide is removed from the air mainly by photosynthesis
- ii. Carbon is lost in form of carbonates of calcium and magnesium through leaching and drainage.

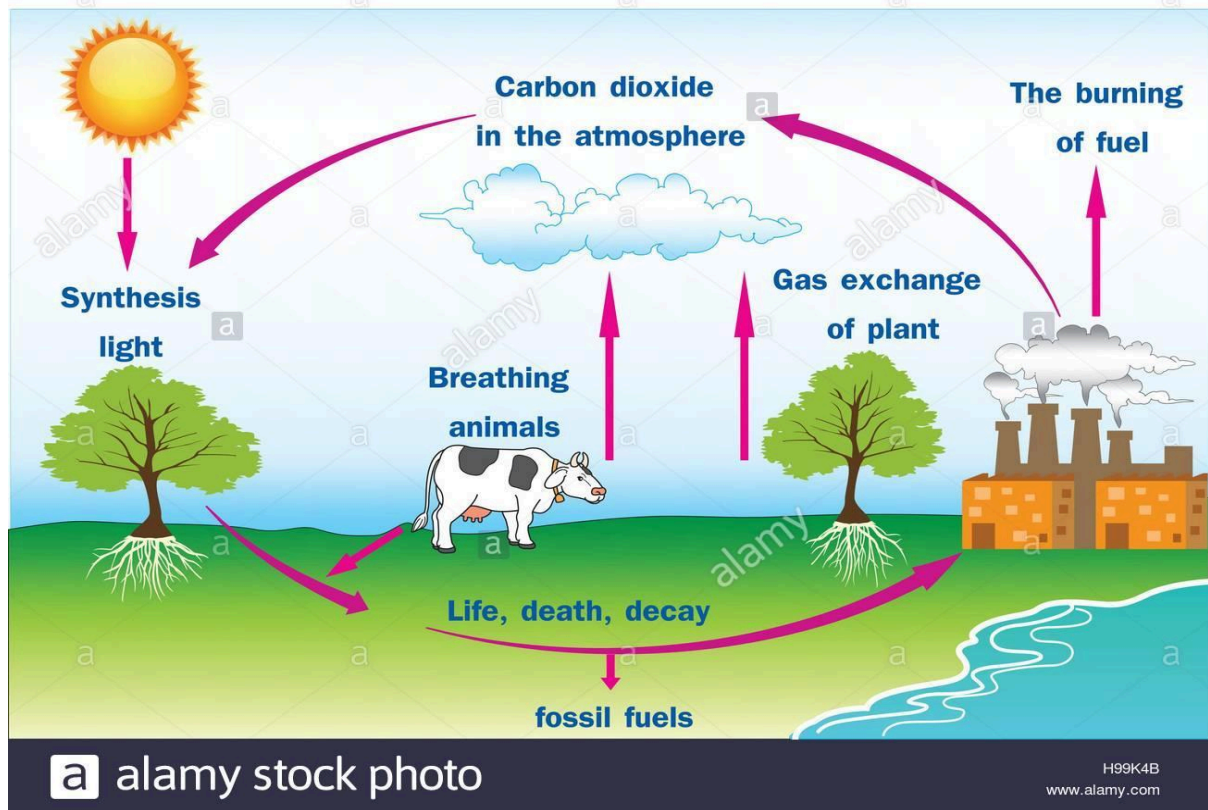
The atmosphere gains carbondioxide through

1. Burning of fuel like coal and wood
2. The action of volcanoes which releases carbon dioxide
3. The respiration of plants and animals
4. Death and delay and putrefaction of plants and animals
5. Diffusion of carbon dioxide from seas and other bodies of water

### IMPORTANCE OF CARBON CYCLE

1. Plant use carbondioxide obtained from the air to manufacture their food during photosynthesis
2. Provision of carbon which is the essential building block of all organic matters
3. Organic matter which is made from carbon helps to replenish soil nutrients.

# Carbon cycle



## WATER CYCLE

This is the continuous movement of water from the atmosphere to the earth and from the earth to the atmosphere.

