AGRICULTURE NOTES FORM THREE

Agricultural Mechanics

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AGRICULTURAL MECHANICS

THEME 1.0: AGRICULTURAL MECHANICS

Introduction: In order to do work ENERGY must e used, the rate of expenditure is proportional to the rate of doing work which is known as POWER.

Form of energy

I) Animated Energy: Is the energy of expended by using muscular power of human beings and animals. II) In animated Energy: Is the energy expended through transformation of natural resources e.g. fossil fuel, wind.

Definition: Is the application of engineering principles and techniques in agricultural sector involving utilization of all forms of energy through mechanical assistance in agricultural products.

Components: Tools, Implements, Machines.

Advantages of mechanization

i. Brings more intensive production

ii. Put more land into use

iii. Increases speed of work and capacity

iv. Releasing labour peak

v. Increases labour productivity. POWER

Limitation:

i. Not suitable in steep slopes e.g. mountain

ii. Need technical knowledge

iii. It is expensive.

iv. It is weather sensitive.

Definition: Is a proportional integration of the rate of energy expenditure and the rate of doing work.

TYPES OF POWER

I) Human power: Have the ability to work by using hands, operate machinery using legs and hands in daily agricultural activities.

- When he uses hands in small scale and simple tools called hand tools. These include;

a) Hoe: This is a device used for turning the soil (digging), make ridges, uprooting stumps etc. It varies in weight, size and shape depending on the use.

b) Rake: A short spronged tool used in soil leveling, removing stones and weeds, breaking dumps during seed bed preparation.

c) Machete: A device used for lifting, inverting, leveling the soil, digging holes and even is used in transplanting seedlings.

d) Manure fork: A device whose sprongs have been spaced at regular intervals, similar to a spade but it has no plane blade used in spreading manure.

e) Hand craft: A boat shaped short blade tool used in digging hallow holes and in transplanting.

f) Mattock: Used in uprooting, digging and cutting.

g) Shears: Scissor like tool used in trimming hedges.

h) Secateurs: Similar to shears and is also used in pruning.

i) Sickle: A curved iron bladed with a short hand used on areas of grass cutting.

j)Watering can:A container with a perforated spout used for watering.

k) Forked hoe: A strong sponged tool shaped like a fork used for rhizomatous weeds and loosening hard soil.

CARING AND MAINTENANCE

- Cleaned and wiped after use.
- Greasing of metal tools to prevent rust by using grease or engine oil;
- Construction of tool shed or store.
- Arrangement of tools in proper order in the shed and store right after use.

b) **ANIMAL POWER:** Power generated by use of oxen and buffaloes and camels involves pulling of courts and plough under the guidance of human beings. Animals used are drought animal.

LIMITATION

- Farmers have to posses the drought animal.
- Animal's disease and parasite.
- Vegetation availability for grazing animals.
- Land topography i.e. layout of the land should be reasonable plat and with light soil.
- An advision service to train and advice farmers on the use of animals and equipment.

QUALITIES OF A DROUGHT ANIMAL

- They should be healthy and strong.
- They should have short horns.
- They should be at the age of 2-3 years.
- Selection should be done in pairs.
    - Similar size
    - Similar strength
    - Similar temperate
- They should be castrated male animals.
- They should have humps for a yoke.
- They should be of quite temperate.

NB: Preferably nose ringed to make it easy for people to control.

HARNESSING

Meaning: Is the process of hitching implements to drought animals using a harness.

TYPES OF HARNESS

YOKE HARNESS

Commonly used in Tanzania, It consists of beam, skey, straps and U-bolt.

- It is commonly short about I.5m long (Beam Length), when used in ploughing and harrowing while other operations like cultivation i.e. weeding and ridging require long beamed yoke of about I.4m. Physical structure: Is a smooth piece of wood to be rested on the neck of an animal.

Skeys: Piece of wood which are fitted into beam perforation so as to keep animals in position. U-bolt: A device fixed at all the centre of a beam where an implement can be fixed.

Straps: Leather made ropes which are lied skeys below animal neck.

COLLAR HARNESS

Collar harness is a single animal harness consisting of a collar and strips.

Methods of training animals

i. Far Eastern method (Indian type)

Requirements: Neck rope, nose rope, through nose ring, rein la rope connecting nose and neck rope used for guide animal during operation, one pair of oxen, and one person implement.

This method involves use of one pair of oxen and one person controls both oxen and implement control of animal is archived by rope passed through a hole and around the neck.

ii. Traditional method

Requirements: one or more pairs of oxen, one people, implement and other as above.

- This involves two pairs of oxen guided by two people, one in front loading animals and another person at the near controlling implement.
- A trained pair is in front, untrained pair is in the near. Procedure; each animal should be given a name.
- Retraining an animal by rope to make him accustomed to being tied and controlled by a rope.
- Animals should be fixed at a distance of about I.2m apart to make them accustomed to move on pairs.

- Tying the pair with a yoke at least daily for 3-4 days to make them familiar with yoke.
- Use of suitable commanding words like Go- nenda, Turn right- kata kulia.With the help of reins
- Familiarize pulling by pulling a piece right log attached the yoke by means of chain.
- Use the oxen for light work as a short and gradually change heavier work.
- After about I0 days, harness the animal to a plough.

NB: People training oxen should be calm, patient from and consistent.

Management of oxen: It's important so as to obtain maximum power output. This involves the followings;

- Utilization of animal should be done in cooler position of the day add permitted to eat, drink and rest.

  Example:

6:00 am release to graze and water	4:00 pm release to graze and water
7:00 am yoke for work	4:00 pm yoke for work
10:00 am release to graze and water	6: 00 pm release to graze and water, get them to res

- Working animals should rest under shed to protect from them from wind, sun and rain
- Disease and parasites such as tick borne diseases have to be controlled.
- Check injures every day after work and advice possible treatment immediately.
- They must be well fed on rich pasture, hay or green fodder and other recommended feeds.
- Feed supplement and minerals must be fed on well cared paddock.

Tools and implements used

- -Qualities of tools and implements used: simple, strong, light, durable and inexpensive. Examples are:

i. PLOUGH:(Both donkey and oxen)-One furrow mould board plough are commonly used made on steel and double hands and a depth wheel in front of a beam.

ii. CULTIVATOR: At lined implements used for inter row weeding.

iii. OX-RIDGER: An implement consisting of two mould board back to back for making ridges.

iv. CARTS: A wooden box fixed on top of two wheels connected to an axle used for transportation of inputs and products.

v. TOOLBAR: A light metal/ wooden frame to which different piece of equipment can be attached depending on the job to be done.

vi. Is supported by wheels or skids.

USE OF TRACTOR (TRACTOR POWER)

- Conversion of chemical energy of fuel to chemical power for use in the farm, petrol, diesel, coal etc is vital example of fuel used.

- Liquid fuel engine called internal combustion engines where power production is achieved through a combination of steam engines and a boiler steam generator.

Factors to consider when applying tractor mechanization

i. Farms must be large with plenty of work throughout the year.

ii. Preparation of enough capital for buying and operating a tractor.

iii. Finding skilled people/ personal for operating, repairing and maintaining a tractor

iv. Availability of spares and services at a reasonable price.

v. Justification of a tractor running costs with expected returns.

Limitations of Tractorization

- Tractors and spares (i.e. equipment/implements) are very expensive.
- It needs fuel and lubricants which increase cost.
- Tractor requires highly skilled labour for operating and maintenance.
- Economically not suitable for peasants as require large farms with plenty of work.

Importance

- Transporting for product/ produce, fertilizers, seeds and buildings.
- Opening up new land with subsequent fertilizers.
- Weeding and harvesting.
- Processing food and livestock feed by transmitting power to grinding machines through P.T.O.

CLASSES OF TRACTORS

i. 2-wheeled tractor: Single axle tractor, small in size operating by individual behind it.

Used in small jobs around home e.g. garden;

ii. 4-Wheels tractor: Two axle tractor whose engine power is transmitted in both axles.

- Usually big in size depending on Hp e.g. Medium 15-16 Hp while large-75 Hp and above.
- Used in ploughing, transport etc.

iii. Track-laying tractor: With I endless tracks instead of wheels.

Commonly used:-

- Land cleaning and farming operation
- Deep tillage operations.

- Working in difficult soils e.g. swampy and soft soils.

4. WHEELED TRACTORS

Selection: Size of tractor; this depends on type and condition of soil i.e. the heavier the soil more power is required hence buying a big tractor

- Type of work e.g. pulling tillage machines requires large size.

Make a model of tractor to achieve the following qualities:

i. Manufactured by reliable industry

ii. Reasonable price;

iii. Spares are easily and readily available iv) Low operational costs.

iv. Easily serviced, adjusted and repaired.

MPLEMENTS USED BY TRACTOR

A. CULTIVATION: Include machinery used to prepare the soil for planting e.g. ploughs

- Mould board ploughs: produces more even surface so that use of harrow may not be necessary.

- Disc plough: preferred in a farm with three stumps a rotating disc roll over the obstruct instead of being caught up.

B. RIDGERS: To make ridges for crops e.g. potatoes

- Disc and mould board type.

C. FERTILIZER DISTRIBUTION: To achieve even distribution of fertilizer the field.

D. PLANTERS: Implements maintained a tractor for the purpose of planting.

E. CULTIVATORS: Used as a following up after ploughs.

- Disc harrows: breaking down soil humps.

a) Tined cultivators: inter row weeding.

b) Rotary cultivators: a P.T.O shaft driven implement used in breaking up soil.

MAIN PARTS OF AN ENGINE

A tractor is divided into four main parts;

i. Stationary parts: these include engine block, crank case, cylinder head and oil sump. These parts do not make any kind of movement relative to their own position on the tractor.

ii. Reciprocating parts: These include pistons, inlet & outlet valves and connecting rod. The part makes to and fro movement.

iii. Rotating parts: These include crank shaft, shaft and fly wheel.

iv. Auxiliary part: These include facilitates smooth engine function by coordinating the stationary, reciprocating and rotating parts together. They include the following systems; cooling system, fuel system, electrical system, lubricating system, transmission system and hydraulic system.

MAJOR PARTS OF THE TRACTOR

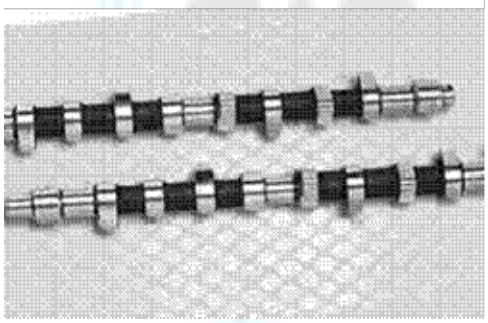
Basically the tractor can be divided into 5 major parts.

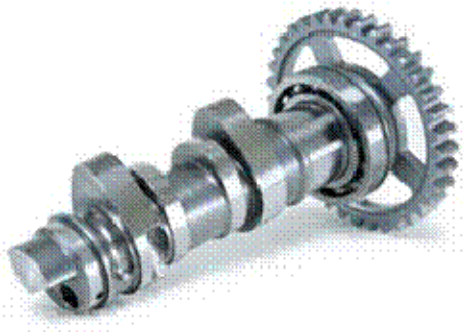
1) Engine: This is a group of parts assembled in a specific order used to convert the energy given off by burning fuel into a useful/ mechanical form.

Also may be classified according to: cylinder placement e.g. v placement, one line placement

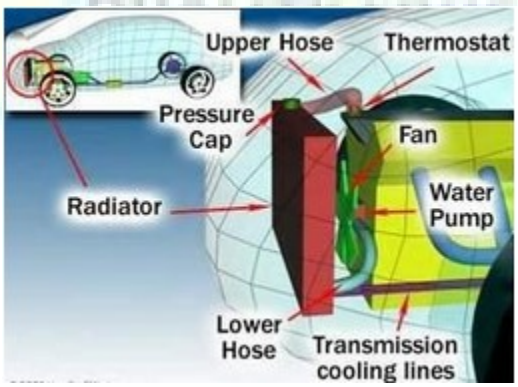
a) Valve placement

b) Cam shaft placement





c) Cooling system – air, liquid



d) Fuel used-diesel, petrol

e) Number of cylinder

f) Principle of operation (2 or 4)

2) Clutch unit: Is a device used to connect/ disconnect the flow of power from the transmission unit.

3) Gear box: Is a system of gear which transfer and adopt the engine power to the drive wheel to advice the following: selection of speed ratio for various speeds and reverses the travel of the machine.

4) Different units: This parts do the following; transmit power to the drive excel and to allow each drive wheel to rotate at different speed.

5) Final drive: This is the last phase on the power chain; it gives the final reduction in speed and increases in torque to the drive wheels.

INTERNAL COMBUSTION ENGINES

a) Stationary parts

- Cylinder head: Is the cap that attaches to the top of the engine block covering the upper cylinder opens there by forming a combustion chamber in the engine between the engine block and the cylinder head there is a gasket (cylinder) which seals the engine.

- Engine block: Is a group of cylinder east in one unit usually made of cast iron, contains water jacket that surrounds the cylinder to aid in cooling.

- Cylinders: These are tubes inside the engine blocks with smooth entering finishing and serve as a guide for the pistons as they move up and down.

- Crank case: This is lower part of the block, confines the lubricating oil near the engine moving parts.

- Oil pan/ sump/ reserve: Aids the crank case in confining the oil near the engine moving parts.

b) Rotating parts:

- Crank shaft: Changes the reciprocating action of piston to rotation movement.

- Fly wheel: It is a heavy mental wheel, it attached to crankshaft and serves for purposes.

i. Smooth out engine power impulses.

ii. It can be connected to starter for starting purpose.

iii. Provide a place to mount the clutch.

iv. Provide extra turning fore

c) Reciprocating parts

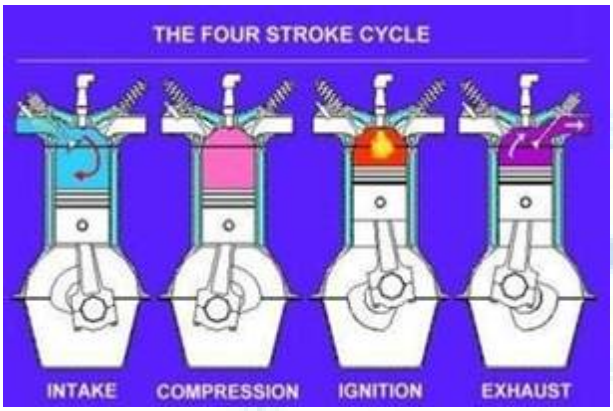
- Pistons: The force of exploding gases is received by the piston head and is transmitted to a piston pin, connecting rod and crank shaft.
- Rings: Are fitted to the piston to seal in combustion and compression pressure as well as to prevent lubricating oil to enter the combustion chamber.
- Values: Closes and opens the parts to the crankshaft so as to release air intake exhale unwanted gases.
- Connecting rod: Connects the pistons to the crank shaft.

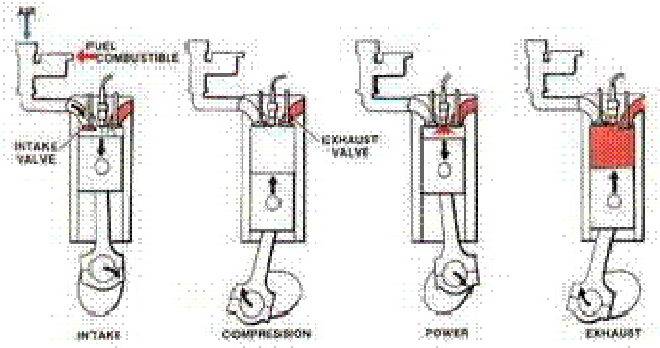
d) Engine accessories

There are components of the four separate system needed to operate an internal combustion engine, these includes; Electrical, Lubricating, fuel and cooling systems.

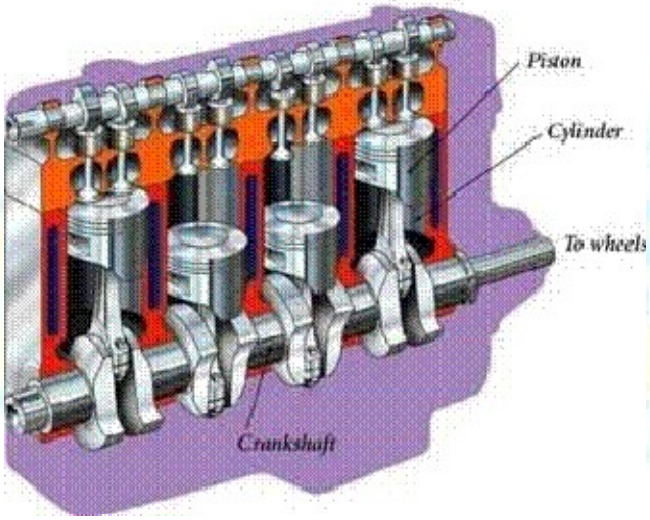
ENGINE CYCLES

i. Four stroke engine cycle: This involves two complete revolution of the crank shaft.





A Four-Stroke Engine



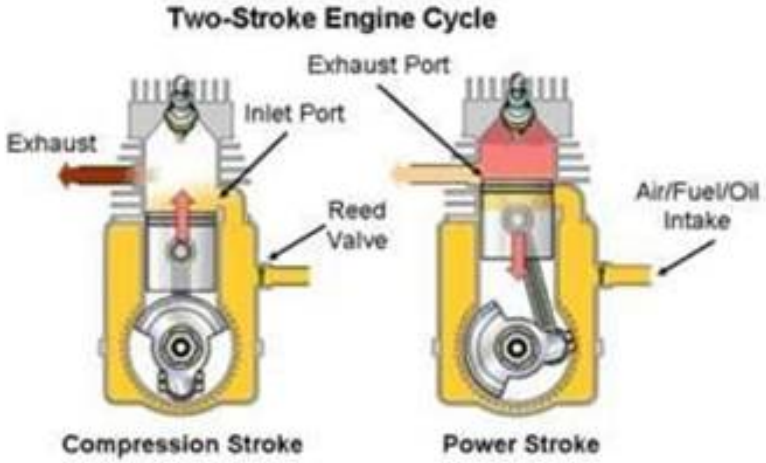
- Induction stroke: As the piston moves down towards the crank case intake values open partial vacuum is created in the cylinder vaporized fuel or air moisture is forced in the cylinder.

