FARM MACHINERY

These are tractors, bulldozers, shellers, grinding mills, incubators, milking machines and sprayers.

Tractors

It is the most important and versatile machine used on the farm. Principally, a tractor consists of an internal combination engine and a hydraulic system and is equipped to power both mobile and stationery equipment and implements.

Types of tractors

Tractors are classified based on their types of engine, wheel and engine power output (capacity).

Engine type these are of two types:

1. Injection or diesel type: this is the most common type. It has no spark plugs and used diesel oil.
2. Petrol engine or carburetor type: it is found in the tractors that are used in small horticultural operations. It uses spark plugs and petrol or gasoline which is burnt in a carburetor.

Wheel type

These are types of tractors which are classified based on the wheel s types.

1. Pneumatic tyre type: it has large rear and small front wheels. It is common in tractors that are used in upland areas.

Fig.4.1. A tractor with pneumatic tyre type

2. Crawler types: it has chain or crawler wheels which are common in bulldozers. It is suitable for working in wet land where a lot of traction is required.

   Engine power output or capacity

   Based on power output, tractors maybe described as large, medium or small.

   Uses of a tractor

   1. With a trailer attached to it, it can be used for transporting farm goods.
   2. It pulls implements such as plough and ridger

3. Through the power take-off shaft, it propels equipment such as mowers.
4. It provides hydraulic propulsion for mounted and semi-mounted equipment
5. It is in a stationery position, it can be connected through a belt pulley to operate grinders, threshers and pumps.

Maintenance of a tractor

A. This may be grouped into daily and routine operation
    a. Daily checking involves:
        I. Checking oil and radiator water levels
        II. Checking electrolyte level in battery
        III. Checking tyre pressure
        IV. Checking the hydraulic level.
        V. Gauging the fuel level, and
        VI. Tightening loose bolts and nuts

B. routine maintenance practices are:
        i. Changing crankshaft oil and filter
        ii. Adjusting brake and clutch
        iii. Draining radiator water and refilling as directed
        iv. Lubricating metal panels when necessary
        v. Changing sparks plugs where applicable
        vi. Respraying metal panels when necessary
        vii. Always parking on level ground under shade when not in operation and
        viii. Adhering to manufacturer

Bulldozer and grader

A bulldozer has an internal combustion engine and is fitted with a heavy blade that is set across the front of vehicle. It is used for clearing, felling and uprooting of trees and stumps and for moving earth. Grader has a higher blade set midway under the machine. It is used for leveling. The use of both machines in clearing ground may lead to loss of topsoil. This may be grouped into daily and routine operation.

Bulldozer

Maintenance of a bulldozer and grader

b. Daily checking involves:

VII. Checking oil and radiator water levels

VIII. Checking electrolyte level in battery

IX. Checking tyre pressure

X. Checking the hydraulic level.

XI. Gauging the fuel level, and

XII. Tightening loose bolts and nuts

B. routine maintenance practices are:

ix. Changing crankshaft oil and filter

x. Adjusting brake and clutch

xi. Draining radiator water and refilling as directed

xii. Lubricating metal panels when necessary

xiii. Changing sparks plugs where applicable

xiv. Respraying metal panels when necessary

xv. Always parking on level ground under shade when not in operation and

xvi. Adhering to manufacturer

ASSIGNMENT Enumerate 6 precautions in operating a tractor.

Sheller

It is a machine designed to extract cereals grains from the cob, and ear head or pulses from the pod. There are different types that are specific to certain crops. some are manually operated.

Basically, a sheller consists of

i. A hopper for feeding the crop into the equipment
ii. A beater or shelling cylinder
iii. A concave or stationary plate with slots against which the cylinder beats
iv. A winnowing device which blows the chaff away from the grain and
v. A sect of sieves which separates and sorts the grain from the chaff.

Grinding and mixing mill

A grinding mill is used to break grain into smaller particles in order to increase digestibility or palatability and to facilitate mixing with other feed ingredients.