### The atmosphere receives water through

1. Evaporation from oceans and land
2. Transpiration from plants
3. Breathing and respiration by plants and animals

### Land receives water through:

1. Rainfall and precipitation
2. Infiltration and percolation

## FORMS IN WHICH WATER EXISTS IN THE SOIL

1. Hygroscopic water
2. Capillary water
3. Gravitational water

### Ways of conserving water in the soil

1. Stoppage or reduction of water-run-off
2. Addition of humus or organic matter
3. Removal of weeds to reduce transpiration and water loss
4. Mulching
5. Cover cropping

## FIRST TERM Agricultural Science E-LEARNING NOTE

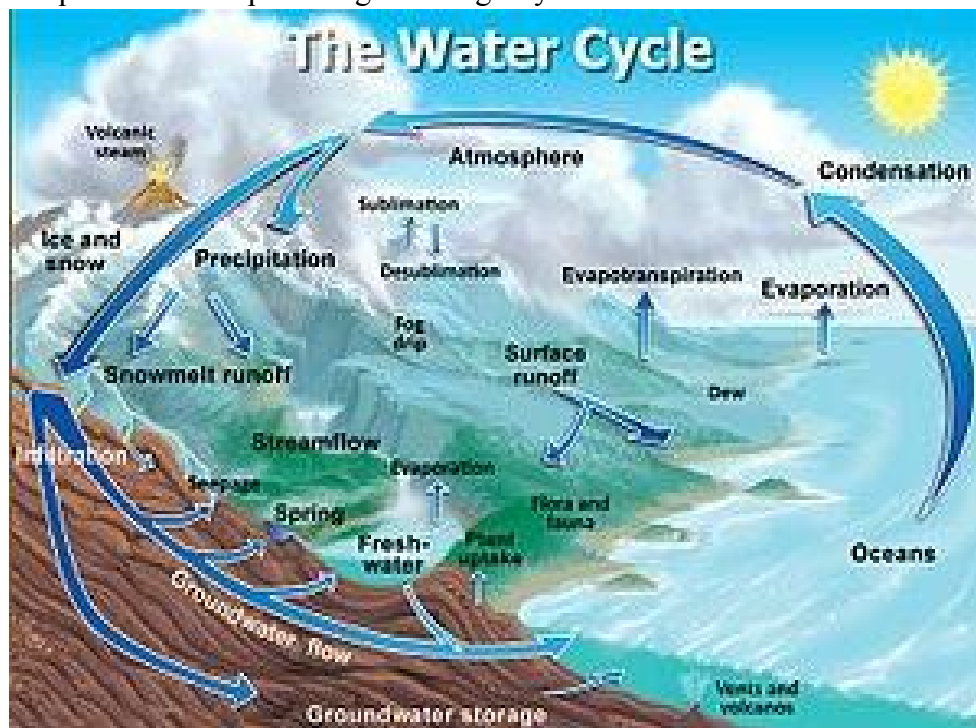
6. Contour ridging
7. Appropriate tillage
8. Strip cropping

### EVALUATION

1. Explain Nitrification.
2. List five ways the soil can gain nitrogen.

### IMPORTANCE OF WATER TO CROPS

1. Water provides the medium for absorption of minerals salts
2. It facilitates transfer of nutrients to other parts of plants
3. It is an essential raw material during photosynthesis
4. Facilities enzymatic activities occurring in crop plant protoplasm
5. It is a constituent of protoplasm
6. It has cooling effect on crops
7. It helps to sustain life
8. It helps in seed germination
9. It helps to maintain plant turgor or turgidity



### GENERAL EVALUATION

1. List five importance of water to crops.
2. List three form which water exist in the soil.
3. List three ways by which Nitrogen is lost from the soil.
4. What is macro nutrient? List five examples.
5. What are micronutrients? List five examples.

### READING ASIGNMENT

Essential Agricultural Science for Senior Secondary Schools by O.A. Iwena, Chapter 18, pages 187 – 201

## FIRST TERM Agricultural Science E-LEARNING NOTE

### WEEKEND ASSIGNMENT

1. The conversion of nitrates to nitrogen gas by certain bacteria is \_\_\_\_ (a) oxidation (b) reduction (c) nitrification (d) de-nitrification
2. Microbial decay of plant and animal remains into simpler nitrogenous compound is \_\_\_\_ (a) nitrification (b) putrefaction (c) leaching (d) burning
3. The washing away of soil nutrient down beyond the reach of the root is called \_\_\_\_ (a) erosion (b) mulching (c) leaching (d) fertilization
4. The following are macro nutrients expect (a) boron (b) nitrogen (c) magnesium (d) calcium
5. Which of these is not a micro-element? (a) copper (b) zinc (c) boron (d) potassium

### SECTION B

1. (a) Differentiate between macro and micro nutrients  
(b) List three factors influencing nutrient availability in the soil
2. (a) State three function of Nitrogen to plants  
(b) State three importance of organic matter in Agricultural

### WEEK TEN

#### TOPIC: FARMING PRACTICES

#### CONTENT

- Types of farming practices
- Methods of Replenishing lost nutrients
- Factors influencing nutrient availability in the soil