- Compression stroke: Intake values close as crank shaft rotates piston move up and compresses the fuel/air moisture.

- Power stroke: The mixture burns just before piston reaches top of the travel. The expand gases which result to burning of fuel, forces the piston down to turn the crank shaft.

- Exhaust stroke: As the piston goes down exhaust value open forcing burst gases out of the cylinder

ii. Two stroke engine cycle: This involves one complete revolution



- This is accomplished by eliminating the valves as used in the four strokes

In place of the valve two parts enter the cylinder wall.

	PETROL	DIESEL
1	Light engine block	Heavy engine block
2	Carburetor is used	Fuel injector pump is used
3	Efficiency is 25-100	Efficiency is 40%
4	Has spark plug	Has no spark plug
5	Fuel ignited by electric plug	Fuel is ignited by compression
6	Has a low compression	Has a high compression

ENGINE ACCESSORIES

i. Cooling system: To remove unwanted excess heat.

- To maintain efficient temperature under all operating condition for power, economy and minimal
- Bringing the engine to operating temperature when starts up.

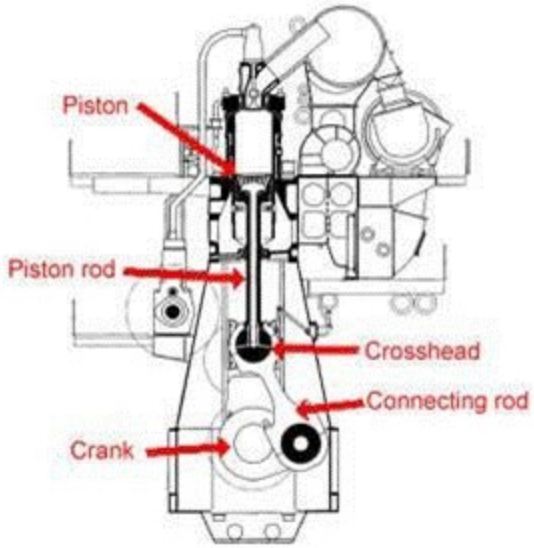
Components:

- Water cooled engine: Radiator: a device made of brass and copper to facilitate cooling and protecting it from rust and corrosion.
- The radiator consisted of a series of fine tubes with firm which provide large surface to air.
- Water is confined in tubes and is allowed to cool rapidly under the influence of air draw through the radiator by fan.
- To archive operating temperature treatment is used to limit water flow.
- Hoses: Provides connection from the radiator and water pump.
- Water pump: Circulates water through the engine.
- Thermostat: To provide constant temperature control.

Care of Radiator:-

- Keep fan and pump belts at proper tension.
    - 20 mm when pressed at its middle length
    - Hoses should be in good condition
    - Check pressure cap for proper operation.
    - Keep all connection tight.
    - Keep radiator core free from insects and dirt.

ii. Fuel system: This has tank of supplying the engine with clean fuel in the correct ratio.



Diesel: Fuel is passed to injector pump, after passing, filter by gravity or pump. Fuel is then sent to injector at a very high pressure into cylinders with compressed air. When fuels come into contact with compressed air it ignites due to high temperature of the compressed air.

Petrol: After passing through filters, fuel from the tank and air is mixed at a proportional in a carburetor

1/15. In turn the mixture is sucked into the engine cylinder for combustion.

CARBURETOR: For mixing petrol and air in the right proportion.

Components:

- Fuel tanks: A fuel storage unit, situated at a position where it will not drop well protected from flying stones and busting from accident event.
- Should have a rent to allow air, to avoid vacuum creation drainage valve for cleaning.
- Fuel lines: Diesel: Low pressure fuel lines – tank- injector pump, Petrol- High pressure fuel lines – injector pump – tank.
- Fuel filter: Removes impurities from fuel.
- Fuel lift pump: Used to such, push fuel to the injector pump through filter from the tank.
- Injector pump: It times, measure, delivers fuel under pressure to the cylinders.
- Injector nozzles: Atomizes and spray fuel in the cylinders.
- Air cleaners: Prevent dust and dirt from entering the engine.

Maintenance: Check tank leak and repair, filter elements should be changed

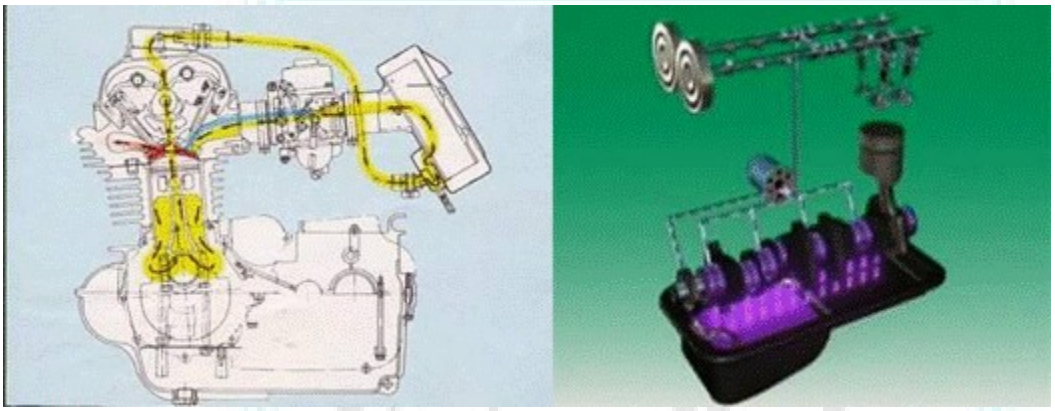
iii. Lubrication system: This system conducts the following jobs in the engine.

- Reduce friction between moving parts.
- Absorb heat
- Seal the pistons ring.
- Cleans and flashes moving parts.
- Helps to reduce engine sound.

This is achieved by supplying a thin film of oil on the surface of moving parts.

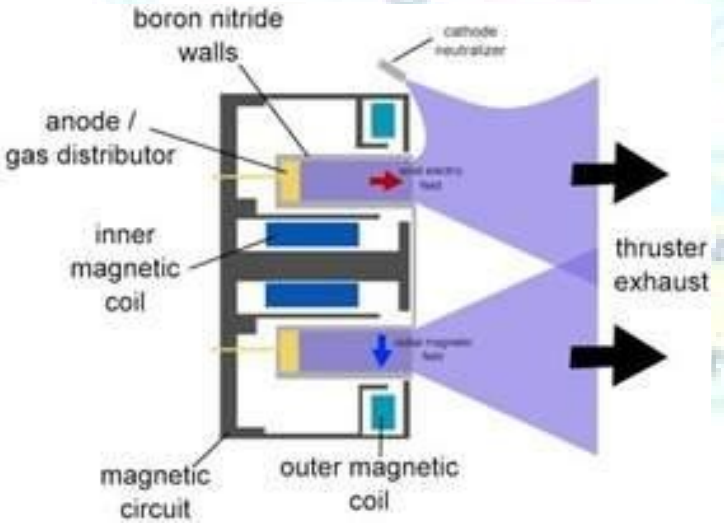
Classes:

a) Force feed lubrication: Is a system in which oil is fed up under pressure from a pump to all bearings.



b) Splash feed lubrication: This is a commonly used in single cylinder engine where moving parts are lubricated by splashing of oil over them.

iv. Electrical system: This system involved in supplying electrical for starting engine and lubrication.



Components:

- Battery: Source of electrical energy needed to operate the ignition system voltage is either 120.
- Ignition switch: Used to connect and disconnect the flow of electricity across the terminals.
- Resistor: Control the amount of current reading the coil.
- Coil: Consists of a transformer that raises the battery voltage.
- Beaker point: Connect and disconnect current flow in the circuit by opening and closing of beaker point.
- Condenser: Provide a place where a primary current will flow when point are open.

v. Transmission system: A mechanical system is a common type used consisting of clutch, gear box, differential unit, final drive.

This transmits power produced by the engine to the tractor wheel as well as prouding varying speeds according to the operation being undertaken.

vi. Hydraulic system: A system consisting of oil reservoir pipeline and control valves.

- Oil pumped under pressure to the cylinders canse a flow of oil to and flow the hydraulic system. This transmitting power from one point to the free linkage of a tractor used to control the setting of implements.
- Also hydraulic system can be used to transfer power to external cylinder for external operations.

TRACTOR CONTROL

Some of the small important control of tractor is: starter, starter switch, clutch pedal, gear selector, accelerator pedal/ throttle, brake pedal, steering wheel, hand brake.

a) Starter switch: start the engine.

b) Clutch pedal: connects and disconnects power of the engine from the gear box for choosing appropriate gear.

c) Gear level/ selector: for selecting appropriate gear.

d) Accelerator pedal/ throttle: control speed by controlling fuel supply to the engine. e) Brake pedal: for stopping a tractor.

e) Steering wheel: control direction of movement of two tractors. g) Hand brake: safe packing of a tractor.

DAILY SERVICE AND MAINTENANCE OF THE TRACTOR

- Lubricate all grease ripples especially front wheel bearing.
- Check for oil and fuel levels.
- Check for current type pressure and battery condition.
- Check for sufficient water in radiator and top up accordingly.
- Check for excessive fuel or oil leakages.
- Check and ensure brakes are latched and nuts and bolts are tightened.
- Check and clean air cleaning system.

TILLAGE IMPLEMENTS

TILLAGE: This is a practical of modifying the state of the soil in order to provide suitable condition.

OBJECTIVES:

- Production of suitable tilt.
- Control and destruction of pest and diseases.
- Facilitate in cooperation of fertilizer and manure and weed control.

TYPES

A. PRIMARY TILLAGE: This is the initial major soil working operation designed to loosen the soil, bury plants material and residues and rearrange soil aggregates.

B. SECONDARY TILLAGE: Intended to create well retained soil condition.

IMPLEMENTS:

i. Primary tillage implements: For primary tillage.

ii. Secondary tillage implements: For secondary tillage

I. PRIMARY TILLAGE IMPLEMENTS

PLOUGHS: Ploughing is the basic tillage operation in which a layer of soil is separated from sub soil and inverted. This operation can be accomplished by disc plough, mould board plough and chisel plough.

DISC PLOUGH: An implement with concave disc mounted on bearing which rotates as they at through soil.

COMPONENTS

- Main frame: Large steel tubes to which a top link mask and cross shaft are attached.
- Standards: where disc hearings are fixed to which disc are fixed on the hub of the bearing assembly.
- Scraper: is attached to each disc and they cut the soil clothes vertically.
- Disc: for cutting and inverting the furrow slices.

NB: The orientation of the disc is determined by the disc angle and the tilt angle.

- Disc angle: is the horizontal angle between the plane of the disc face and the direction of travel.
- Tilt angle: is the angle between the disc face and the vertical axis.

When disc angle is increased the plough penetrates deeper but more power is used. The adjustment to get appropriated depth is done by adjusting the top link.

Disc plough is used in areas where mould board plough will not work satisfactory.e.g.

i. Dry land

ii. Rough and stony ground

iii. Sticky soil having hard pen i

iv. In deep ploughing.

v. Pealy and leafy mould soils where mould board plough will not turn the furrow slice.

MOULD BOARD PLOUGH: Used to give good residue coverage and soil pulveration especially in areas where soil is soft and free from roots and rocks.

COMPONENTS

- The body: used for the attachment of their tools.
- Share: makes a horizontal cut separating the further slice.
- Slade: receives the down ward pressure due to the weight.
- Land slide: counter check their side way forces.
- Disc coulter: makes the vertical out to the furrow slice.
- Skin coulter: assisting in the complete burial of crop residue and trash.

CHISEL PLOUGH:

Are used to break through the shoulders compacted on other wise impermeable soil layers to improve water penetration, best results are obtained when the soil is dry.

COMPONENTS

- Heavy duty frame: where a number of tines are bolted to it.
- Tines for opening up the soil pan.
- Shear bolt: incorporated at the foot of the line which breaks on an underground obstruction.
- Tines are arranged into 3-4 rows, depending on the type of work, soil conditions and power available.
- Rigid tines are common but spring loaded or heavy duty tines (flexible) are also available.

II. SECONDARY TILLAGE IMPLEMENT HARROWS:

TYPES

DISC HARROWS

- Offset harrow: has two gangs left and right throwing the soil on the other sides.
- Single acting disc harrow: Have two opposed gangs of disc blades throws soil out wards.
- Tundern disc harrow: has two additional gang that throw the soil backwards the centre.

ADJUSTMENT: Is done by varying the disc angle and working depth. The hand level or hydraulic vain on the harrow is used to after the cutting depth.

MAINTENANCE OF TILLAGE IMPLEMENTS

- The rotary components require daily greasing.
- Implements should be checked before starting days work.
- Loose nuts and bolts should be tightened.
- At the end of each day work, it is advisable to clean the implements.
- At the end of each season, the important must be checked for distribution and wear.
- Replacement of component sharpening or resurfacing and must proofing of the soil engaging parts should be done.

Planting equipment

- These can be hand operated equipment e.g. hoe, tractor/ animal drawn planters.

Advantages of drawn planters over hand operated planters

- Saves labor and time
- Facilitate post planting operations e.g. weeding, spraying and harvesting due to uniformly.
- Ensure uniform distribution of seeds.
- Ensure uniform planting depth.

Ways of seed planting by machine planters

a) Broad casting: This is the random scattering of seeds over the surface of the field.

BROAD CASTER: These implements distribute seeds with reasonable uniformly over a given area.

- Seed covering is a separate operation or not done at all.

Demerits

- Difficult to estimate the seed rate.
- Other operations e.g. weeding can't be carried out.
- Seed coverage is poor. Sometimes thinning is required.

b) Row planting: Is an accurate planting pattern and covering of seeds is at about equal internal in rows.

ROWNPLANTERS: These are to distribute seeds at equal internal in

Components

- Seed and fertilizer hoppers.
- Meeting devices for seeds and fertilizer
- Delivery tubes.
- Furrow openers.
- A press wheel for covering and firming soil around the seeds.

NB: Generally the planters opens furrow and open seeds then deposits seed and fertilizer in the furrow then confirm.

- The most metering devices for most planters consists of a seed plate with a number of seed cells. The seed planter is put at the bottom of the hopper and receives its drive from ground wheel of the planter.
- The seeds are picked up in the seed cells and the plate rotates until they reach a hole at the hoppers bottom.

c) Seed drilling

SEED DRILL: This works on the same principles as a row planter. The main difference between the 2 is the metering mechanization and delivery tubes where in seed drill is placed close by Calibration of row planters

It involves: selection of a connect seed plate belt or wheel and clocking its performance.

The following steps are used to calibrate a single seed selection plate.

i. Select a suitable seed plate belt and wheel for the seed to be planted and lifted to the planter unit.

ii. Sack up the planter unit such that its device wheel rotates freely.

iii. Fill the planter unit with seeds.

iv. The device wheels is turned a number of revolutions representing a known distance which can be determined by; Distance= Number of revolutions X drive wheel circumference (cm).

v. Seeds are collected for the same number of revolutions of drive wheel in stage.

vi. Seeds are collected and counted and data obtained is used to calculate within row spacing.

Within row spacing: Distance represented by known number of revolutions o D/wheel- Number of seeds collected for the same number of revolutions of D/Wheel.

vii. Within row spacing can be raised by changing the drive sprocket ratio is step III-IV are represented until the desirable rate is obtained.

OPERATING PROCEDURES FOR PLANTING EQUIPMENT

- Seed should be graded to uniform size so that they fit in the seed cell.
- Set or calibrate the equipment so as to provide the required/ desired plant spacing.
- Select the correct seed plate for the particular seed size.
- In case of a row planter the correct spacing between rows is obtained by moving the planter unit along the tool bar.
- Adjust the depth of penetration of the furrow openers.

- The equipment should be operated at reasonable speed (4-10) so as not to affect the seeding rate.
- For best results the field should be level free of trash and obstacles.
- Greasing and oiling should be done
- Clean after use.

CROP PROTECTION EQUIPMENT

The main crop protection is against weeds (herbicides) and against insect (insecticides). Types of equipment used: sprayers and dusters.

SPRAYERS

Types:

a) Syringe sprayers: This is a simple hand operated sprayer consisting of piston cylinder arranged with inlet/outlet valves.

b) Knapsack sprayers: Three types: Hydraulic, Pneumatic and Motorized.

Components

- Consists of a tank strainer boom and nozzle sophisticated one have additional parts as an agitator pressure regulator and pressure gauge.
- The rate of work when using a knapsack sprayer depends upon the walking speed.
- Knapsack is more expensive than syringe but they are more efficient and suitable for large farms and tree crops.

c) Tractor operated sprayers (Boom sprayers)

Components are tank, pressure cylinder, pump, filter, boom, nozzles.

Tractor operated sprayers are made up of either fibre glass (strong, light, resistant but expensive) or steel tanks.

- The length of the boom or sprayers bar may vary from 5-17cm.

NB: The effective working width of the boom is referred to as boom width.

Operating procedures/ precautions

- Spraying should be done when weeds/ pests are more susceptible to chemicals.
- Spraying should be avoided during rains and strong winds.
- Spraying should be done from the lee ward towards the wind ward side.
- Care should be taken to avoid inhaling the chemicals and body protection should be done.