A mixer is used to facilitate in mixing the various ingredients. A mixer consists of a steel cylinder which tappers to a conical hopper at the bottom. The mixing is performed by a large vertical hanger which

revolves continuously, carrying material from the bottom of the hopper and sprinkling it over the surface.

Incubator

An incubator is used for incubating eggs until hatching. There are various designs but basically an incubator has a heat source, a thermometer, humidifier, hygrometer, egg trays, air circulation vents, eggs turning device and internal insulator.

In using the incubator, it is important to:

1. Operate it according to the manufacturer's instructions
2. Wash and disinfect it after each batch of eggs have hatched
3. Restrict entry into the hatchery 
4. Run the incubator for at least 12 hours before each loading and
5. Keep the hatchery well ventilated

Milking machine

A milking machine is used for milking animals' especially dairy cattle. There are various designs but basically a milking machine consists of:

a. A vacuum pump which produces the suction required for milk let-down
b. Teat cups which connect the pump to the teat of the udder and stimulates them
c. A collecting pipe and container to collect the milk
   In using the machine, it is essential to
   i. Sterilize it before and after milking
   ii. Start milking only after let-down
   iii. Ensure that there is no leakage in the plant and
   iv. Stop milking as soon as milk flow stops.

Sprayer

In larger farms, a sprayer may be a tractor or aircraft-mounted.in small farm operations hand-operated sprayers are used. Some are powered by small motor while some are pressure operated. A common type of manually operated sprayer is the knapsack sprayer. It consists of a 10-15 litre tank, a pump lever, pressure gauge, flexible delivery pipe which is connected to the lancet, spray gun and nozzle and a pair of carring belts.

Maintenance

1. Rinse and wash equipment after use
2. Unscrew gun and lancet and rinse.
3. Clean nozzle ensuring the there are no blockages
4. Apply grease to movable joints.

Tractor-coupled implement

These include

1. Primary tillages: this involves the breaking and loosening of the soil to a depth of 15-90cm. the mouldboard and disc ploughs are the two principal types of primary tillage equipment.
2. Secondary tillage: This includes all soil stirring operations at comparatively shallow depths. These are normally performed after the deeper primary tillage operation. The major types of secondary tillage equipment are the spike-tooth harrow and the disc harrow.

Ploughs

The plough is the primary tillage implement used for working the earth to loosen and pulverize it before the seeds are sown. Ploughs are mounted directly on a three-point linkage and can be lowered and raised through a hydraulic system.

The main components of the plough are

1. The mouldboard plough
2. Disc plough.

The mouldboard plough is responsible for the shattering and inversion of the furrow slice. The degree of both of these factors being determined by the type fitted.

Disc ploughs

The disc plough is generally used where soil conditions are very hard and rough. It is more suited for tropical conditions where the climate is hot and the land bakes hard.

Harrows

They are also called cultivators and are used after ploughing to break up the clods and furrow slices and work the soil to a fine tilth. Other uses include destruction of weeds, mixing of fertilizers with soil and covering of seeds.

Types of harrow

1. Spring tine harrow or cultivator
2. Disc harrow
3. Rotovator (rotary cultivator)

Ridgers

They are implements used for making ridges. the two common types are disc and mouldboard ridgers. Like a plough, a disc ridger is preferred to a mould board in the tropics because of the obvious advantages pointed out earlier. A disc ridger with five discs therefore, produces two and a half ridgers in one run and a total of five ridges on the return run.

Planters

Planters are power-operated devices for placing seeds into the seedbeds. In precision planting, planters open the furrow and drop the seeds at regular intervals both between and within rows and intervals after cover up the seeds. Drilling planter ensure that seeds are dropped at precise depth with adequate separation between rows and not within rows.

Planters may be trailed or tractor mounted. It is possible to attach fertilizer, pesticides and herbicides- units to trailing and rear mounted planters.

Harvesters

These are used for harvesting crops. They include mower, hay balers, forage harvesters and grain combine harvesters

i. Mower this is used for harvesting grass and legumes for making hay, and is also used for mowing lawns.
ii. Forages harvester: it is a tractor mounted piece of equipment with a plant cutting and chopping unit.
iii. Hay baler: it is a piece of equipment used for making compact, rectangular bales of hay. Bailing makes it easy to stack and it utilizes less space.
iv. Combine harvester. It is complex machine which combines snapping or heading, threshing or shelling and winnowing of grains as it moves over the field.