#### FARMING PRACTICES

The following farming practices have consequences or effects on the soil;

#### 1. BUSH BURNING

This involves the setting of fire on the bushes to clear out the vegetation

##### MERITS

- a. It releases potassium and phosphorus as ash
- b. It has some sterilizing effect on the soil
- c. It stimulate the growth of fresh grass
- d. It destroys soil borne pathogen or germs
- e. It destroys the seeds of weeds

##### DEMERITS

- a. It destroys the organic content of the soil
- b. It reduces the population of soil live organisms
- c. It oxidase nitrogen and sulphur into gaseous forms
- d. It exposes the soil to erosion and leaching
- e. It may raise the PH level of the soil
- f. It causes environmental pollution
- g. It destroys the soil structure
- h. It reduces soil water content

#### 2. OVERGRAZING

Overgrazing is a situation where more animals than can be supported on a particular pasture are put there to graze.



## FIRST TERM Agricultural Science E-LEARNING NOTE

### **MERIT**

- a. More faeces are dropped which could improve the fertility of the soil
- b. Weeds can easily be eradicated from such land.

### **DEMERITS**

- a. It depletes the vegetative cover of the soil
- b. It causes poor growth and regenerative capacity of vegetation
- c. It exposes soil to erosion
- d. It destroys soil structure
- e. It leads to soil compaction
- f. Compacted soil reduces water infiltration
- g. Pore spaces in the soil in the soil are reduced

### **3. CLEAN CLEARING**

This is the removal of the entire vegetation on a piece of land.

#### **MERITS**

- a. It gets rid of weeds from the land
- b. It may leave land free of all obstacles

#### **DEMERITS**

- a. It leads to disturbance or removal of top soil
- b. It leads to increase evaporation of water
- c. It exposes the soil to erosion
- d. It leads to reduction in organic matter
- e. It leads to loss of soil nutrients
- f. It leads to leaching
- g. It destroys the soil structure

### **3. FERTILIZER APPLICATION**

This involves the application of certain chemical substance to the soil to increase its fertility

#### **MERITS**

- a. It supplements nutrients content of the soil
- b. It enhances the productive capacity of the soil
- c. It increases the population of microorganism in the soil
- d. It stimulates vegetation growth

#### **DEMERITS**

- a. Excessive application of fertilizers can cause soil acidity
- b. Excess application can also reduce the activities of soil organism
- c. Excessive application may also hinder the growth of crops

### **4. ORGANIC MANURING**

It involves the application of manure e.g green manure, farm yard manure and compost manure to the soil in order to improve its fertility.

#### **MERITS**

- a. Organic manuring returns nutrients to the soil
- b. It improves the texture and structure of the soil
- c. It encourages the activities of soil organisms
- d. It improves the water temperature fluctuations in the soil
- e. It prevents soil erosion
- f. It improves water holding capacity of the soil

#### **DEMERITS**

## FIRST TERM Agricultural Science E-LEARNING NOTE

- a. The process may lead to introduction of pathogens to the soil
- b. It may have adverse effects on crops, if not properly applied

### 5. **CROP ROTATION**

Crop rotation is the system of farming whereby different crops are grown on the same piece of land year after year on a definite manner so as to maintain the fertility of the soil

#### **MERITS**

- a. It adds nutrient to the soil through nitrogen fixation
- b. It increases the yield of crops
- c. It controls the growth of weeds
- d. It maximizes the use of available land
- e. It control pests and diseases associated with soil
- f. If controls erosion

### 6. **CONTINUOUS CROPPING**

This involves the growing of crops on the same piece of land every year without the application of manure or fertilizers

#### **MERITS**

- a. It enables different crops to be grown and harvested
- b. It maximizes the use of available land

#### **DEMERITS**

- a. It depletes soil nutrients
- b. It ensures the spread or multiplication of germs
- c. It ensures the multiplication of pests and parasites
- d. It results in low yields of crops

7. **FLOODING:** It is defined as the accumulation of an abnormal large quantity of water in an area which refuses to percolate or flows away.