Calibration of a tractor operated sprayers

This involves the setting up and adjusting of the sprayer in order to achieve the desires application rate. Steps

- Fill in the tank with chemicals and set the pressure to the desired working pressure.
- Graduated containers are used to collect resolution derived from several nozzles in a known duration.
- The volume of chemicals solution collected is determined.
- The application rate (l/ha) can be calculated on the basis of delivery rate, forward speed and boom width.

Application L/ha= total delivery rate L/min: - operating rate ha/min. Where: total delivery rater= volume of chemical delivery by nozzle/min. Operating rate=Area covered in one minute.

Factors affecting application rate;

i. Forward speed,

ii. nozzle size and

iii. type & ratio of water to chemical.

DUSTERS

Dusting: Is the application of powdered chemical to crops over livestock.

- Dusting of crops is most effective when the leaves are dump and atmosphere is relatively dry. The operation should be avoided in the presence of strong winds.

Types

- Small hand operated: cheap effective and suitable for applying a large volume of gas at a short time.
- Machine duster: either tractor operated or aircraft operated.
- Care and maintenance of sprayers and duster
- Clean all parts with clean water and right chemical should be used.
- Flash all parts with clean water after dusting/ spraying and flash with Na2 CO3 after using acidic chemical.
- Detach all parts and dry them up and metal parts should be treated with oil/ grease.
- Store in a cool dry and safe place. Harvesting equipments

Types

i. Manual/ hard harvesting

ii. Machine operated/ harvesting by use of combine harvester.

COMBINE HARVESTERS

- The combine harvesters outs the crop, conveys it to the threshing mechanism which sots the grains or seeds from the straw trash/chaff. The straw is left in a swath behind the combine and the chaff is brown out.
- The clean grain is elevated to the tank combines are either self propelled or tractor down.

Function compound of a combine harvester

- The reel: which is located over the cutter bar helps to pull the crops over the cutter bar.
- The screw anger: behind the cutter bar feeds the crop on the elevating mechanism to the threshing cylinder.
- The threshing unit consists of rotation cylinder and stationary concave drum between the crops which is fed.
- The high speed on the cylinder knocks the grain loose from the heads.
- The concave can be raised or lowered to adjust the gap between in and cylinder hence control the effectiveness of threshing.
- Grains remaining into the straw is carried back to the beaker which fluffs the straw so as to shake the grain out the beaker then pushes the straws into grain walker which borne the straw shaking out any remaining grain.
- Below the sleeves there is a fan which blows air upward through the sleeves lifting the material which rest on them.
- Clean grain collected is then conveyed by elevator to the grain tank.

Forage harvesting equipments

- Involves the cutting of posture grass to be fed as hay, silage or green fed. Usually the grass is out and left in the field for a few days to dry, before it is collected and stored as loose hay or balled and stored as baled hay.
- The out grass may also be collected green and to animals to direct with tools like slashes, sickle etc. even tractors. E.g: for hay making these includes mowers, swath tuners and bales, for silage making flail type harvesters are used.

MOWERS

Are two types

i. Reciprocating mowers: consists of a knife moving to and for cutting the grass with a shearing action.

ii. Rotary mowers: rotate horizontally and out the grass by impact.

- These are suitable for cutting light vegetation on fairly leveled land.
- They are stronger and better suitable to cut thick and vegetation on a rough ground.
- The cutting action of the rotary mower results into the being chopped and accelerated into pieces to which become difficult to collect the bale.

SWATH TUNERS

- Grass for hay making is cut and left to dry in a swath. Also turn the swath turners.
- The common type of swath turner is finger wheel swath turner / rake wheel turner.

BALERS

- Are used for picking, compressing and trying to cut grass into neat bundles for easily transportation, storage and feeding, they are usually driven by P.T.O shaft.

FLAIL TYPE FORAGE HARVESTERS

- Suitable for harvesting all types of green material for silage making. The flail type is cheap and simple.
- It works in the same principle as the rotary mowers except that in the case the blades called flails are hinged to the vertical.
- The cylinder is rotated at high speed through a P.T.O shaft.
- The flails cut the vegetation on impact and flying it into a trailer.

Other source of power is wind, water, sun, nuclear, fossil fuel, charcoal, and biogas.

FARM SURVEYING AND MAPPING

Meaning: Process of observing and measuring in order to determine positions, distances, boundaries, size and elevations of various physical features of the land.

Purpose of surveying

- To determine vertical and horizontal distances between two or more points on the land.
- To locate physical and non physical features on the surface of the land.
- To locate the direction of various features on the land.
- To determine area of a given piece of land.

The process of surveying: Done in three stages

A. Reconnaissance survey: Taking a general view of the area to be surveyed so as to get overall picture of the work to be done. It is done by visual observation of the area.

B. Observing: Measuring and recording direction, angles and elevation by using surveying equipment in order to determine the relative positions and size various features of the land.

C. Presenting the data: Collected in a form which allows one to understand and interpret the information. This can be done either by: drawing, written reports, tables, any convenient form.

Basic surveying equipments

- Odometer (perambulator) -Plumb bob - chain -arrows -surveyor's rod/ leveling staff rod - tape
- Plane tables - ranging pole - pre determine length of rope - range finder -plan meter
- Compass - altitudes - ruler - pantograph - field note book - erasers -Sharpeners - pencil
- Calculators -Abney level -Slides rulers -Hand level -Box spectant -Umbrella - Clinometers

Methods of surveying and mapping

A. LINEAR SURVEYING: This is the determination of horizontal distance between two parts. The distance can be measured pacing, odometer/ hand wheel and chaining/ taping.

i. Pacing: This is the determination of horizontal distance involving counting the number of paces/ strides made on the distance to be determined.

Advantages: The simplest method of determining distance in the field- used as a rapid means of roughly checking distance.

Disadvantage: Not so accurate as the length of a person pace depends on whether the person is walking, up or down hill or loose or firm soil in wet or dry soil and in short or tall vegetation.

NB: To improve accuracy in pacing. It is therefore necessary to determine the number of someone paces in an accurately measured 100m distance on the same ground before pacing.

ii. Odometer/ land wheel: These are simple device which measure distance by registering the number of revolution of wheel.

- Such devices may be pushed by hand or pulled by vehicle.
- Odometer can be used suitable in flat smooth surface while land wheel can also be used on rough grounds.

iii. Chaining/ Taping: Instruments used by a Chains.

Types

- Gunter chain: This chain is at 66 yards land and is divided into 100 links of 7.92 long.
- Standard/ Engineers chain: Similar to Gunter chain but in this type the length of the links are 12 long. The total length is 100 feet.
- Metric chain: Usually 20-30m long with links of 20cm long.

a) Tapes: Used when greater accuracy is needed e.g. in building roads and other subsiding measurements. They are marked in hectres or centimeters of the feel or inches.

Types

- Linen tape: made of linen with steel wire woven into fibers.
- Steel tape: they are more accurate than linen.

b) Arrows: Made up of steel and is about 350cm long.

- Used to mark temporary stations when surveying.

c) Ranging poles: Usually .made up of wood with a pointed at alternate bands of white and black.

- Used to align survey lines on the ground.

d) Plumb bob: Used to indicate a vertical position of a point e.g. in chaining long slopes.

- Made up of a sold piece of metal with one end pointed and a ring fixed to a flat base

e) Field note book: A book in which field notes are recorded.

B. TRIANGULATION: This is a survey method where by an area to be surveyed is divided into several triangles.

- The length of side of each triangle are measured and booked.

C. LEVELING: This is a process of determining the difference in elevation between two points

Types

- Differential leveling: Involves the determination of the difference in elevation of several points apart.
- Profile leveling: This is a process of determining the elevation of a series of points at measured intervals.

Instruments/ Equipment

i. Level: There are many level types which can be selected according to the accuracy required e.g. Dumpy level, Abney level.

ii. Leveling: This is a long rod graduated in meters, lengths and hundreds of meter.

- Used together with a level to measure the size of a vertical distances above a reference plane.

D. COMPASS TRAVERSING: Is a process of determining/ establishing the positions of successive points. Types

- Closed transverse: A transverse which proceeds from one known point to another.
- Open transverse: A transverse which does not close into a known point.

SCALES AND THE CALCULATION OF AREAS

The scale of a map: This is the ratio of the plotted length on a map or plane to the actual length on ground. Used to present the generally large survey feature on a map or plan.

Ways of showing scales on a map/ plan

a) Imperial scales: This scale is represented by a length in inches on a paper and is equivalent in some other units on the ground e.g. 1 representing 1oo.

b) Metric scales: Similar to imperial scale except that the units used are metric e.g. 1cm represents 100m.

c) Natural scales: This scale is represented as a ratio can be measured/ used with any system of units of measure e.g. 1:100,000 may mean: 1cm or inches on the map represent 100,000cm or inches on the ground.

d) Scale bars: This is the method of indicating scale on the map or plan. Usually reproduce on the drawings to provide a ready means of scaling distances.

Calculation of Area

Area of land surveyed plots can be calculated by using any of the following method;

a) Dividing the map or plot into geometrical figures

Triangles (triangulation) and squares are the geometrical figures usually used for area determination. The plot is divided into triangles. The measurement are converted to actual distances using the scale of the map, the area of each triangle is the calculated by using Y to base X height formula*Total area of plot is the sum total area of triangles.

- When using square method square tracing paper is placed over the plot whose area is to be determined the number of whole squares within the plot is then counted, the partially filled squares are estimated a fractions of whole squares. These are then added so as to get an appropriate number of whole squares.

- The total area of the plot is equal to the sum of the squares.

b) Using ordinates by

- Trapezoidal rule: Under this method the total area is equal to the common distance apart multiplied by the sum of half the first and last ordinates plus all other ordinates i.e. Total area= d (1/2O1+O2+O3+…..OR-D + ½ on).

- Simpson's rule: In this methods total area is equal to one third the common distance apart multiplied by the sum of the first and last ordinates plus twice the sum of the other add ordinates plus four times the sum of the even ordinates i.e. Total area=d/3(01+4o2+2o3+4o4+……2o(n-2)+4o(n-1)+0n)

c) Using a plan meter

A device which allows is to be mechanically obtained by reading off a graduated unit.

ERRORS

These are three kinds of errors in measurement.

i. Systematic or cumulative errors: Sources are

a. Wrong length of the tape/ chain.

b. Poor straightening of tape/ chain.

c. Poor ranging.

d. Temperature variations.

e. Slope

f. Sag

ii. Compensating / Accidental errors: Sources are

a. Variation intention of measuring tape

b. Wrong holding of tape and station marking.

iii. Gross errors: Sources are

a. Displacement of arrows/ station marks.

b. Miscounting tape/ chain lengths.

c. Misreading the tape/ chain.

d. Wrong booking of field notes.

THE PROCESS OF CHAINING

i. The head chain man with the zero and of the chain unrolls it towards the reference point. The near chain man holds the other end of the chain at the starting point.

ii. 1st 100cm measurement: The head man should have 10 pin regardless.

iii. The real man should align the head man by sighting on the reference point the chain should be straight and stretched.

iv. When the rear man has 100m mark exactly on the starting point he will call stick. The head man will place a pin.

v. The rear man pickup the pin and walks forward while the head man pulls the chain to the next point. When the end of the chain is about 6m from the pin on the ground, the rear man call chain to signal the head man to stop

vi. Procedures iii-iv are repeated until the head man had no more pins or reference point is reached rear man gives 10pins to headman.

NB: Both men should count pins. The distance to the 11th pin this is in the ground in 10 chain lengths or 1000m

- The number of pins held by the rear man in the distance from the starting point in hundreds of meters. vii) Chaining continues until the reference point is reached.

EXAMPLE OF CHAIN SURVEYING AND BOOKING

a) Method of setting off set to the chain line, off sets: line measured perpendicularly to the chain line.

1) Using an optical square

2) Using right triangle method

b) Assumption: The ABCD farm below with a fence boundary on one side; a farm house and garage. The following procedure can be used to survey the farm.

Procedure

i. Chain line AB and book the readings 10, 20, 30, 40, 50, 60, 70, 80, and 90.

ii. Take the offset of the fence which is 10m from point A and B m on the first end of hence on the chain line.

iii. Take the offset of the end of the fence which is 70m from point A and 15m from machine.

iv. Take the offset of the other end of the house which is 40m from A and 25m from chain line.

v. Book reading and repeat the procedure until all the survey lines are completed booking each line on separate pages of record sheet.

LEVELING

Differential leveling

Assumption: Finding a difference in elevation between points A & B in a farm.

Terminologies

i. Bench Mark (BM): Is a fixed point of reference for leveling, whose height above the datum is known

ii. Datum (D): Is any level surface to which elevation of points may be referred.

iii. Reduced Level (RL): Is a height or elevation behind the fore sight.

iv. Back Sight (BS): Is a height or elevation behind the foresight.

v. Fore Sight (FS): Is a height or elevation taken at succeeding stations of leveling area before shifting instrument level.

vi. Height of Instrument (HI): Is a reading taken at station added to the elevation of that point (i.e. BM+BS=HL).

   a. A man reading leveling instrument.

   b. N0 staff man.

vii. Intermediate Sight (IS) and Turning Point (TP) Procedure

1) The staff is held at "A" and the instrument level is set at point 1(pc).

- The first reading taken at station A is a back sight (BS) say 1.5m
- The reading is added to the elevation of station A to get the height of instrument (HI). i.e. 400+1.5=401.5 where 400m-BM, 1.5M-BS, 401.5m-HI.

2) The staff man moves first station P1 to station 1(S1). The instrument level is turned so that a reading is taken at station 1.This is a Fore Sight (FS) say 1.9m. The elevation of station SI, to determined y HI-FS i.e. 401.5-0.9=400.6 where401.5-HI, 0.9-FS, 400.6-Elevation

3) The level man moves to position P2 and sets the instrument to read the staff at station S1 (say 1.2m) reading s added to the elevation of station S1, to get the new HI. i.e. 400.6+1.2=401.8 where 400.6- Former HI, 1.2-BS, 4001.8-New HI of P2

4) The staff man moves to S1 and as IS reading is taken (say 1.4m). This reading is subtracted from HI to get the elevation of S2

   i.e. 401.8-1.4=400.4 where 401.8=P2-P1, 1.4-FS, 400.4-Elevation of S2

5) The level man moves to position P3 from which he reads the BS from staff at position P3 from staff at position S2 (Say S2=1.8m). This reading is added to the elevation S2 to get the new height of instrument HI i.e. 400.4+1.8=402.2 where 4042.2-P3HI, 1.2- BS 400.4- Elevation of S2

6) The staff man moves to station B and FS reading is taken (say0.2m). The reading is subtracted from HI to get elevation of point B

   i.e. 402.2-0.2=402.0 where 402.2-HI of P3 0.2-FS

   402.2-0-Elevation of station B

PROFILE LEVELING

Profile leveling is a process of determining the elevation of series of points at measured interval along a survey line.

Procedure

1) A benchmark is chosen where the staff will be stationed and BS reading is taken (say 6000m).

2) An instrument is placed at position PX and BS reading is taken as BS from the bench mark (say 0.6m).

3) The staff man moves to station A and reading is taken (IS) 0.9. The elevation of point A in the determined by subtracting the reading1 from HI i.e. 600.6-0.9, where 600.6-HI(PX),0.9-IS, 599.7- Elevation of A

4) The staff man moves to S1 and 1S reading is taken (say 1.2) the elevation of S1 is then determined by subtracting IS reading from HI i.e. 600.6-1.2=599.4 where 600.6-HE(PX), 1.2-IS at S2, 599.4-Elevation of S1

5) The staff man moves to S2 and IS reading is taken (say 2.1). The elevation of S2 is then determined by subtracting IS reading from HL. i.e. 600.6-2.1=599.5 where 600.6-HI(PX), 2.1-IS at S2, 599.5-Elevation of S2

6) The staff man moves to S3 and FS1 reading is taken (say 2.9). The elevation of S3 is then determined by subtracting FS from HL i.e. 600.6-2.9=597.7 where 600.6-HI(PX), 2.9-FS at S3, 597.7-Elevation of S3

7) The level man moves to position PY and sets the level. This point is also known as Turning Point (T.P) BS reading is taken (say 0.5m). A new HI is determined by adding Back Sight to the elevation of S3 i.e. 597.7+0.5=598.2 where 597.7-Elevation of S3, 0.5-BS, 598.2-New HL

8) The staff man moves to S4 and IS reading is taken is taken (say 0.9m). The elevation of S4 is then determined by subtracting IS from the new HI i.e. 598-HL, 0.9-IS at S4, 597-Elevation of S4

9) The staff man moves to S5 and IS reading is taken (say 1.4m). The elevation of S5V is then determined by 598.2 -1.4=596.8m where 598.2-HI, 1.4-IS at S5, 596.8-Elevation of S5

10) The staff man moves to point B and a final reading (a FS) is taken which is a Fore Sight (say 2.3m). Elevation of B is determined by 598.2-2.3=595.9 598.2-HI, 2.3-FS, 595.9-Elevation of B

NB: When the level was at PX the instrument man could not read the staff beyond S3 because staff was below line of sight. This shifting of PY and successive readings of BS from S3 to be taken and FS is taken to point B. All these elevation readings are called Reduced Level (R.L)

CONTOURING

Contour: This is an imaginary line of constant on the surface of the ground.

Contour line (on a map): Is a line connecting points on the map with equal elevation on the ground. Elevation of the contour line (on a map): Is represented by a number which appear on the contour line.

Example of natural contours; Ocean/ sea lake shores and rivers

USES

Used in farmers in

1. Contour ploughing
2. Contour planting
3. Laying out terraces
4. Laying out grass strips
5. Laying out water control structures

Requirements

- Instrument level (Abney level) -Level man
- Staff -Staff man

Procedure

- A point is selected to be located on a contour line. The level man then stands on the contour line.
- The staff man moves 15-30m up and down along the approximate contour as directed by the level man.
- When the level man locates the point on the line a stake is stuck by the staff man remains besides in the stake while the level man moves past him another 15-30m.
- The level man sight back the staff man moving up and down the slopes until he is on contour line.