FARM SURVEYING AND PLANNING

Farming surveying is the determination of specification location, topographical and edaphic characteristics and structures through measurements and mapping for intended farm projects.

IMPORTANCE OF FARM SURVEYING

A farm survey is important in order to

i. Establish farm boundaries and prevent encroachment and legal dispute over property.
ii. Obtain information as regards topography, soil types and vegetation.
iii. Determine which farming activities are practicable without damage to the natural resource
iv. Obtain results as to soil characteristics and be able to plan conservation measures:
v. Enable the farmer consolidate land
vi. Enable the farmer obtain credit facilities from financial institutions.
vii. Enable government to implement land tax policies effectively.

COMMON SURVEYING EQUIPMENT

These include;

1. Ranging pole
2. Measuring tape
3. Measuring line
4. Gunter's chain
5. Prismatic compass
6. Theodolite

Ranging pole

It is a straight wooden or tubular metal pole of 2.5m long. It is fitted with a heavy pointed metal shoe for sticking into the ground. The length is usually painted in alternate bands of red on black and white, each band being about 300mm. The uses are:

1. Determining base lines or boundaries
2. Marking out distances in survey stations and
3. Rough measurements of short distances.

Care

1. Clean with wet duster after use
2. Store in a cool dry place
3. Tighten loose metal shoe before use

Measuring tape

It is made up of a plastic fibre or metal strip calibrated and housed in a plastic or leather casing.it may be as long as 30m and can rolled back into the casing after use.

It is used for

1. Measuring length of distances; and
2. determining straight lines and right angled triangles

Care

1. Wipe clean with wet cloth after use.
2. Roll back into casing when dry.
3. Apply oil to roller when necessary.
4. Store in a cool dry place.

Measuring line

It is a long piece of twine or rope used for linking survey stations or marking out plots by fastening it to pegs.

Pegs.

These are pieces of wood with one pointed end that can be stuck into the ground.

Gunter's chain or surveyor's line

It is a metal chain available in 20m, 25m, and 50m lengths. It combines the functions of a measuring tape and a line. It is used for rough measuring and it is also suitable for work in swamps.

Care

1. Wash and dry after use.
2. Roll up after drying
3. Apply oil if it is to be stored for a long time.
4. Store in a cool, dry place.

Prismatic compass

It is similar to a pocket compass. It consists of a compass box with a surface graduates from 0 to 90 from north to south end; it also has a moving dial.

Care

1. Wipe it clean after use
2. Store it in the casing when not in use
3. Ensure that it does not get wet.

The theodolite

A theodolite consists of a sighting telescope and two graduate's circles for determining vertical and horizontal angles. It is used for accurate measuring of angles and directions, and for extending lines along a distance.

Care

1. Store in the casing when it is not being used
2. Protect it, especially the lenses from moisture and dirt

3. Unscrew it from the tripod after use.

Farmstead planning

A farmstead is the dwelling place and production center in a farm enterprise. It is therefore, necessary that in planning a farmstead the comfort and well-being of the farm family and the optimal utilization resources should be uppermost in the mind of the farmer. The following factors most be borne in mind when planning a farmstead.

ACCESSIBILITY

In order to improve efficiency, facilities should be located within walking distance. Thus, in constructing roads, utilities and production and production units, consideration should be given to the frequency of visit, attention required and use. For example, a feed mill should be located close to animal houses.

TOPOGRAPHY

It determines to a great extent the location of various farm units. For example, the living quarters should be located on the highest ground to give complete views of the farm; animal houses should be located on high ground which is free from wetness while crop fields should be located on lowlands.

SOIL TYPES

Animals' houses, farm structures, living quarters and pastures are better sited on poor soils. Exotic crops are located on fertile soils.

HEALTH AND COMFORT

In locating animal houses the health and comfort or the farm family should be considered. Animal houses should be place far away in a leeward direction from the living quarters in order to reduce foul odours and noise.