## **EFFECTS OF TILLAGE IMPLEMENTS ON THE SOIL**

### 1. **PLOUGHING**

- a. It increases the soil organic matter content
- b. It helps to mix the soil together
- c. It improves water infiltration capacity
- d. It improves the aeration of the soil
- e. It leads to compaction of the soil
- f. It spreads disease causing organism in the soil

### 2. **HARROWING**

- a. It leads to fine tilth through the mixing of soil
- b. It increases aeration and water infiltration
- c. It increases root penetration
- d. It leads to destruction of soil structure
- e. It may lead to soil erosion

### 3. **RIDGING**

- a. It prevents erosion and improves water penetration
- b. It collects together rich top soil
- c. It improves aeration and root penetration
- d. It improves water conservation in the soil

**FIRST TERM Agricultural Science E-LEARNING NOTE**

- e. It also facilitates the harvesting of roots crops

**EVALUATION**

1. List five effects of bush burning on the soil
2. (a) Define Tillage  
(b) Explain Zero tillage

**METHODS OF REPLENISHING LOST NUTRIENTS**

1. **CROP ROTATION:** It is a system of farming whereby different crops are grown on the same piece of land year after year in a definite manner so as to maintain the fertility of the soil.

The layout of a four-year crop rotation plan is shown in this table

YEAR	PLOT I	PLOT II	PLOT III	PLOT IV
1	Yam	Cowpea	Cassava	Maize
2	Cowpea	Cassava	Maize	Yam
3	Cassava	Maize	Yam	Cowpea
4	Maize	Yam	Cowpea	Cassava

**PRINCIPLES OF CROP ROTATION**

1. Deep-rooted crops like yam and cassava should not follow each other
2. Shallow-rooted crops should not follow each other
3. Crops which have the same diseases should not follow each other
4. Crops which have the same pests should not follow each other
5. Crops of the same family should not follow each other
6. Crops which control weeds should be planted
7. Legumes should be included in crop rotation

**CONDITIONS NECESSARY FOR THE PRACTISE OF CROP ROTATION**

- a. Where land is scarce or limited in supply
- b. Where population is high
- c. The need to have different varieties of crops
- d. The need to maintain soil fertility
- e. Where the soil is exhausted of nutrient

**2. ORGANIC MANURING**

Organic manure refers to the decayed plant and animal products which have been carefully prepared to supply nutrients to plants or crops.

**3. BUSH FALLOWING**

This is the practice in which farmlands are left to lie fallow after one or two years of cultivation to allow the nutrients to revert to the soil.

**4. COVER CROPPING**

It is the process of planting certain plants mainly to cover soil surface to conserve the soil nutrient.

Some common examples of cover crops are: mucuna pueraria, centro, clotalaria, calapogonium and cowpea

## FIRST TERM Agricultural Science E-LEARNING NOTE

### 5. **LIMING**

It is the process whereby Calcium or magnesium containing compounds are added to the soil to reduce soil acidity. Some common liming materials are: limestone, quicklime, slaked lime, basic slag, dolomite, gypsum, wood, ash etc.

### 6. **APPLICATION OF INORGANIC FERTILIZERS**

Fertilizers are chemical substances in form of powder, granules, pellets, or crystals which can be added to the soil to increase fertility.

### **EVALUATION**

1. What is crop rotation?
2. List five principles of crop rotation

### **FACTORS INFLUENCING NUTRIENTS**

Availability in the soil

1. Soil PH
2. Concentration of other nutrients
3. Leaching
4. Crop removal
5. Oxidation and Reduction of organic materials
6. Burning
7. Soil Texture
8. Erosion
9. Soil moisture content
10. Level of Organic matter/Micro Organisms in the soil

### **WAYS IN WHICH SOIL NUTRIENTS CAN BE LOST**

1. Crop removal
2. Erosion
3. Leaching
4. Soil Acidity
5. Excess of other nutrients
6. Oxidation and reduction of organic materials

### **GENERAL EVALUATION**

1. What is Bush burning?
2. State the merits of bush burning
3. What is crop rotation?
4. List five principles of crop rotation
5. State four effects of ploughing on the soil

### **READING ASSIGNMENT**

Essential Agricultural Science for Senior Secondary Schools, Chapter 18, pages 187 – 201

### **WEEKEND ASSIGNMENT**

1. The following are pre planting activities except (a) ploughing (b) bush clearing (c) harrowing (d) thinning

## FIRST TERM Agricultural Science E-LEARNING NOTE

2. The following are types of manure except (a) green manure (b) farm yard manure (c) NPK (d) compost
3. The following are methods of fertilizer application except (a) broadcasting (b) ring method (c) Top dressing (d) Eroding
4. The following are liming materials except (a) limestone (b) Urea (c) quicklime (d) slaked lime
5. Nutrients are lost through the following means except (a) crop removal (b) Erosion (c) leaching (d) mulching

### SECTION B

1. (a) State four demerits of bush burning  
(b) State four uses of lime in Agriculture
2. (a) Define soil organic matter  
(b) State five ways in which soil organic matter is important in Agriculture.