- 0nce established another stake is stuck and the staff man moves past the level man as before.

- The process is repeated until the entire contour has been located and established.

COMPASS TRAVERSING

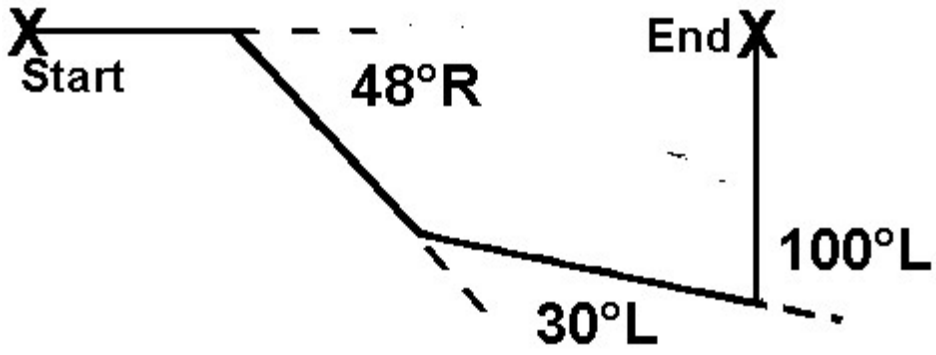
Traverse is a method in the field of surveying to establish control networks. It is also used in geodetic work. Traverse networks involved placing the survey stations along a line or path of travel, and then using the previously surveyed points as a base for observing the next point. Traverse networks have many advantages of other systems, including:

- Less reconnaissance and organization needed
- While in other systems, which may require the survey to be performed along a rigid polygon shape, the traverse can change to any shape and thus can accommodate a great deal of different terrains
- Only a few observations need to be taken at each station, whereas in other survey networks a great deal of angular and linear observations needs to be made and considered
- Traverse networks are free of the strength of figure considerations that happen in triangular systems
- Scale error does not add up as the traverse as performed.

Azimuth swing errors can also be reduced by increasing the distance between stations

- Link traverse
- Polygonal/Loop traverse
- Open/Free traverse
- Close traverse
- Close traverse is useful in marking the boundaries of wood or lakes.
- Open survey is utilized in plotting a strip of land which can then be used to plan a route in road construction.

Surveying by open



Traverse: Is a series of points on surveying lines connected established positions. Requirements: Chain/ tape, arrows, ranging poles and prismatic compass.

Procedure: The position of point A and distance and bearing from another point B is taken.

SOIL AND WATER CONSERVATION

Reasons for studying soil and water conservation factors relating to

i. Poor rain fall distribution -Excessive movement of soil

ii. Too much or too little rainfall -Moisture retaination -Control of excess water

iii. Low soil fertility due to poor soil structure and absence of essential nutrients.

SOIL CONSERVATION: This refers to all practices which are geared at preventing excessive movement of soil, so as to control the soil properties e.g. fertility in terms of essential nutrients supply.

WATER CONSERVATION: This refers to all practices geared at retaining the needed soil moisture and controlling excess water, so as to make effective use of too much or too little or poorly distributed rainfall.

SOIL CONSERVATION

SOIL EROSION: This is the wearing and removal of soil particles by action of WATER and WIND

EFFECT OF SOIL EROSION

i. Reduces the productivity of land due to decline of soil fertility.

ii. Render large tracts of land unable due to gullies.

iii. Causes silting of dams and rivers.

iv. Decrease in amount of water available for crop growth due to excessive runoff instead of percolating in soil.

v. Encourage floods due to sitting of rivers and dams destroying agriculture land, crops and properties.

SIGN OF SOIL EROSION

i. Appearance of gullies

ii. Appearance of muddy rivers and streams

iii. Sitting up of dams and water ways

iv. Appearance of bare soil.

CAUSES OF SOIL EROSION

i. Deforestation: This is the cutting of trees indimiscriminately without replanting.

ii. Overgrazing: This is continuous grazing or animal over a certain piece or land causing the following:

- Weakening of the plant root system binding the soil due to the removal of the grass cover.
- Trampling of the soil by the animals.

iii. Bad farming practice: This includes such practices as:

- Planting animal crop on steep slopes
- Clean weeding of plantation crops.

- Uncontrolled burning of the bush.
- Ploughing along the slopes

iv. Destruction of vegetation along the river banks: Through destruction of trees and grass, which hold together the soil along the bank and thus loosening the soil.

v. Living organisms: They loosen the soil hence more susceptible to erosive agents.

AGENTS OF SOIL EROSION

i. In high rainfall areas WATER is main agent

ii. In dry areas with sand soil WIND is main agent.

WATER EROSION

FORMS:

- Sheet erosion: This is a uniform removal of soil from wide area
- Rill erosion: Is the removal of soil where by small channels (rills) are formed.
- Gully erosion: Is the removal of soil through well developed deep channels called gullies.

WIND EROSION

FORMS:

- Saltation: This is the suspension of soil particles in the air and skipping and bouncing of soil particle on surface.
- Surface creep: This is the rolling/skidding of soil particles in continuous contact with the soil surface.

EXAMPLE OF SOIL AND WATER CONSERVATION SCHEMES IN TANZANIA

A. HASHI-HIFADHI ARDHI SHINYANGA

B. HESAWA- LAKE ZONE CONSERVATION SCHEME

C. HADO- HIFADHI ARDHI DODOMA

D. KAEMP- KAGERA CONSERVATION SCHEME

E. LOWER MOSHI IRRIGATION SCHEME- KILIMANJARO

F. RUBADA- RUFIJI BASIN DEVELOPMENT ASSOCIATION

G. KIHANSI CONSERVATION SCHEME- MTERA

H. MALDO IRRIGATION SCHEMES METHODS OF SOIL EROSION CONTROL

Goal: Regulation of movement of water and wind on the surface of the soil which is achieved by;

i) Mechanical measures ii) Agronomic measures

A. MECHANICAL MEASURES

Refers to all measures that will break up the slop and intercept the run of water before its volume and velocity can cause erosion, Therefore it involves mainly construction of different structure such as:

a) Hill side ditches: These are small ditches made with a gradient of a half to one percent, with the earth removed from the ditch and placed on the lower side to form a ridge.

- These are normally 3cm deep spaced 20m-30m apart along the contour.

b) Terraces: This involves the construction of small walls of stones or earth, rain forced with vegetation to form barrier against the movement of soil, these are of three types

i. Narrow based terrace: These are narrow banks kept wide permanent grass spaced between 15m-30m apart with slope of about 6%

ii. Broad based terrace: A wide banked terrace used in slope of 2-4% spaced about 30m apart. iii) Bench terrace: This involves reshaping the land into a series of steps spaced 7.5m apart.

- The steeper part must be kept (bench face) under permanent grass or protected by stones.

- The procedure is a big large ditch on the contour and to throw all the soil on the upper side to form a ridge on which grass is granted.

c) Storm drains or diversion ditches: These are channels constructed around the slope in the upper most part given a slight gradient to cause water to flow to the desired outlet. The design and capacity of the ditch will vary according to the type of soil, slope and estimated peak runoff which may occur in the area.

B. AGRONOMIC MEASURES

Refers to specific farming practices which can be used to reduce the severity of water and wind erosion. These include;

a) Minimum tillage: This is a minimum disturbance of soil involving as little cultivation as possible.

b) Contour strip cropping: This is a practice of growing crops which give little soil cover e.g. maize in alternate strips with dense crops (e.g. cassava) along the contour line or is a practice of growing alternate strips of different crops in the same field along a contour.

c) Vegetative buffer crops: This is a practice of leaving strips of uncultivated land between strips of cultivated land which acts as barriers

d) Mulching/ Use of cover crops: Mulching is a practice of cover the soil surface with straws, cut herbage or leaves so as to protect the soil from direct rain drops, wind and sun's heal as well as retaining soil moisture in areas with limited moisture supply. When it decomposes it adds organic material in the soil.

e) Wind breakers: Are trees/ shrubs which are grown in the direction of wind so as to reduce its velocity.

f) Reforestation: This is the practice of growing trees in bare land. This protects soil and crops and the roots bind soil. Others:

- Avoiding indiscriminately slashing and burning.
- Avoiding deforestation.
- Avoid over grazing.
- Avoid cultivation on very steep slopes.

ANNUAL FIELD CROPS PRODUCTION

Meaning of field crops: Non-horticultural grown for economic importance.

Categories:

a) Cereals: These are crops bearing seeds which are called grains-They include; paddy, maize, millet, wheat, sorghum.

b) Legumes: These includes: Kidney beans, soya beans, cow peas, pigeon peas

c) Root crops: Cassava, round potatoes, sweet potatoes.

d) Oil crops: Ground nuts, sunflower, simsim.

e) Fibre crops: Cotton, sisal.

f) Medicinal crops: Tobacco.

g) Beverage crops: Coffee, tea.

h) Spice crops: Cloves and ginger.

Roles:

1) Food supply

2) Supply of industrial raw material

3) Sources of employment

4) Foreign exchange

5) Improving living standard-Health wise, Clothing, Economic wise.

A. PRODUCTION OF CEREAL CROP

MAIZE

Scientific name: Lea maize

Origin: Mexico Family: Graminae

Characteristics

- Height depends on the variety but 1.2m-2.5m
- Fibrous root system and parallel leaves, wind pollinated.
- Both male and female parts are on the female (male is same plant). NB: Upper part (male) Tussels lower part (female) –sill (cob)

Variety:

i. Hybrid varieties

a. Single cross

A*B} e.g. H511, H611, H612

A B}

b. Three way cross

AXB}

ABXC}

e.g. H632, H603

ABC}

c. Double cross

AXB CXD

AB CD

ABCD

ii. Open pollinated varieties (composites)

ECOLOGY

- Altitude: 0-2400m a.s.l

- Temperature: grows in wide range of temperature but hybrids in low temp while composites in high temp
- Rainfall: Well distributed amount of rainfall 850-1500mm is preferred.
- Soil: Well drained fertile soil of PH 5-7 is ideal.

FIELD HUSBANDRY

- Land preparation
- Bush cleaning, ploughing and harrowing creating moderate fine soil
- Planting: Early and timely planting is essential because of avoiding diseases and pests.
    - Use of nitrogen flush with depth of planting 2.5-5cm deep.
- Spacing: Different between varieties, soil fertility and rainfall availability

Generally 90cmX30cm- normal/ optimum conditions, 75cmX25cm-highly fertilizer soils

- Two seeds/ hole, seed rate 20-25 kg/hector

- Fertilizer application: Depends on soil analysis recommendation but generally.

At planting- organic manure, in organic manure, phosphate 40-60kg p202/h hectors

After weeding- Top dressing of nitrogenous fertilizer is done 75-100kg of SA/hect. Done by hand or machine.

- Weeding: Proper and timely weeding is necessary to reduce weed plant competition are reduce risks of pests.
    - Good weeding should be when the plant is at 4-5 leaf stage at knee height.
    - Weeding can be done manually, mechanically or chemically using 2-4D and Altrazine2.5-5 litre/ hect fore past emergence broad leaf killer and paraquant, gramoxine, cesaprim, round up as non - selective pre emergence.
- Pest control
- Maize stalk borer- Buseula fueca

Damage symptoms: Caterpillar feeds on young tender leaves and stalk resulting into dead heart symptoms, windowing of leaves and stunted growth with poor seed setting

Control

- Early planting
- Timely weeding
- Burning of crop residues
- Chemicals e.g. thiodan dust or spray after 1st weeding
- Maize leaf hopper- Licadulina ubla

Symptoms

- They stuck the leaves causing maize streak diseases

Yellow parallel lines along1 the leaves are seen impairing chlorophyll for photosynthesis.

Control

- early planting
- Use of resistant varieties e.g. Kito and Kamani.
- American boll worm: Heliothis amigera Symptoms

Caterpillar's boreholes in the cobs causing rusting and destructing of seed/ kernels.

Control

- Early planting
- Burning crop residues
- Use of chemicals e.g. Thiodan
- Cut worms: Agaratus spp

Symptoms

Damage seedlings as they emergence

Control

- Chemical spray e.g. Thiodan or Aldrin 40
- Army worms: Spodoptera execipta

Damage

- They eat the whole plant.
- Control: Use of chemicals e.g. Sumithion, EC spray, thiodan spray.
- Aphids: Rhaprolosiphure maydis

Symptoms

- They are greensh/ brownish insects feed by sucking the plant under nearth the leaves.

Control

- Insecticide spray

DISEASES CONTROL

i. Maize leaf streak: Viral diseases caused by virus transmitted by leaf hopper.

Symptoms

- Yellow/ White along the leaf veins, chlorophyll are destroyed and started growth.

Control

- Early planting
- Use of resistant varieties
- Uprooting affected plants
- Crop rotation

ii. Maize leaf rust: Fungal disease caused by Puccina sorghum

Control

- Use of resistant varieties varieties e.g. IMVI, Staha, Katumani .

- Early planting.

HARVESTING

- When the crop has reached 18%-25% moisture content it is for harvesting.
- This can be detected when the cob harvesting farming black colour near the leaf strength
- The harvested cob maize is further dried in well prepared cribs.
- Shelling is later done when at 11%-12% moisture seed dressing is then done before storage using such chemicals e.g. Actelic.

MARKETING: Is done through local markets.

RICE

Scientific name: Oryza sativa

Origin: India (Indo -China)

Distribution in Tanzania

- Mbeya - Mbarali, Kyela
- Morogoro – Dakawa, Ifakara,
- Kilombero Coast – Ruvu, Bagamoyo, Rufiji
- Kilimanjaro – Lower Moshi Irrigation
- Shinyanga/ Tabora – Maronga Irrigation

Varieties: Afaa Mwanza- Kilomber, Sindano

Types

i. Indica characteristics

- Long and weak
- Drought resistant
- Low tillering capacity

- Have strong arma
- Grains are long and narrow
- High amylase content which result to be less glutamic

ii. Japanica characteristics

- Short and steady stems
- Short and broad grains
- High tillering ability
- Low amylase content resulting to be more glutamic

ECOLOGY

- Altitude: 1200m a.s.t
- Temperature: Require high temperature and prolonged sunshine 20-30c.
- Rainfall: its hydrophytes hence require 3-4 months of well distributed 800mm rainfall. FIELD HUSBANDRY

Land preparation

- Usually done at the end of wet season to allow decomposition of straws
- For irrigated rise the field should be level to allow easy distribution of water.
- The field should be free from weeds. Planting

Direct planting either broadcasting or dibbling, Transplanting: Use of nursery propagation.

Advantages of using Nursery

- Lower seed rate used.
- Better spacing control.

- Better weed control.
- Better management of initial stages.
- Shortens the field period of which the plant will remain. Disadvantages
- Require high labour during transplanting.
- Require a lot of water and clearing during transplanting

Spacing

During transplanting 18-20cm between two rows and 10-15cm within the rows

Water management for irrigated rice: Irrigation channel should be kept clean.

- Low water level should be maintained soon after germination in the ready weeds increased as crops get high
- When herbicides and fertilizer are applied, periodic drainage is important to be done.

1st planting/ transplanting

2nd at tilling

3rd at mode elongation

4th booking/ provide formation

Fertilizer application: 60-120kg of nitrogenous fertilizer/ hect should be applied on the above periods

Phosphorus 45-60kgs P2 05 /hect of ISP, DSP, NPK

Weeding

Types of weeds

- Bam yard grass- Echinocina corona
- Guinea fowl grass- Proltbrolia spp

- Wild rice- Oryza bathii, Oryza porictata
- Nut grass- Cyperus rotundus

Control

- Manual uprooting
- Herbicides e.g. Beragram 4l/ hact
- Use of weed free seeds
- Use of clean planting material
- Crop rotation
- Cleaning of irrigation channels

Diseases control

Ride Blast: Fungal diseases caused by Pycularia Oryzae

Symptoms: Formation of spindle shaped lesion on leaves and broken neck symptoms in panides

Control

- Use of resistant varieties

Spray fungicides

- Cultural practices e.g. uprooting infected plants.
- Seed treatment before planting using organ chlorine compound

Pest control

i. Army worms

ii. White eyed shoot fly- Dropsith thoracia

Damage: Feed on the centre of the stalk

Control: Chemical sprays e.g. Diazon, sumithion, Malathion, rogor.

iii. Maize cob worm: Maesasmia trupesalies.

Damage: Roll the leaves

Control: Insecticides sprays e.g. Durbane dethane

iv. Stalk borers: Buseda fusca

v. Queleaquelea: Searing, quelea box chemical.

Harvesting

- Done when crop is fully matured and leaves have partially through hand or machine.

WHEAT

Scientific name: Triticum durum

Distribution in Tanzania: Arusha and Mbeya

Varieties:

Variety breeding depends on the following factors

- High yielding
- Early maturing
- Diseases resistance
- Straw strength
- Baking quality

ECOLOGY

- Altitude: Wheel prefers high altitude areas of elevation 1500-2000m a.s./
- Rainfall: Well distributed of about 900-1500mm
- Temperature: Cold weather is highly preferred.
- Soils: Well drained and fertile soil.

FIELD HUSBANDRY

LAND PREPARATION

- Clearing and burning of previous season crop residues and straws.
- Preparation of moderately fine tilth.

PLANTING

- Done by broadcasting or drilling and seed covering must be ensured. Done during onset of rains
- Seed rate of 1020 kg/ hect

FERTILIZER APPLICATION

Is done by broadcasting or during land preparation by, mixing the soil with1 organic. Inorganic fertilizer 200kg/hect of (AN) applied at planting and at tillering.