ORIENTATION

It is important to locate building where they are exposed to sufficient sunlight and air. Animal houses should be constructed in a north-south direction so that the lengths are protected from the prevailing winds which may cause chills.

CALCULATION OF AREA OF A FARM LAND AND POPULATION

The shape and size of any farm land can be measured or determined by farm surveying. The area of land varies some are rectangular, square, triangular or even circular in shape.

The formula used in the calculation of farm lands and plant population includes:

- ✓ **Area of farm land**: This refers to the product of the length and width of the farm land measured in meters. Mathematically,
  Area of farm land = Length X width (meters)2
  i.e. (L X W) m2
- ✓ **Number of plant stand/plant population**: This refers to the number of plants in an area of farm land. Mathematically,
  Plant population = Area of farm land (m2)
  Spacing (m2)
- ✓ Spacing: is the distance between the crop plant and the next plant which is usually between and within the rows e.g. 60cm X 30cm,100cm X 75cm etc.
- ✓ NOTE: one hectare=10,000m2: This figure means there are 10,000m2in one hectare of land.

  Assignment

  1.Draw the following square, rectangle, triangle, circle and trapezium using the following farm shape, outlook and area.

BASIC ECONOMIC PRINCIPLES

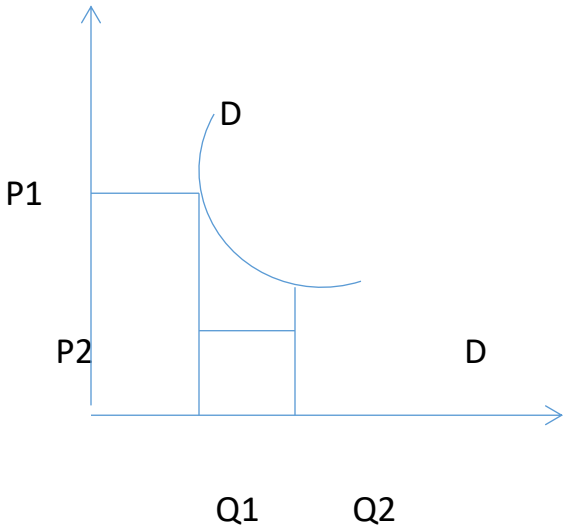
Demand

Demand can be defined as the quantity of a commodity that an individual is willing to buy at a specified price in a given market. When the demand is high for a commodity, the farmer earns more money, when the demand for a commodity is low; the price of that commodity falls and the farmer is at a loss.

Law of Demand

The law of demand states that the lower the prices of a commodity, the greater the quantity demand (bought) other things being equal. Therefore, the higher the price, the lower the quantity demanded.

For example, more of a commodity Q2 is demanded at a lower price (P2) than commodity demanded Q1 at a higher prices (P1) as show below.



Factors affecting the demand for agricultural produce include the following:

- Price of the commodity
- Taste and preferences
- Consumer's income
- Prices of related goods
- Population
- Weather
- Future expectation
- Advertising
- Technical innovation
- Government taxation policy
- Social events and festivities

MEANING OF SUPPLY

Supply is defined as the quantity of a commodity that producers are willing to sell at a specified price in a given market at a given time. Supply does not mean the total production but the actual amount the producer is willing and able to offer.

Factors Affecting the Supply of Agricultural Produce.

Price

Deducing from the law of supply i.e if the price of a commodity increases, more of the product will be supplied.

Cost of production

If the cost of factors of production increases, less of the commodity would be demanded by the producer, therefore, both his output and supply would fall. But lower cost of production would increase their supply.

State of technology

Improved production techniques and making use of modern technology lowers the cost of production thus, increase their supply.

Substitutes

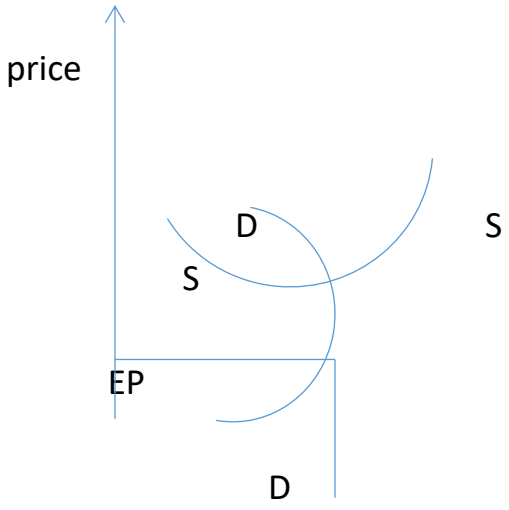
If the resources from the production of a commodity are shifted to other uses, an increase in its price would lead to an increase in the supply of others or if a commodity is preferred to others.

Weather

An unfavorable weather condition (e.g. heavy or little rainfall, earthquakes etc.) leads to poor growth of crops thereby reducing its supply.

INFLUENCE OF DEMAND AND SUPPLY ON PRICE

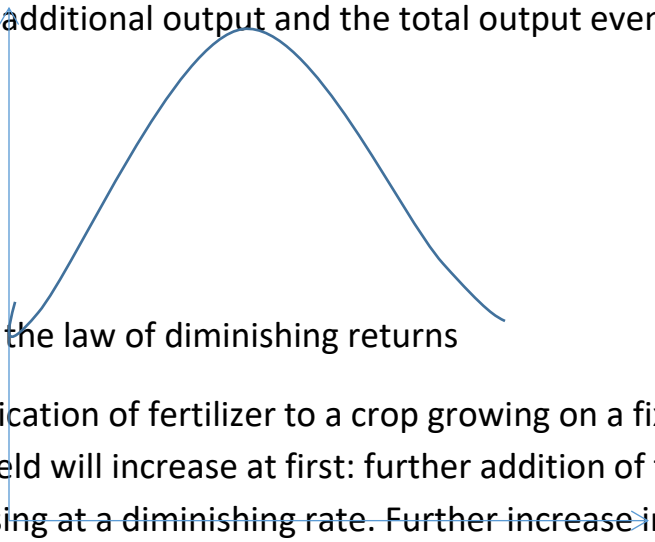
In a free market situation, the forces of supply and demand dictate the price. In a situation where the amount supplied for sale just equals the amount required by the consumer, the price tag is referred to as the equilibrium price or market equilibrium price. This price is determined by the intersection (EP) of the demand and supply curves shown below.



From the figure, it can be observed that the equilibrium price (EP) will change as either demand or supply changes. The farm income tends to vary from year to year depending on supply and demand circumstances. To protect farmers from fluctuations that can lower income below their production costs. The governments establish various types of agricultural support programs, like the commodity boards where guaranteed minimum prices are fixed for agricultural commodities. This is meant to prevent price from falling below a minimum price, the commodities will be sold to the government at the guaranteed minimum price rate.

LAW OF DIMINISHING RETURNS

The law of diminishing returns states that if an increasing amount of one input is added while other inputs remained fixed, the output will increase to a point where a further increase for input will result to a decrease of a marginal return per unit of the varying input. In other words, as more and more units of a variable factor of production are added to given quantity of fixed factors, the additional output and the total output eventually decline.



Graph showing the law of diminishing returns

For instance, if the application of fertilizer to a crop growing on a fixed area of land is increased, the yield will increase at first: further addition of fertilizer may lead to the yield increasing at a diminishing rate. Further increase in fertilizer application will reduce the yield or even damage the crops because of the high concentration of the fertilizers.

FARM ACCOUNT

Entries of sales and purchases

Meaning of farm account: are statement of money paid out or received for goods and services used in a farming business.

Meaning of farm record: are written documents showing major activities going on in the farming business.

IMPORTANCE OF FARM ACCOUNTS AND RECORDS

1.It shows the financial position of the farm: it shows the financial weakness or strength of the farm.

2.Whether profit or loss is made: It enables the farmer to whether he is running the farm at a profit or loss.

3.Detection of fraudulent practices: it enables the farmer to detect fraudulent practice on the farm.