NB: Most of sourthen parts of Tanzania soils are deficient in Cu and Ma, Hence fertilizer rich in Mn and Cu are essential. Cu: 20-40kg/ hect of Cu SO4 at 5years interval and Mn: 35-40 kg/ hect of Mn SO4 during planting.

WEEDING: Can be done manually by hand hoe or uprooting OR Chemically use of MCPA=1.5-3l/hect (post- emergence) and S10MP: 3l/ hact (pre-emergence)

DISEASES CONTROL

i. Leaf rust- Puccinia app

ii. Leaf butches- Septeria spp

Symptoms

- Brown / yellow patches on leaves
- Grey- Brown colour spots in plants leading to premature death.

Control

- Use of resistant varieties
- Crop rotation
- Avoid dose season.

iii. Leaf blight- Helminth trichoistoma(fungi)

Symptoms

- Development of brownish lesions. Control
- Use of resistant varieties.

Yield: 2-3 tonnes/ hacts under good management

FINGER MILLET

Scientific name: Elensine cororana

Origin: East Africa

Varieties: Early millet (14-15 weeks to mature), Late millet (16-24 weeks to mature)

Characteristics

- It can be stored for a long time than any other cereal crop.
- Cannot be penetrated by storage pests due to small size of seeds
- Can dry quickly

ECOLOGY

Altitude: 900-2400m a.s.l Rainfall: 900m per annum. Temperature: 18c-27c

Soils: Well drained fertile soil

FIELD HUSBANDRY

LAND PREPARATION

Weed free and fine seed bed is required

PLANTING

- Should be done in the onset of rains

- Is done by drilling and thinned to a spacing of 5cm within the row.
- Drill rows should be spaced 25cm

WEEDING

Is done together during thinning when the plant is 7cm long

FERTILIZER APPLICATION

20-25kg/hect of Nitrogen fertilizer

20kg/hect of phosphate fertilizer

DISEASES CONTROL

Leaf spot: Cerceporta phacimaculani(fungi) Damage: Formation of sports on leaves

Control: Use of resistance varieties e.g. Serere 107, serere 2A-9

PEST CONTROL

Birds, grasshopper, locust

HARVESTING

- When heads get ripe by cutting the further dried in a cob and then threshed, winnowed and stored for selling

YIELD: 250-1100KG

SORGHUM

Scientific name: Sorghum vulgare

Origin: Africa, mainly found in Tanzania in Dodoma and Shinyanga Distribution: Well suited in scarcity rainfall areas e.g. Dodoma and Shinyanga

ECOLOGY

- Altitude: 900-2500m a.s.l

- Rainfall: 300-500mm per annum
- Temperature: 22c-29c
- Soil: can be grown in wide range os soil even poor soils.

CHARACTERISTICS: Which make sorghum to survive in low moisture?

- Morphologically, sorghum reduces leaf area by folding leaves.
- Have got extensive root system and have got checked growth.

Varieties

- Serena: resistant to birds, diseases and seeds.
- Dubbibora: Adopted to high rainfall areas and colour is light red.
- Tegemeo and Lulu: White grains

FIELD HUSBANDRY

LAND PREPARATION: Medium- fine seedbed is required

PLANTING: Onset of rain

- Seeds rate : 5-7kg/hect, 2-3 se/hole

SPACING: 60CMx15cm

FERTILIZER APPLICATION

- 40-60kg/hect of nitrogenous fertilizer
- 25-40kg/hect of phosphorus fertilizer
- Usually the amount depend on the soil fertility

WEEDING

- Can be done by use of hand hoes or herbicides
- The most dangerous weed is with weed (striga spp)

- Witch weed: purple- flowering striga- striga haemonthica, Red-flowering striga- satriga asiation

CHARACTERISTICS

- Parasitic weed
- Its host is a sorghum plant
- Produce a lot of seed which can survive in the soil for more than 20days.

EFFECTS

- Sorghum plant produces a chemical substance called EXUDATE which stimulates germination of striga seeds.
- After germination, striga roots attach themselves on host through vascular bundles suck food material.

Control: Cultural method: Uprooting before flowering

- Mulching which suppress the growth of striga
- Irrigation as excess suppress the growth of striga
- Use of resistant varieties e.g. Serena, puto
- Crop rotation
- Planting trap crop e.g. ground nuts and cotton.

Chemical method: Use of sythentic stimulants which contain striga e.g. Ethylene C2H2 which when mixed with soil stimulates germination of used then die.

- Use of herbicides like (2-4I) Amine, MCPA (Pre- emergence)

PEST CONTROL

i. Sorghum shoots fly-Anterigona saciata

Damage: Sucking the cell sap of leaves causing drying of the plants

Control: Insecticides sprays e.g. Durban, Dethane

Others:

i. Stalk bore: Buseola fusia, bird's e.g. Quelea quelea, wild pegion

Control: Scaring them away

- Planting resistant varieties e.g. Serena because they have bitter test, loose penides hence no support varieties with long glumes.

Diseases control

i. Leaf blight

ii. Leaf rust

iii. Black suit (Asali diseases): Sphacelia sorghum

Damage: Formation of hard dark grains replacing the grains

Harvesting

- This is done by cutting the head/ penicles
- Threshing by biting with the sticks or stumping by tractor wheels
- Winnowing is then done and drying to 10% moisture control content

Yield: 1000-2500kg/ hect depending on variety.

B. PRODUCTION OF LEGUME CROPS

Are plants which produce pods which contain high seeds?

COMMON/ KIDNEY BEANS

Scientific name: Phaselous vulgories

Origin: South and central Africa

Characteristics: Are used in the growth habit as related to vegetative and reproductive phases

a) Determinate growth habit: This is bush or dwarf type of growing none creeping.

- It has two phases i.e. vegetative and flowering phases, they stop together.

b) In determinate growth phases: This is fully climbing/ creeping habit.

- It has two phases but when flowers start the vegetative phase continues to grow.

c) Semi-determinate growth habit: This is a semi- climbing habit of growth.

Varieties

- Canadian Wonder Bean (WCB).
- Sumbawanga A and B
- Selian Wonder Bean (SWB).
- SUA 90, SUA 87
- Kabaniwa
- Maasai red
- Lyamungo

ECOLOGY

- Altitude: 900m-1200m a.s.l
- Rainfall: 300-600mm at first weeks of growing stage.
- Soils: Requires medium heavy looms, slightly acidic Ph 5.5-7.

FIELD HUSBANDRY

- Land preparation: The land should be weed free either flat or rose.
- Planting: Is either by hand or machine at depth of 2.5-5cm.

- Seed rate: For small varieties-50kg/hect, for large varieties e.g. Lyamungo 85 is 80kg/hect.

- Spacing: 50cmx10cm

NB: When intercropping spacing should be increased.

- Weeding: Timely weeding is done 40days after germination.
- Fertilizer application: Since bean plants have symbiotic relation with Rhyzobium bacteria then 20-30kgs of NPK/hect can be applied during planting or 15-20 ton of farmyard manure can be mixed with soil during preparation of land.
- Pest control

i. Stem maggot: Ophionia spensellela

Symptoms: It bores through the leaf blade or petiole and moves down to the stem. Up to the ground level and starts to destroy the stem tissues and cause down to the stem base. Roots will not die.

Control

- Early planting.
- Use of chemicals e.g. sumithion, Malathion
- Sees dressing by Aldrin

ii. Bean aphids: Aphids fabal

Damage: Sucking plant sap transmitting bean enosaic virus.

Control: Chemical sprays e.g. Sumithian.

iii. Maruea: Maruea testuralis

Damage: They cause destruction of seeds in the pods.

Control: Application of insecticides during flowers period e.g. Durban, dethane.

iv. American boll worm: Heliothis amigera

Damage: Destroy seeds in the pods.

Control: Chemical sprays e. g. Sumithion, malathion.

Diseases control

1) Bean rust: Fungal disease by Uromyces upendiculate

Symptoms: Development of small whitish round spots surrounded by narrow yellow bands causing premature defloat.

Control

- Crop rotation
- Destruction of plant residues
- Use of resistant varieties e.g. CWB, SWB

2) Bean Anthracnose: Fungal diseases by Collentricum Lindemethianum

Symptoms: Dark brown sunken lesions on the leaves, stems and pods.

Control

- Use of disease free seeds.
- Use of disease free seeds.
- Crop rotation

3) Paternal blight: fungal disease by Pseudonomus spp

Symptoms: Water soaked lesions which dry up and become brown and finally defoliation.

Control

- Use of resistant varieties.

- Use of diseases free seeds.
- Crop rotation.

4) Angular leaf spot: Fungal diseases by coryne bacteria spp

   Symptoms: Sudden wilting of the plant

   Control: As above

5) Bacterial wilt: Fungal disease by phasecisapopsin griseola

   Symptoms: Formation of spots within the vein and pods which are brownish.

   Control: As above

6) Bean mosaic virus

   Control

   - Use of resistant varieties.
   - Crop rotation
   - Use of disease free seeds.
   - Destruction of crop remains.

Harvesting: Done by either hand picking from the field or uprooting the heaping and later biting by sticks, winnowing and drying.

Yield: 670-2500kg/hectre.

SOYA BEANS

Scientific name: Glycine max

Origin: South East Africa

Distribution: Northern and Sourthen regions and some parts of Morogoro

Description: Soya bean is an annual crop which is good source of carbohydrates, proteins and oil. Uses: Human feed, oil source, livestock feed (soya bean cake)

Limitation: Need prolonged cooking, have bitter test, have poor digestibility

Varieties: Human series e.g. 11/H 137, 3H/1 and BOSSIER.

ECOLOGY

- Altitude: 900-2000m a.s.l
- Rainfall: 500-900mm per annum.
- Temperature: 18c-30c optimum
- Soils: PH 6-6.5

FIELD HUSBANDRY

- Land preparation: Same as common beans.
- Planting: The planting operation should be timed such that the crop receives enough moisture for growing stage and mature at drying stage.
- Spacing: 60cmx10cm-hand planting, 75cmx10cm-mechanics of planting.
- Fertilizer application: 20-30kg/ hact of nitrogenous fertilizer, 20-60kg/ hact of phosphatic fertilizer during planting.
- Weeding: Careful weeding is needed within the first 5 weeks.
- Pest control

i. Leaf spots: Fungal disease caused by Cepharia Kikichii

Symptoms: Formation of spots causing defoliatin.

Control: Use of resistant varieties, Destruction of crop residues.

ii. Soya bean mosquic virus

Symptoms and Control: As common beans

- Harvesting: Ready for harvesting after 80-125days by picking or uprooting and later biting by stick.
- Yield: 500-1200 kg/ hect

C. PRODUCTION OF ROOT CROPS

CASSAVA

Scientific name: Manilot esculentum

Origin: S. America

Description:

- It is a drought resistant crop.
- It has got high biological efficiency for crop production.
- Little labour is required during production.
- Cultivation and processing is easy.
- It is capable of remaining in the soil for a long time

Disadvantages

- It has got low nutritive value it contains 0.7-2.7% protein, 62%H2O, 32%-35% Carbohydrate.
- It is poisonous under certain conditions, as the tuber contains cynogenic glucoside of which under improper preparation it changes to linamarian which is toxic.
- Produce low yields at more than 1900m above sea level.

Varieties:

- Amani series, UMS (Ukinguru Mahihot Selection)
- Bitter varieties: Liongo, -Ukerewe, -Njema, -Binti Moshi, - Dododa, -Binti Simba
- Sweet varieties: Msitu Zanzibar -Kigoma -Sukari

ECOLOGY

- Altitude: Less than 1500 a.s.l
- Rainfall: 500-700mm per annum.
- Soil: Deep free from stones, not very fertile PH 5-8.

FIELD HUSBANDRY

- Land preparation: It is done by ploughing and harrowing, seed beds can be flat or ridges.
- Planting materials: Stem cutting are used for propagation.
    - Seeds are used only in case for breeding.
    - Cutting should be 30-45 long taken at the centre of the stem and 2.5-4cm thick.
    - Cutting should be taken from plants of at least 10months old and disease free.

Time: Enough moisture should be available during planting.

- Common way of planting is at slanting angle of about 45c and nodes jointing up.
- Fertilizer application: Application of phosphatic fertilizer stimulates roots and starch accumulation.
- Weeding: Should be done in the early stages.
    - Early thing up is done during weeding.
- Pest control

i. Tobacco whitefly: Bemiccia tobacco

Effect: the nymph sucks up the cell sap and transmitting cassava mosaic virus disease.

ii. Cassava white: Mononychellus spp

Damage: They feed on young leaves during dry season.

iii. Cassava mealy bug: Phenacocus manihot

Control

Plant quarantine

- Use of resistant varieties
- Destruction of the affected plant
- Biological control

Diseases control

1) Cassava Mosaic: Viral disease

Symptoms: Crumpling and Evisting of the leaves which show yellow patches i.e. molting of leaves.

- Stunted growth
- Reduced yield

Control: Use of resistant

Varieties

- Use of clean plating materials
- Destruction of affected plants

2) Cassava bacterial wilt: Xerthronomus manihot

Symptoms: Small angular, water soaked lesions on the leaves

- Orange yellow fluid comes from leaf petals
- Defoliation

Control: Use of resistant

Varieties

- Destroy affected plants.

Harvesting

- Sweet varieties mature 8-9 months.
- Bitter varieties mature between 12-18 months.
- Harvesting is done by uprooting the whole plant or by piece, meal for domestic consumption.

Yield: 10-25tones/hect

SWEET POTATOES

Scientific name: Ipomea batatus

Characteristics

- It is a root crop
- It is a drought resistant crop

ECOLOGY

- Altitude: 0-2400 a.s.l
- Rain fall: 750mm and above
- Temperature: Warm and cool climate are suitable for its production
- Soils: Can be grown in a wide range of soils. Varieties: SPN/01, SPP/41, SPS/44

Planting varieties: Potato rims (strips) of 30-45cm long

NB: If planted is high, proteins soils, it will result to large watery tubers called TUMBOS FIELD

HUSBANDRY

- Land preparation: Mound or ridges should prepared for planting
- Planting: A pial piece of vines are used as cuttings.

The pieces are planted at an angle with1/2-3/2 of the length buried.

- Spacing: 90-25 between ridges/rows, 30-60 between vines.
- Fertilizer: Farm yard manure is the only manure found to give support, response.
- Pest control

    i. Potato weevil: Sxlas spp

Damage: Bitterness on the crops caused by larvae causing discoloration of the crop.

Control: Crop rotation

- Chemical spray e.g. malathian

Diseases control

Virus B and whitelfly –transmitted virus

Symptoms: Stunted growth, excessive branching of the plant and tubers have hard sports.
Control: Planting improved varieties

- Harvesting:
    - Digging by hard hoe to uproot the tubers
    - In case of poor storage, few are harvesting at a time.
    - It can go from 4-6 months ready to harvest.
- Yield: 25-80 tons/hect

D. PRODUCTION OF OIL CROPS

GROUND NUTS

Scientific name: Arachs hypogeal

Family: Leguminaceae

Characteristics: Leguminous crop which sets pods underground which can be eaten row or cooked. Seeds can be crushed to the processed to produce edible oil residues can be used as

Livestock concentrates feed. Seeds contain 40% oil and 30% erud protein.

Varieties:

ii. Virgin runner types which have large seeds e.g. Asirya Mwitura.

iii. Spanish-Valencia erect types which have smaller seeds e.g. Bukene Bold.

Runner types mature longer 5months while erect type is early maturity 3months.

ECOLOGY

- Altitude: low- medium altitude.
- Rainfall: Minimum rainfall of 300-500mm
- Temperature: Warm temperature
- Soils: Well drained loose sandy soils rich in la as heavy clay soil hinder pod formation and harvesting is difficult.

FIELD HUSBANDRY

- Planting: Areas with high sand soils ridges or mounds should be used to help conserve moisture.
- Spacing: 50-60cmx10cm (erect type) 60cmx15cm (runner type)

- Fertilizer: ISP 200kg/hect is applied along the row at planting time, FYM can be applied during1 land preparation.

- Weeding: Within 2-6 weeks after planting groundnuts should be kept free from weeds.

- Pest control

  i. Leaf caters e.g. Beetles and Caterpillars

  ii. Leaf suckers e.g. Aphids and Thrips

Control: Spraying of insecticides e.g. Dursban, Dimethoate, Endosulphan. Symptoms: Defoliation usually near maturity.

- Disease control

1) Leaf1 spot: Fungal disease by Cereospara vachidieda

2) Ground nut fast: Fungal disease by Uromyces spp

Symptoms: Brown spots on the leaves.

Control: Sprays dithane M4S

- Harvesting

  - The crop is ready for harvest when the leaves turn yellow and Fail off.

  - The whole plant is dug out and pods are removed by hand and sun dried.

  - The crop should be stored as whole pods so as to resist insect attack.

SUN FLOWER

Scientific name: Helianthus annuus

Characteristics: Is grown for its seeds which contain 25-50% oil.

- Sunflower seed cake is a livestock feed.

Varieties: There are a number of varieties distinguished by their colour

Black or white, grey stripes or dark stripes

Most common area is record black, Jupiter white

ECOLOGY

- Altitudes: grows well in coastal areas up to 2600m a.s.l
- Rainfall: 750mm is more ideal but dry weather is needed during maturity

FIELD HUSBANDRY

- Land preparation: fine tilth should be prepared
- Planting: Planted by hand or machine at spacing of 75cmx10cm or 75cmx30cm
- Fertilizers: Phosphatic fertilizer of FYM is applied during land preparation.
- Weeding: Is necessary during early stages but when plants reach 90cm of height weeding is not necessary as they suppress weeds.
- Pest control
  i. Birds
  ii. American boll worm

Damage: They destroy/ damage seeds

Control: Scare them away

- Apply suitable insecticides e.g. Endosulphan.