4.Procurement of loan: Good farm record can be used by the farmer for easy procurement of loan from banks.

5.Changes in prices of produce: It enables the farmer to monitor the changes in prices of produce bought or sold by the farm.

TYPES OF FARM RECORDS

Farm records which a good farmer should keep are:

- **Farm diary**: is the record of daily activities on the farm .it also show the movement of staff and visitors to the farm, losses to thieves, a good reference book to obtain information about the farm.
- **Yield or production record:** it shows the yield of crops cultivated on the farm. Also it shows the produce from livestock or poultry.
- **Payroll or labor record:** it shows the amount and types of labor hired or employed to work on the farm. Also it shows the rate and wages paid.
- **Farm inventory**: is a record which contain all the list of items on the farm at a particular time e.g. equipment, farm buildings, farm tools etc.

  Types of farm accounts
  - Sales account
  - Purchase account
  - Cash analysis account
  - Profit and loss account

Profit and loss account: is the type of account prepared at the end of a business, usually a year by the farmer with the purpose of knowing whether his business is making profit or loss.

Example 1: prepare a profit and loss account for segun farms for the year which ended 31/12/1990 using the following:

i.	Cost of feeds	#500.00
ii.	cost of drugs	#200.00
iii.	Sales of eggs	#2,000.00
iv.	Eggs for domestic use	#200.00
v.	Loss due to mortality	#300.00
vi.	Value of stock left	#600.00
vii.	Farm wages	#400.00
viii.	Sales of spent layers	#1,000.00
ix.	Transportation cost	#300.00
x.	Depreciation	#200.00
xi.	Electricity bill	#300.00
xii.	Net profit	#1,600.00

SOLUTION

Segun farms profit and loss account as at 31 December,1990.

Debit			**Credit**		
S/N	**Particular**	**#: K**	**S/N**	**Particular**	**#: K**
I	cost of feed	500:00	iii.	Sales of eggs	2,000.00
ii.	cost of drugs	200.00	vi.	Eggs for domestic use	200:00
v.	Loss due mortality	300:00	vi.	Value of stock left	600:00
vii.	Farm wages	400:00	viii.	Sales of spent layers	1,000:00
ix.	Transportation	300:00			
x.	Depreciation	200:00			

xi. Electricity bill	300:00	
Total expenditure	2,200:00	
Xi.Net profit	1,600:00	
Grand total	**3,800:00**	**3,800:00**

Assignment

Explain the following terms:

i. Depreciation
ii. Useful life of an asset
iii. Farm asset

2.List the methods of calculating depreciation of farm machines

NUTRIENT CYCLING

Nutrient cycling is described as a process of circulation of nitrogen, carbon and water.

Nitrogen cycle: It involves the complex process of adding and removing nitrogen naturally from the soil. It is a sequence of reaction, indication how nitrogen is added to and removed from the atmosphere and soil.

PROCESS BY WHICH SOIL GAIN NITROGEN

- ✓ Symbiotic nitrogen fixation: Some bacteria (Rhizobium leguminosarium) live in the root nodules of leguminous plants and fix atmospheric nitrogen directly into the plants.
- ✓ Non-symbiotic nitrogen fixation: The Azotobacter and clostridium also live freely in the soil and fix atmospheric nitrogen into the soil either aerobically or anaebically.

- ✓ Ammonification: This involves the process of formation of ammonium compound from dead and decaying animals and plants and their waste product (urine and faeces).
- ✓ Application of organic manure and nitrogen fertilizer also supply nitrogen to the soil.

Carbon cycling: is the process of circulation of carbon in nature.

Losses in form of carbonates of metals like calcium and potassium.

- ✓ Photosynthesis used by plants to make their own food.
- ✓ Through drainage and leaching.

How atmosphere gain Co2

- ✓ Burning of fuel
- ✓ Respiration by plants
- ✓ Death, decay and putrefaction of plant and animals
- ✓ Action of volcanoes which release Co2

Assignment

1.Define denitrification

2.List other process by which soil gain nitrogen

3.State three importance of carbon cycle.