- Disease control

These include:

1) Leaf spots
2) Leaf rust

3) . White blister

4) Stem rot

5) Root rot

Control: Destruction of control residues

- Crop rotation

- Harvesting

Cut the plant when the disc florest turns brown and the back of the head turn yellow.

Dry the heads in the sun, thresh the seed by beating the heads using stucks

E. PRODUCTION OF FIBRE CROPS

COTTON

Scientific name: Gossypium horsutum

Characteristics

- Cotton fruits are called bolts which produce fibre called LINI as well as they posses seeds.
- Cotton seeds contain edible oil while the cake is rich in protein and is fed to livestock.

Varieties : Most were bred at UKIRIGURU of which most of them called UK or UKA varieties have different names depends on production and length fibres e.g. long varieties and short fibre varieties

ECOLOGY

- Altitude: Below 1400m a.s.l with warm climate.
- Rainfall: Requires 25mm per month 1st and 2nd, 3rd and 4th. After that very little rainfall is required so as to allow cotton lint to mature.
- Soils: Wide range of soils is favourable for cotton production except on for
    i. Wide logged soils
    ii. Soils which are pH below S

FIELD HUSBANDRY

- Land preparation: Is done by hand, oxen or machine
- Planting: Is done by hand where by 6-10 seeds are planted per hole
- Spacing: Usually depends on area of production in Western Tanzania cotton growing areas 90cmx15cm
- Heavy soil areas: 150cm ridges with two rows spacing at 45cm apart are used within 45cm.

In coastal areas the spacing of 90cmx30cm is used

- Thinning: When plants reached 10m tall, uprooting (thinning) of excess of weak 2 seedlings is done leaving seedling on Western zone and 1 seedling in coastal zone. It is done at the time of first weeding.
- Weeding: Is done either by hand or use of chemical herbicides e.g. OR Is done at thinning stage and later separated as seen in nursery
- Fertilizers:
    - A large quantity of FYM can be applied to the soil during land preparation if available.
    - 125 kg/ hect of SSP (Single super phosphate) during planting can be applied.
    - 6weeks after planting top dressing of SA/CAN fertilizers at 12kg/ hect can be applied.
    - Usually after first weeding1 and thinning.

- Pest control

Those affecting cotton bolls: American, pink and red bolls worms, Cotton strainers, Aphids, seed bugs. Those affecting roots: Root knot nematode, mites.

Others: False cooling moth, Caridea, Jassida, Cygns

Control:

- Insecticides at least 6 times e.g. endosulphan, sumithion, thiodan etc starting 2 weeks after planting.
- Destruction of crop residues right after harvesting by uprooting and burning (destruction/ control of boll worms)

Disease control

1) Bacterial blight: After leaves, stems or bolls showing water patches water which later on turn brown and dry up.

Control: Destruction of crop residues.

- Seed dressing by copper fungicides.

2) Fusarium wilt: Stunted growth is experienced, leaves become yellow and develop brown patches between the veins.

Control: Plant resistant varieties e.g. UK series

3) Venticulum wilt: Fungal diseases resembling above in symptoms and control.

Harvesting: Is done by hand picking

NOTE:-Do not break the twigs or leaves and mix with the lint.

- Do not pick lint in wet weather.
- After picking sort the lint to remove twigs and leaves or any dirt

F. PRODUCTION OF MEDICINAL CROPS

TOBACCO

Scientific name: Nicotima tubacum

Characteristics

- 1.2-2.4m depending on varieties
- 18-30 leaves per plant depending on variety
- 10,000 seeds gram contain 1-8%nicotine.
- Life span is 4-41/2months. Types
- Flu cured tobacco
- Fire cured tobacco
- Sun dried
- Nicotine tobacco

ECOLOGY

- Altitude: Medium altitude 100-1500m a.s.l
- Temperature: Warm temperature of 27c.
- Rainfall: Well distributed 38mm for 16weeks after transplanting.
- Soil: Sand soil with ph5.5-6.5(well drained)
- Distribution: Flue cured- Kesi (Kutsang 5-1), white gold, NC95 and fire cured-Heavy Western

FIELD HUSBANDRY

Tobacco is propagated by seeds, but the seeds are so minute that direct sowing isn't possible

- Nursery preparations:
  - Selection of nursery site

- Well protected from wind
- Near a source of water
- Well drained soil

- Preparation
  - Preparation of seed beds (raised) with 1.2x2.3m measurement.
  - Seed bed sterilization is done by burning the seed and injection (fumigation) using EDB (Ethyl Dibromicte) or MB
  - After 21days the seed bed is watered and NPK is mixed with1 soil (using a rake) 2.5kg/ bed of N6P18K6.
  - Sowing is done by mixing seeds with water and watering along the surface using the cane which must have a rose.
  - Seeds will drop together with water through the rose.
  - Sprinkle sterilized sand to over the seeds and then special well proned mulch and is removed after germination.
  - Nursery site should be fenced.
- Hardening off: After 4weeks, 5 seedlings are pruned so as to facilitate strong stems and reduce growth speed.
  - Frequency of watering is reduced to once per day so as to harden the seedlings adopt field condition after transplanting
- Transplanting: Well prepared ridges are used spaced 1m apart.
  - Seed beds are watered before uprooting the seedling.
- Time: Usually it is recommended to transplant a few days 1-2 weeks before the onset of rainfall
- Spacing
  - Holes made 54-59cm apart are used (flue cured) 1.06x1.06m- 0.9x0.9m
  - Water mixed with chemicals (e.g. Aldrin) is put in each hole so as to protect seedlings from soil and micro organism e.g. nematodes, earthworms etc

- Uprooted seedlings are then transplanted.

- Weeding: Tobacco is attacked by many insect and diseases thus weeding (timely and clean) is highly required

- Fertilizer: Compound fertilizers are applied within a week of transplanting NPK or top dressing of nitrogen fertilizer according to the recommendation to be done. *130-200kg/hact of phosphatic fertilizer.

- Topping: Is the removal of flowers as soon as they are seen at least 5 plants have started flowering.

    - This encourages formation of bigger and heavy leaves.

NB: This operation stimulates SUCKERS which have to remove i.e. desuckering.

- Pest control

    i. Nematodes

    ii. Termites

    iii. Crickets iv)Cutworms

    iv. Ants

    v. Whiteflies

Most of them affect seedlings in the nursery.

Control

i. Proper seedling sterilization and fumigation to control nematodes

ii. Crop rotation to control nematodes

iii. Malathion sprays to control white flies.

iv. Other any insects can be controlled by Aldrin and Dieldrin in nusery bed during sowing

- Disease control

1) Damping off: Fungal disease symptomized by shivering of seedling shoots just above soil surface.

Control: Use of copper fungicides.

2) Frog eye: Fungal disease symptomized by development of spots which are pale centre surrounded by a dark margin.

Control

- Early planting
- Little application of N fertilizer
- Removal of affected leaves
- Copper fungicides in nursery

3) Brown spots: Fungal disease symptomized by development of circular brown spots on leaves.

Control

- Early planting
- Removal of affected leaves

4) Anthracnose: Fungal disease symptomized by water saked patches which later turn brown or white with dark margins.

Control: Fungicides sprays e.g. Zinet, Macozeb, Thiram.

5) Leaf curt: Viral diseases characterized by thick leaf veins which then harden and curl.

Control: Destruction of crop residues after harvest.

6) Mosaic virus: Viral disease showing yellow matter

Control

- Observe nursery cleanliness.
- Avoid smoking in nursery

7) Bossette: Viral diseases characterized by started growth with small leaves

Control

- Kill aphids in nursery using insecticides.
- Destroy crop residues.

- Harvesting
  - Fire cured tobacco: harvest when leaf tips and edges turn down ward with leaf blade become yellowish scattered.
  - Flue cured tobacco: harvest when leaves become lighter in colour and midribus become white.

  NB: Ripening of leaves starts at the base of the plant upwards.

  - Curing: this is oxidation of chlorophyll breaking down starches and sugar in leaves. It is done in special structures called BARNS.
  - Flue curing: consists of fine plane and pipe leading at the base of the barn called flue of which when heated transmit up the metal pipe which dries up the leaves.

Procedures:

i. Filling in the leaves in barn, after tying the leaf petides on sticks using strings from the top to the bottom of barn.

ii. Yellowing: by lighting the fire and spreading wet sticks to create humidity after closing all barns vents 32-38c.

iii. Fixing and drying by openings the vents and increase temp to 49c for 24hrs and raise further to 30c-79c for drying of midrib after closing the vents.

iv. Cooling by opening all vents to allow air to soften the leaves.

Fire curing process

i. Filling leaves in the fire curing barn

ii. Make a fire place in a pit on barn floor

iii. Yellow the leaves by hanging the leaves in the barn without any firs for 4-7 days

iv. Light the fire and keep it on for 3-6 days a week.

NB: Ensure that the fine gives a lot of smoke but little heat.

FOREST CROP PRODUCTION

MEANING OF FOREST: This is a continues stand of trees which may reach a height of about 50m with crown touching or inter minghing often interlaced with leaves.

The canopy may be thick consisting to several district layers.

FOREST CROP: This refers to the forest stand and produce derived from the tree stand (pods, fruits, timber, fuel, soil conservation, shelter, pulps etc)

MAJOR FOREST TYPES IN TANZANIA

	TYPES	LOCATION
A	-Lowland rain forest(0-200ma.s.l) Rainfall:Above1500m	-Eastern Usambara mountains. -Uluguru mountain sand lower slopes of Udzungwa mountains.
B	-Upland rainforest(above1500m) Rainfall:Above1500m	-Western Usambara -Kilimanjaro, Rungwe, Pare and Uluguru mountains.
C	-Lowland dry ever green forest(0-1500m)with poor rainfall	-Shores of lake Victoria and LakeTanganyika.

D	-Upland dry ever green forest(1200mabove)with poor rainfall -Distribution of 850-1300mm or less accompanied by permanent dry.	-Found indried North Western slopes of Usambara, Kilimanjaro and Merumountains. -Major portion of parents.
E	-Ground water forest	-On ground with high water table
F	-River line forest	-Patches surrounding sprung a long river banks,stream and lake.
G	-Swamp forest (from sea level upwards)	-Found inland or high saline water and water loged soils.
H	-Saline water swamp forest(mangrove)	-Found in the estuaries of Rufiji and Ruvuma rivers. -Along mainland coastlineMoyiaandWest Coast of Pemba.

ROLES AND POTENTIALS OF FOREST IN TANZANIA

Apart from the direct objective of obtaining forest products e.g. timber, fuel, wood, poles etc it has following objectives:

- Protect water catchment areas.
- Preventing erosion (soil conservation).
- Giving shelter to agriculture.
- Providing habitat to wild fauna.
- Facilitate scientific research in disease curing.
- Provide employment in forest based activities e. g bees keeping.

- As a form of insurance.
- Land tenure rights.

FOREST MANAGEMENT

Meaning: This refers to the practical application of the scientific techniques and economic principle of forestry aimed at substituting yield of products derived there in.

The sustained- use of forest is done so as

a) Stratification of the basic needs of the people living within the forest. b) To harvest all products at sustainable level.

b) To facilitate improvement of attachment regulation, nutrient, recycling and maintenance of biological diversity measures.

- Prohibiting excessive logging operations to avoid environmental degradation and to prevent un controlled fires.
- Preventing accelerating agriculture development on the perennials and within the forest themselves through land use planning.
- To prevent uncontrolled exploitation for fire weed, char cools and development of deforestation.
- Encouraging artificially grown fire wood sources for industries and urban domestic fire wood supplier.

LOCAL AND EXOTIC TREE SPECIES AND THEIR VALUE

VALUE	EXAMPLE OF THE TREE SPECIES
A] TIMBER	-Milicia excels(mvule) -Tectoria grand is(mtiki) -Pinus patula(pine) -Cypres suslustarica(mbani) -Grevillea robusta
B]POLES	-Casuatina equriselifolia(mvinje) -Eucalyptus saligna(mkaratus)
C] FUEL WOOD	-Eucalyptus spp -Aeacia spp -Azadirachter indica(mwarobaini,neemtree) -Leucacina leucocephale -Casualina conninghania
D] SHELTER	-Casucania equisetifal -Leucaenia ceuvonephela -Azadirachitaindica
E] PULP	-Eucalptusglobus -Pinuspatula
F] SOIL CONSERVATION	-Mangrooves(mikoko) -Casuarinaglobus -Aquaramaarusei -Leucaenaleucocephala -Sebasbaniabisphinoba -Grevillearobusta
G]AMANITY (Decorationand food)	-Mangiferaindica(mangotree) -Psidiumgwayara(mpera) -Spathodeamlotica -Jacarandamimostalia(x-mass tree)

SILVICULTURAL SYSTEM

Meaning:

Sulviculture: This is the art and science of established forests naturally or certicially.

ARTIFICIALLY REGENATION

This involves the following operations:

i. Choice of species of trees and shrubs

ii. Site selection

iii. Nursery preparation

iv. Nursery sowing and management

v. Transplanting

i. Choice of species of tree and shrubs

The following should be considered

- Ecological requirement of the species I.e. climate, altitude etc
- Use of which a tree is to be put e.g. timber, poles etc

ii. Site selection is based on – plant indicators e.g. natural species growing on the site

- Condition of adjoining agriculture crops.
- Soil potential

iii. Nursery preparation (seed tree qualities

a. Choice of seeds-good health tree

- good form i.e. straight stem
- small branches in relation to stem size and vigorous growth

b. Where to collect seeds

- Collect from one area where all the tree of the species being collected are virgorous and healthy.
- Avoid areas with serious attack of seed borers.
- Collect from within the natural home or indigenous species for this is the best tree grows.

c. When to collect seed: when ripe

d. Method of seed collection

- Sort and grade sees and retain only the biggest/largest one for use.
- For tree that split open e.g. carsia, wattle etc collection of the fruits is done before they burst open so that seed extraction could be done easily.

e. Seed storage

- Seed of the species commonly planted in Tanzania should be sown within one year of collection to avoid loss of viability.

When storing the following should be observed

- Seeds must have dried before being stored.
- The store must be dry and well ventilated.
- All seeds must be labeled with than name of the species, batch number and date of collection.
- Carry out frequent inspection and remove those damaged.
- Maintain the seed register, giving all details of the seeds in store

f. Seed testing: This is done before sowing.

- 100 large seeds are cut open:- good seeds contain vernels which fill up the seed cut.

- bad seed (which have less viability) contents are brown and strunked.

OR Water test: floaters are bad while sinkers are ok/good. *% of viability is then done/ calculated.

g. Pre- treatment of seeds: This is done so as

- To break seed dormancy and ensure rapid generation.
- To improve vegetative growth associated with nitrogen fixing bacteria through inoculation. NURSERIES

Types:

A. Temporary nursery

Advantages

- Cheap because no houses, stores
- Disease isolation is easy.
- Can be sited close to the planting area.
- Easy and cheap carriage of plants to the area of planting.

Disadvantages

- New ground must be cleaned every one to two years -high risk
- Plants in the nursery may be destroyed by animals hence- has higher running costs.

B. Permanent nursery

Advantages

- Frequent watering and soil tilling makes the plant healthy.
- Full protection can be provided for the seedling including a resident nursing man.

Disadvantages

- Require more expenses to make house, stores etc
- Carriage of plants to area of planting is expensive.
- Can't be sitted as close to the planting area as temporary nursery.
- Land may get exhausted.
- Spread of disease.

Details of permanent Nursery

Should posses the following:-

- A good and permanent supply of water.
- A good and well drained soil.
- A good or easily accessible for haulage of materials.
- Slightly sloping ground sheltered from strong wind.
- Staff house should be near to the nursery.
- Avoid heavy clay soils, swampy valley bottom and exposed hill top.
- Use good soil mixed with forest soil, manure or sand and gravel before filling the polythene tubes. Operations of the nursery site
- Clear all the trees, roots and stones.
- Clear all trees within 30m of the nursery boundary (to avoid roots feeding from outside trees)-Fill the soil 30cm deep ; Remove and destroy anthills.
- Uprooting born tree/ roots/ weeds outside the nursery area to the reduce risk of fungi, harmful to seedlings.

Nursery shape, size and layout

- Square/ rectangular is best because of easy layout.
- Size depends:-Number of seedlings to be raised each year.
- Species e.g. other take less room compared to others.
- How the plants are grown i.e. make it easy to allow further expansion.
- Place the nursery seedbeds and store in the centre.
- Fences, hedges and wind breakers
- Should be created to keep at cattle and wild animals by use of barbed wires, wire must etc
- For wind breakers and pigeon peas ornaments can be plant

Fertilizer application: Depends on the availability and use

- Forest soil
- Animal manure
- Clay added if the soil forest is too sandy
- Peat or compost can be added to make the soil of good nature.

NB: All these can be mixed to get standard soil mixture (mms)

- Artificial fertilizer used in mixtures e.g. Ammonium sulphates, super phosphate, potassium sulphate
- Application is done 3months in advance.

Watering: before 8am and after 5:30.

Mulching: to preserve soil moisture and suppress weed growth. Shade: to protect seedlings from rain drops, wind and water crops. Planting: before planting is done, packing out of soil moisture is done so as

- to give move room for seedling to develop
- to facilitate seedling to efficient water absorption
- to facilitate easy transplanting due to compactness of roots

Pruning: root pruning should be done frequently to encourage fibrous root system as well as making lifting of seedling easier and faster establishment.

Raising Seedling in temporary Nursery

- Seedbed size: 0.9 m by any convenient length.
- Spacing: o.9 m between seedbeds 7.5cm below plants.
- Making seedbeds: Use ropes and pegs to mark then till the soil and mix and make as level as possible.
- Soil mixtures: Must be done textured (i.e. 50% seined forest soil and 50%sand)
- Sowing: Water seed beds with perenox at 2-2.5/ litres of water to destroy any dumping of fungi 3- 4 days before solving.

Water the bed one day before solving.

- Mix fine seeds with sand twice their bulk.
- Spread seeds with dry sand to twice its depth.
- Form the converging with a broad flat board.
- Water lightly and water again later on the day.

Shade: Should be in place until even germination has been obtained and seedlings look well established (usually 7-10 days)

Watering: Must be done using can with fine rose, Water with perenox at weekly interval

Transplanting

a) Site selection

- Protect against termites
- Carry out drainage work
- Clean the site
- Till the land
- Carry out water conservation
- Carry lining out or pegging i.e. operation of marking the position when each tree is to be transplanted
- Digging holes, heap top soil and sub soil separately and during refilling by starting the top soil On a very wet ground use mounds.

b) Should be done on the main rain.

- Avoid twisting or bending root during planting.
- Leave fertilizer in each hole and encourage health start of seedlings.
- Spacing depends on
    - Cost
    - Rate of growth
    - Shape of tree
    - Demands

WOOD PRESERVATION

This is a chemical treatment done to wood for protection against:

- fungi: copper sulphate, sodium dichromate and acetic pentaoxide are used.
- nsects: dry bull tin oxide and penta chlorephend are used.
- water: using tour and paints

Methods of application

- Painting or spraying making the wood surface water proof.
- Soaking or boiling logs of timber in a chemical.
- Sap replacement: Lessons heat un pregnation by vacuum or pressure function pumps e.g. Creosola proteils timber against fire, fungi, bacteria and repel insects when heated penetrates tissues of timber.

Characteristics of good preservative

- Must contain toxic substance that can kill bacteria, insects and fungi.
- The chemical; must have residues/ presistance on the surface or inside the wood to be preserved.
- The chemical must not be flammable and water soluble and cheap.
- The chemical must have high penetration power in wood and low toxicity to human and environment.

LUMBERING

This is a process of timber harvesting i.e. removal of mature stem from natural forest or plantation.

It involves: Tree falling, conservation of logs or poles, extraction of road side, transportation to industrial site.

Methods of harvesting timber

Consists of either excavating a pit on the ground or placing support to the logs across the pit OR Erection of trees making a slope of which the logs are rolled. Peg screws; 5m long or more are used.

- The timber produced is earned manually from the sowing site to the nearest road and stacked. Advantages
- Forest flow disturbed by log extraction is reduced.
- Road density and subsequent soil erosion risk can be decreased.
- Disturbance of wild life by machine use is less. Disadvantages
- Is a selection falling, canopy gaps are distant from one another increasing eventual tending costs
- Control of harvesting is made difficult
- Small diameter log material and crows tend to be left as waste
- Poor dimensional sowing often includes high value exports.
- Use of chain saw machines is difficult.

AGRO-FOREST

This is a collective term used to cover a variety of land uses including tree growing, posture and crop production on the piece of land for the purpose of increasing or improving the output of the soil.

It involves planting trees and shrubs as purposely done in association on with other farm enterprises.

- Benefits derived: Is a remedy of deforestation (source of wood fuel)
    - Source of income.
    - Environmental benefits
    - Beautification.
    - Labour sowing (women)

CHOICE OF TREE SPECIES AND SHRUBS

As a general rule tree and shrubs suitable for Agro forest should have these habits:

i. Fast growth: the farmer does not have to wait long to get the end product e.g. firewood,fruits, timber

ii. Deep rooted: this ensures minimum competition of soil nutrients and moisture with crop plants as well as resisting drought.

iii. Nitrogen fixing: some leguminous spp are capable of fixing nitrogen as well as their leaves are rich in protein which then can be a good source of animal feed (cut as folder)

iv. Good in by product production: this includes timber, poles, honey, etc such trees should produce products without affecting crop plants.

FORM OF AGRO FOREST (AF)

Depends on farm size and type of crops, growth habits of crop, topography, climatic factors and land conservation measures

i. Intensive hedge row (inter cropping)

- Rows of trees or shrubs are planted between crops rows e.g. cereals (calindra) can be planted.
- Achieved by planting the shrubs after every third row of maize at a spacing of 60cmx70cm
- Such trees are pigeon peas, sesban, dinicidia

ii. Wide row planting

- This aims at wood and tree products such as poles, timber, planted at a spacing of 8-20cm between rows and 4m for both trees.
- Such trees are: coconuts, mangoes, avovado.
- Trees for wood and timber spp e.g Cadca spp African black wood (mpingo), sycomolis (mkuyu)Acucia spp (figi)

iii. Boarder planting

This is planting of trees and shrubs along farm border for

a) Protecting the farm as fence

b) Mark boundary

c) Farm wind break

d) Provide wood and timber for fuel, building and for sale.

Such trees are: Eucalyptus spp

- Marmacia spp
- Greenidelea robusta
- Sracunda minesitalia

Other harvested tree planting: for fruits, for fuel and sale..

LIVESTOCK PRODUCTION

THEME 3.0: LIVESTOCK PRODUCTION

Pig farming

Advantages of keeping a pig

i. Pigs can eat a variety of food or products and are fast growers.

ii. Pigs are prolific i.e. give birth to many piglets. The action of giving birth in pigs is called farrowing.

Adult female pigs are called sows while adult male are called boars

iii. Pigs have a short reproductive cycle i.e furrows 2 times a year. Each patch of piglets is called LITTER with 16 or more.

iv. Pigs don't compete with crops for land.

v. Pigs have a high dressing percentage i.e. meat% is high and nutrition of good quality.

vi. Pigs have high capacity to store fats.

vii. Pigs can withstand tropical temperature.

Factors limiting pig industry in Tanzania

i. Irregular supplies of concentrates.

ii. Pigs compete with man for food (do not eat grass).

iii. Lack of knowledge for pigs husbandry among farmers.

iv. Religious, taboos and social rigidities.

v. Disease and parasite incidences.

vi. Shortage of storage facilities.

vii. Damage of inbreeding: As pigs have high prolific rate there is a damage of inbreeding which result into loss of vigour and other side effects.

PIG BREEDS

1) Land race: -Have high slim white body

- Have short legs
- Have drooping ears
- Highly prolific
- Have high food/ feed conservation ratio.

2) York shire/ large white: -Have white body

- Have high dressing percentage
- Have erect ears
- Smooth long bodies
- sows have a good mothering ability

3) Saddle back: -Have medium size body

- They are black in colour with a white belt around the shoulders, body including front Legs
- They have a well curved back and floopy ears.

4) Hampshire: -Have similar characteristics as saddle back however

- They have erects ears instead of floopy ears.

MANAGEMENT OF YOUNG PIGS

- Provision of colostrums: Piglet has to suck their mother's milk along the first three days after being born.
- When piglets are 1-3 days old, their intestine absorb immune globin. As the piglet becomes older their intestine becomes impermeable to immune globin.
- Farmer should help the piglets to find the teats of their mother immediately after birth.

During 1st -6th Week

- Dipping the navel into iodine tincture to prevent navel infection.
- Removal of mucus from their noses.
- Each piglet should be provided with identification by ear notching, ear tattooing, ear notching.
- Prevention of piglets against anaemia by supplying iron through

a) Injection of 200mg of iron dextinne into the ham of each piglet 2-3 days after birth and repeated after 3 weeks.

b) Smearing/ spraying ferrow sulphate salts to be the udder the sow of the sow area/ day during the 1st 4-6weeks.

c) Piglets may be given a dose of iron solution through the mouth once per week.

d) Placing clean, red or yellowing sterile soil in the farrowing pen where piglets eat the soil to get iron.

e) Administer iron tablets to each through the mouth.

- Cutting the needle teeth, normally piglets are both with 8teeth known as temporary needle teeth. Those teeth may injure the sow during sucking as well as injuring another. Hence should be cut by plies or nippers after birth.

- Provision of creep area (is a place supplied with artificial source of heat). This can be wooden box of 30temperature.

- Provision of creep feed with a good weaner ratio.

- Castration: Boars which are not castrated have a bad smell and their meat smells bad. Also they have become viscous and become fat slowly. Castration is done 3-6weeks by surgical method.

- Weaning: Piglets may be weaned at the age of 3-5 weeks of provided with creep feed. If not weaning should be done and weeks. Remove the sow so that the piglets don't notice her absence.

REARING PIGLETS AFTER WEANING

- Group the wearers according to weight. Put similar piglet with the same into the same pen, piglets should be washed cleanly. The uniformly of piglets in each pen eliminate bulling at feeding. Each pen should be host 10-30piglets.
- Provision of feeding and water troughs with enough space.
- Feed the piglets twice per day.

NB: When rearing piglets for shaughtering feed then adlibutum i.e. provide enough food and water all the time so that they eat and drink at all the time.

FEEDING SCALE FOR PIGS

MANAGEMENT OF THE BREEDING HERD

- Pig reaches maturity at the age of 6-7 months. Allow BOARS to meet GILTS.
- Don't over feed breeding pigs to avoid becoming too fat which results to low fertility.
- Feed 2-3kgs of pig finisher meal for each boar per day.
- Boars should be given enough exercise but do not overuse.
- One boar should be grouped with 15-20sows, but mature boars can be grouped with 25-30days.

FlUSHING

This is a process of increasing the amount of food for the sows or gilt before mating.

Sign of heat: -The sow becomes restless

- Frequent urination
- The sow makes occasional land grants
- The valve of the sow becomes large and red
- At late oestrus the pigs stand still for the boars to mount

- White mucus discharges from the vulva Mating
- It is advisable to mate sows with boars of similar size. The oestruscycle of sow is21days. The gestation period is 114days i.e. (3months, 3weeks and 3days).
- The standing heat period lost for 40-60hrs. During mating, supervise the mating. Help the boar to insert the penis in the vagina if necessary

- **steaming up**: increase of food ratio to filts or1 sows one month (just before) giving birth.
  - Copulation takes 25minutes.
  - During gestation period, sows should be given 2-2.5kg of food per day.

PARTURITION (FARROWING)

This is the action of giving birth to pigs

PREPARATION BEFORE FARROWING

- Prepare a farrowing pen with the following facilities.
  a) Guardrails to protect the piglets from being crushed by sows when it lies down. Alternatively a farrowing crate can be provided where by the sow can't reach the piglets can reach the sow through the side of the crate.
  b) Preparation of an artificial heating device for piglets in crop box prepared and installed.
  c) Provision of creep feed to be provided outside the following crate.
- The following pen should be treated with disinfectant one week before introducing the pregnant sow.

NB: Place bedding materials into the floor of the pen 4days before the pregnant sow is to farrow.
Signs of farrowing

- The sow becomes restless
- Becomes nervous and unease
- Valva becomes enlarged

- Mucus discharge from the vulva
- Mammary tissues and abdomen protrude
- Milk secretion from the tents
- Frequent urination

CARE OF SOW AND PIGLETS AT FARROWING

- Remove each piglet once it's born.
- Provide colostrums by allowing piglets to suckle.
- If sow doesn't provide enough milk, piglets can be transferred to another sow.
- After birth liquid/ fluid should be collected.
- The sow should be removed from pen and only piglets left.
- Smear the piglets with the liquid of the after birth of the sow.
- Hence the sow will not recognize piglets which are not hers.

NB: If the after1 birth fluid is not available, smear the piglets with a substitute which has a strong smell e.g. engine oil.

Artificial colostrums: If the sow does not provide colostrums within 3 days artificial colostrums should be provided.

CARE OF LACTATING SOWS

During the last 2 days before farrowing the sow should be fed with locative feeds e.g. brans and molasses to prevent constipation.

- One week before farrowing the sows should be dewormed.
- After farrowing sows should be fed with 1/2kg of bran and molasses.
- From the 3rd day awards increase the feed gradually by 1kg per day until 3kg per day.

Feed the sow adlibilum

No. of piglets in the litter	3	6	9	12	15
Amount of feed(day kg)	4	5	6	7	8

NB: The reproductive cycle life of a sow or boar is about 6-8 years depending on proper management. Call all sows, which give small litter and poor fertility and all boars with undersirable characteristics.

PARASITES OF A PIG

The most common external parasites include mites and lice, these can be controlled by scrubbing all pigs regularly with insecticides like texaphene or engine oil.

INTERNAL PARASITES OF A PIG

Include:

- round worms
- norductar worms
- Whip worms
- thread worms
- kidney worms

These damage the intestine, liver, kidney lungs which cause the pigs to be easily attacked by diseases such as pneumonia

CONTROL OF WORMS

- Drench regularly
- Clean the pig pen to prevent them from coming in contact with faces.

- The worm all sows and gilts one week before mating, one before farrowing and one week after weaning.
- The worm all boars at 50kgs weight twice per year.

MAJOR DISEASES OF PIGS

1) AFRICAN SWINE FEVER:

Cause: Virus

Symptoms:

- Fever, Depression, Anaemia, Diarrhoea, Hdding in a corner of filling up, Paralysis,
- Eye and nosal discharge, Death after 7days.

Transmission:

- By direct contact with wild pigs
- Ticks, blood sucking insects, hippos, hyena and porcupine.

Treatment:

- Keep domestic pigs away from wild pigs.
- Control ticks and vaccinate animal.
- Slaughter infected animals.

2) ANTHRAX:

Cause: Bacteria

Symptoms:

- Fever and swelling of lymph glands in throat area.
- Difficulty in breathing

- Loss of appetite
- Death

Transmission:

- Through eating (mouth) it is infections to humans.

Treatment and control:

- burry dead animals
- burn suspected animals
- penicilln naccination

3) FOOT MOUTH DISEASE: Cause: Virus

Symptoms:

- Fever
- Oesicullation in snout, lips, tongue, mouth
- Lamenesis
- Yescrible rapture

Transmission:

- direct through feeding Treatment and control
- No treatment but protects pig by avoiding feeding pigs raw garbage or milk from infected.
- Vaccination
- Slaughtering affected animals
- Enforce quarantine.

4) ENZOCTIC PNEUMONIA:

Cause: Virus (Mycoplasma hypneumonia)

Symptoms:

- Dry cough
- Slow growth

Transmission:

- Young pigs get affected from older ones

Treatment:

- No treatment
- Slaughtering infected animals
- Avoid overcrowding, poor ventilation and humid condtion.

Other diseases: Rinderpest, Hog cholera, Diarrhea, Swine dysentery, Brucellosis, Trip ecronomesis, Black quarter.

SHEEP PRODUCTION

The chief products of sheep are meat and wool

SHEEP BREEDS: Description and breed depend on presence or absence of horms and tail characteristics (fat or humped sheep)

EXOTIC BREEDS: These were introduced in East Africa in 1950. They include

i. Merino sheep (wool)

ii. Porper (multon or flesh)

iii. Romney marsh (dual purpose)

iv. Corriadated sheep (dual purpode)

v. Hampshire down(multon of fresh)

SHEEP MANAGEMENT

- Selection and ailing are essential steps prepare sheep for mating. The ewe and ram should be down (i.e. tipping) before mating.
- Dirty wool around the vulva and anus of the ewe and anus the ram should be dipped to prevent infection during mating.
- Overgrown hooves should be trimmed to reduce the incidence of lareness.
- Mating should be timed to ensure that lumbing takes place where there is plenty of grass and weather either too wet or too old. The best time is towards the end of the rainy seasons.

MANAGEMENT DURING GESTATION PERIOD

- The gestation in ewes lasts for five months.
- Management at this time should be aimed at maintaining heayhly ewes as this will guarantee survival of the unborn lamb.
- The ewes should be vaccinated and drended to control diseases and internal parasites, dipping to control external parasites.
- During the last month of pregnancy the ewe should be put on better food. SEAMING UP: 1-2 months before the ewe should be put on better food
- This helps the foetus to grow rapidly and ensure the buildup of body reserve of fasta needed for milk production.

MANAGEMENT OF LAMBING

- The ewe should be moved into a lambing padlock which has adequate shelter.
- The correct way in which a lamb is born i.e. the head and forelegs first, however when the lamb is not correctly presented a farmer can assist the ewe by approaching quietly and after washing hands, the helper should examine the position of the lamb to determine the cause1 obstraction. When the position is accesed, the helper can gently pull the lamb; As soon as the lamb is born, the mother will lick after birth fluid and will allow her offspring to suck adostrum.

REARING OF LAMBS

- During the first 4-6 weeks lamb are nourished by their mother's milk.
- Growth rate depends on the quality of the milk produced by the ewe.
- Castaration of young lambs-ram not needed for breeding and docking of tails should be carried out during the 1st 2weeks.
- At 6 month, the meat producing lamb are ready for slaughter-vaccination and dipping should continue

Shearing: When sheep are kept for woll,shearing should be done once per year around and is best done during dry seasons

DISEASE CONTOL

Diseases attacking sheep and goats on next page (same as goat).

GOAT PRODUCTION

They are purposely kept for meat and milk.

Breeds of goat: Most breeds are indigenpous and can be divided into two groups;

a) The Somali goats (dual purpose)

b) The small East African goats.

DAIRY GOATS: Jamna pati, Nubians, Saanen, Kamorai, Toggenberg MEAT GOATS: Somali, Turkana, Angola, Kamorai, small East Africa HAIR GOATS: Mohar, Boer, Angola, Kashmir

GOAT MANAGEMENT

In a well managed flock, mating should first take place 15-18months of age. Gestation periods last for 150days, therefore a goat can give birth twice a year

Meat producers: If the goats are kept for meat production, the young ones are left with mother until they are weaned.

Milk producers: The young ones should be removed from their mothers as soon as they are born and bottle/ bucket feed.

- The kids should be fed3times during the first 3weeks and reduced to 2times per day until weaned 4-6months. A kid will need ½ litre of milk per day solid feed should be included from 2-3weeks after birth.

POST WEANING

After weaning kids will need good quality feed if they need to be fattened satisfactory, dipping and vaccination.

GOAT FEEDING

i. Goat brouse rather than grazing, during rainy season, they feed on green leaves and young shoots. As drying follows, they feed on fallen leaves, pods and sees, dry flowers, keads of grass and twigs.

ii. In confined conditions, meat producing goats may be fed on cut forages e.g. sweet potatoes, vines, green maize etc.

iii. Crop residues are also used particularly after cereal harvest.

iv. Milk producers are fed on similar way as in dairy cattle but in addition they will feed on roughages e.g. hay and silage.

- Concetrates should be fed on lactating goats to correct any mineral deficiency and roughage. Browsing: Feed on grass, shrubs and leaves.

Gut closure: Is the process whereby the gut becomes impemiable to absorption of immunoglobin especially 3 days.

BEE PRODUCTION

INTRODUCTION:

Species of bees suitable for keeping are:

i. Apis melifera

ii. Apis adonsoni

iii. Both are kept in highlands and in coastal areas.

ECONOMIC IMPORTANCE

- They change nectar into honey from which wax is obtained and used in the manufacturing of candles, polishes etc.
- Also bees help in pollination.

ORGANISATION OF THE BEE colony

i. The queen: Is a fertile female whose function is to lay eggs.

- After the first mating she can lay eggs up to 4 years when she dies whereby one of her daughter takes over.
- She produces a substance known as queen substance which the workers lick.
- She lays up to 1500eggs per day.

ii. The drones: These are fertile males whose work is to fertile the queen. They are bigger than workers and don't posses sting.

iii. The workers1: These are sterile females and can't lay eggs. They do all the work in the hive e.g. collection of pollen and nectar from flowers, cleaning the cell, provision of ventilation by fanning their wings, feeding the larvae in cell, produce wax to build combs, to seal ripe honey and larvae and to guard the hive.

The comb: The workers build the comb in such a way that it consists of hexagonal cells/ chamber of different sizes.

i. The smallest cells are used for storing honey as pollen and rearing workers

ii. The middle sized cells are used for rearing drone and honey storage.

iii. The largest cells are oval in shape used for rearing virgin queens.

COLONY REPRODUCTION

i. All eggs hatch after 3days each larva has a head and 13 segments.

ii. The salivary glands of the "nurse bees" secrets a substance called "broad feed". The nurse bees feed the entire larva on this broad feed for 3 days.

- The queen larvae are fed on a royal jelly till they become pupa.
- From the fourth day on wards the workers and drone larvae are fed for 6 days.
- Workers and queen larvae are fed for 5days, while the drone larvae are fed for 6days.\
- Queen takes 16 days to image, workers 21days while drones taken 24 days.
- Usually there is in one queen per hive, before the young queen emerge from the cell, the old queen

Leaves the hive with thousands of workers i.e. swarming, the virgin that emerges first which then kills other virgin with her string She goes on mating flight she returns and becomes the new head laying queen on the colony.

MANAGEMENT PRACTICES DONE BY HUMAN BEINGS

Sitting the beehive: The place where bee hives are kept is called APIARY site

Factors affecting selection of a site:

i. For hanging hives: Should be hung on trees near a water source and well protected from wind.

ii. For standing hives: Should be sited at the centre of flowering plants.

- Source of water should not be more than 1 1/2km far.
- Site should have a natural protection against wind and sun.
- Access of apiary should not face the entrance to hive.
- Farm and other domestic animals should have no access to the apiary.

HARVESTING AND PROCESSING OF HONEY

TRADITIONAL METHOD

- Smoke is blown into the hive through the entrance holes to drive away the bees.
- The hive is lowered and turned over; the bottom board is opened to expose all the combs.
- The light colored combs are cut while the old dark combs are left undisturbed.
- After removing the combs the board is replaced.
- The combs are put in boiling water to be melted.
- The contents are stained through a cloth.
- Any hardened wax from the surface of the honey is removed.
- The honey is then slightly reheated in the water pan to make it more fluid then it is bottled.

IMPROVED METHOD

- Before opening up the beehive smoke is blown in.
- The frames are removed and the top of the cell is cut by knife to uncap the comb.
- The honey is extracted with a machine.
- The honey is strained to remove impurities then it is bottled.

HOW TO HANDLE BEES

Bees need careful handling considering the following:

- Don't approach the hive from the front.
- Use smoke properly.
- Don't crush bees otherwise the whole colony will get excited
- Avoid sudden movements.
- If stung while handling a frame doesn't pull out sting but remove them by scraping gently.
- The beekeeper should protect him/ herself.

DISEASES AND ENEMIES OF BEES

- Large animals e.g. honey badgers enter the hive and cause great damage.
- Worm and parasites enter the hive through cracks and cause great damage.
- Rain water leads to dampness which causes growth of moulds and fungi.
- Ants are the greatest enemies, thus should be protected from ants by standing the legs in tines of water are used oil.
- Wax moths cause great damage.
- The bee house has parasites which lay eggs in the hive.

DIARY CATTLE

Meaning of

i. Dairying: This is the keeping of livestock in order to produce mainly milk and meat produce

ii. Dairy cattle: These are cattle kept in order to produce milk and milk products.

The role of Dairying in Tanzania

i. Provision of milk to adults and infants: Milk contributes as an important food for babies (infants) especially for mothers who for reasons produce less milk lows milk is rich in protein, fats, sugar and minerals which can also be fed to adult humans.

ii. Supplies milk products: The milk can be processed into many products e.g. butter, cheese, yoghurt and ice cream.

iii. Provision of manure: Cow during is good organic manure which improves soil fertility.

iv. Provides employment: People who keep dairy cattle get employment and on turn they can employ others for management.

v. Provision of foreign exchange: Through exportation of surplus doing dairy products to other countries.

LIMITATIONS OF DAIRY INDUSTRIES IN TANZANIA

1. Low production potential of local breeds: They produce very low amount of milk.

2. Shortage of foreign currency for purchasing exotic breeds: New breeds are needed in our country to improve production but there is a high shortage in foreign currency for the purpose.

3. Presence of diseases and parasites: Cause/effect production. E.g. FMD, Anthrax, Tuberculosis, Rind pest which are common in Tanzania.

4. Poor/ In adequate nutrition for the animals: Most cattle in Tanzania are grazed in natural pastures of which quality and quantity wise are low especially in dry season which affect milk production.

5. Presence of tsetse flies and ticks: Most areas in Tanzania are highly infected by tsetse flies and ticks causing nagana and East Coast fever respectively.

6. In adequate veterinary services: The number of veterinary personnel at present is too low compared to the numbers of livestock keepers.

7. Poor husbandry: Most livestock keepers in the country don't know good principle of livestock husbandry resulting to low productivity.

8. Poor marketing and in adequate marketing facilities.

CHARACTERISTICS OF GOOD DAIRY COWS

i. Wedge shaped body: A cow with a wedge shaped body is narrow in front and broad at the back.

ii. Well developed udder: A good is one which is firmly attached to the body and is well suspended as well as large with well developed milk veins sagging udders tend to develop mastitis (inflammation of udder) good udder is of medium sized teats well spaced apart.

iii. Ability to secrete a lot of milk: A good dairy cow is of high genetic potential in milk production.

iv. Fertile and calves regularly: Milk production is facilitated by calving hence a fertile cow is able to calve regularly by this ensuring continuous milk production.

v. Docile temperate: A docile cow is ease to manage and easy to handle.

vi. Quick milk let down: This means that once you start milking it lets the milk quite easily and quickly.

vii. Milk with a high content of butter fat and proteins: This is of high quality.

viii. Long lactating period: A standard lactation period lasts for 30days: A good cow secrets milk as many days a possible.

ix. Resistant to diseases and parasites.

x. Tolerant to high atmospheric temperature i.e. able to resist heat stress experienced is tropical atmosphere

xi. Free from venereal and infectious diseases as they may cause infertility and produces milk free milk free from venereal/ infectious.

BREEDS OF DAIRY CATTLE

Terminology

In general, the same words are used in different parts of the world, but with minor differences in the definitions. The terminology described here contrasts the differences in definition between the United Kingdom and other British-influenced parts of world such as Canada, Australia, New Zealand, Ireland and the United States.

An "intact" (i.e., not castrated) adult male is called a bull. A wild, young, unmarked bull is known as a "micky" in Australia. An unbranded bovine of either sex is called a "maverick" in the USA and Canada.

An adult female that has had a calf (or two, depending on regional usage) is a cow.

A young female before she has had a calf of her own and is under three years of age is called a heifer. A young female that has had only one calf is occasionally called a first-calf heifer.

Young cattle of both sexes are called calves until they are weaned, then weaners until they are a year old in some areas; in other areas, particularly with male beef cattle, they may be known as feeder calves or simply feeders. After that, they are referred to as yearlings or stirks if between one and two years of age.

A castrated male is called a steer in the United States; older steers are often called bullocks in other parts of the world, but in North America this term refers to a young bull. Pik er bullocks are micky bulls (un castrated young male bulls) that were caught, castrated and then later lost. In Australia, the term "Japanese ox" is used for grain-fed steers in the weight range of 500 to 650 kg that are destined for the Japanese meat trade. In North America, draft cattle under four years old are called working steers. Improper or late castration on a bull results in it becoming a coarse steer known as a stag in Australia, Canada and New Zealand. In some countries, an incompletely castrated male is known also as a rig.

A castrated male (occasionally a female or in some areas a bull) kept for draft purposes is called an ox (plural oxen); "ox" may also be used to refer to some carcass products from any adult cattle, such as ox-hide, ox-blood, oxtail, or ox-liver.

A Springer is a cow or heifer close to calving.

In all cattle species, a female twin of a bull usually becomes an infertile partial inter-sex, and is called a freemartin.

Neat (horned oxen, from which neat's-foot oil is derived), beef (young ox) and beefing (young animal fit for slaughtering) are obsolete terms, although poll, pollard or polled cattle are still terms in use for naturally hornless animals, or in some areas also for those that have been disbudded or dehorned.

Cattle raised for human consumption are called beef cattle. Within the American beef cattle industry, the older term beef (plural beeves) is still used to refer to an animal of either sex. Some Australian, Canadian, New Zealand and British people use the term beast, especially for single animals when the sex is unknown.

Cattle bred specifically for milk production are called milking or dairy cattle; a cow kept to provide milk for one family may be called a house cow or milker. A "fresh cow" is a dairy term for a cow or first-calf heifer that has recently given birth, or "freshened."

The adjective applying to cattle in general is usually bovine. The terms "bull", "cow" and "calf" are also used by extension to denote the sex or age of other large animals, including whales, hippopotamuses, camels, elk and elephants.

Dairy farming in Tanzania is based on European breeds and crosses with indigenous zebu.

a) Friesian (Holland origin)

- White and black in colour
- Average mature weight 550kg
- Milk has low butter fat content 3.5-4%
- Calves are born large (35-40kg) and heifer under good management calves at the age of 21/2years.
- The udder has a very large capacity with milk yield 3500litres/ lactation.

b) Jersey (Origin: Jersey island in the English Channel)

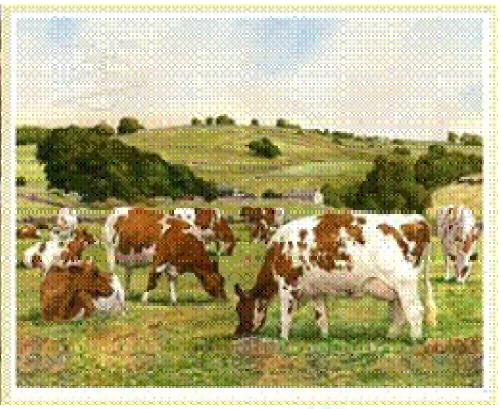
The Jersey cow is quite small ranging from only 400–500 kilograms (880–1,100 lb). The main factor contributing to the popularity of the breed has been their greater economy of production, due to:

- The ability to carry a larger number of effective milking cows per unit area due to lower body weight, hence lower maintenance requirements, and superior grazing ability.
- Calving ease and a relatively lower rate of dystosia leading to their popularity in cros breeding with other dairy and even beef breeds to reduce calving related injuries.
- High fertility
- High butterfat conditions, 4.84% butterfat and 3.95% protein, and the ability to thrive on locally produced food. Bulls are also small, ranging from 540 to 820 kg (1200 to 1800 pounds), and are notoriously aggressive.

Castrated males can be trained into fine oxen which, due to their small size and gentle nature, make them popular with young teamsters. Jersey oxen are not as strong as larger breeds however and are generally out of favour among competitive teamsters

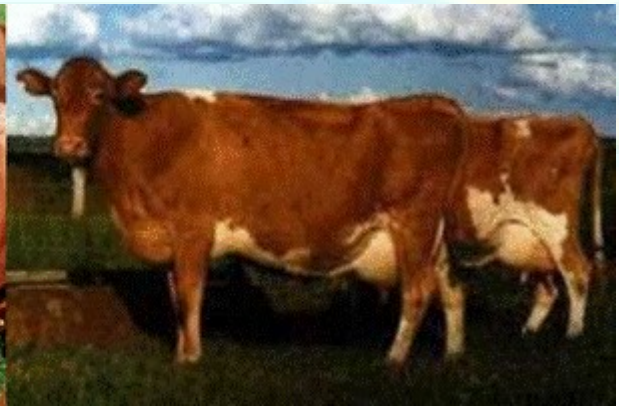
- Light animal and horned
- Heat tolerant
- Yellow- brown colour
- Wedge shaped body with level top
- High butter fat content of 5% - yellow
- Heifer calves down cut 2-21/2 years of age
- Low food requirement hence suitable for small scale.
- Calves are light 20-25kg
- Produce 2300litres/ lactation.

c) Aryshire

- Medium heavy breed
- Mature cow weighs 450-500kg
- Drought resistant
- Have red and white patches on skin
- Average milk yield is yield 3300litres/ lactation with butterfat content of 4%.
- Calves born at average weight of 30-35kgs and age 21/2years.

d) Guernsey (Origin: Island –English channel)

- They are brownish except legs and bottom part whish are white.
- Produces over 2500litres/ lactation with 5% butter content.
- Calves are born at an average weight of 25-30kgs.
- Its horns inwards and forward.
- Mature cow weights 450-500kgs.
- Heifer calves are at the age of 21/2years.

DUAL PURPOSE BREEDS

i. Sahiwal (Origin: Indian subcontinent)


- Best dairy breed in tropics
- Well developed udder and long thick teats
- Milk yield varies from 1800-2000l/ lactation
- Heavily built with short legs
- Difficult milking due to thick teats
- Mature cow weighs 400kgs
- Heifer calves at the age1 of 3years

- Reddish brown colour
- Resistant to tropical diseases

ii. Mpwapwa (developed at Mpwapwa livestock breeding station)

- Have brownish colour
- Have big ears which face down wards
- Survive well in semi arid areas
- Have long face slightly protruding from out side

PLANNING AND DESIGNING A DAIRY FARM

Factors to be considered when planning a dairy farm

1. Consider the site: Include; climatic condition, location (will influence transport), water accessibility, veterinary services availability
2. Topography: This will influence drainage.

3. Flexibility: Space for future expansion.
4. Economic point of view of the enterprise.
5. Legal aspects and public opinion.
6. The system that is to be used in feeding animals.

BASIC REQUIREMENTS OF A WELL DESIGNED ANIMAL HAVE;

- Farm accessibility to fresh water
- Sufficient light and ventilation for satisfactory inspection
- Should allow sufficient freedom of movement of animals
- Should have a facility of emergency provision in the event of breakdown of the existing equipment
- The floors and walls should not harm the animals.
- The internal surface should be easily disinfected and cleaned.
- Provide adequate: bedding especially for calves, dry lying areas for animals and facilities for disposal of waste material.

MAJOR COMPONENTS OF A DAIRY FARM

A good has the following features: Fences, crushes, water supply, dipping tank and dairy basin.

1. Dairy barn: It is a building which provides animals with protection against wind, sunshine, rain, etc.
    - Helps to avoid cattle disease infections.
    - Also it is used to store machinery, feeds and other equipment.
    - It is composed of -dairy room for milk storing
    - stores for food and equipments

- cattle pen
- a cow shed
- passage
- water trough

2. Dipping tank/ spray place: It is a structure used to apply a caricide to kill ticks and other ecto- parasites.

- It consists of a collection area and a passage leading to a tank which contains the acaricide solute.
- Below the tank there is a foot path (in the passage) which contains a caricide or CuSO4 solution, this will stop them from spoiling the solution.
- Drainage race (yard) where it is reduces wastage of acaricides as well as contamination of pastures.

3. Water supply: Water is need for drinking, cleaning and dipping. It is preferably be a water tap.

4. Crushes: This is a passage constructed by use of timber, wood or metal pipes.

- Used to hold cattle in several operations e.g. vaccination, hand spraying, drenching and artificial insemination.

5. Assist in controlling grazing hence prevents overgrazing.

- Also facilitate mixed farming
- Keeps out intruders. FARM LAYOUT
- Dairy house crushes/ spray race and water through
- Calves paddocks-Near entrance to the farm or behind dairy houses.
- Crush and dip found AT THE BACK OF A DAIRY HOUSE: If no slightly sloping land.
- Grass grazing for adult grown up heifer and those fodder crops should be separated by farm roads.

MANAGEMENT OF CATTLE ON DAIRY FARM

The herd of cattle which are kept in a dairy farm is composed of:

- Calves: these are young cattle at either sex.
- Heifers: these are young female cattle 9-18months age.
- Cows: these are mature female (heifer become a cow after calving)
- Bulls: these are mature male cattle which are not castrated. Kept so as to make with cows and heifers
- Steers: these are male cattle which have been castrated.

MANAGEMENT OF THE BREEDING STOCK

This consists of mature heifers, cows and few bulls; which mate with female mature heifers and cows.

When the females conceive they are said to be in calf heifers or calf cows. Gestation period in 280 days

NB:

i. Only fertile cattle should be put in the stock.

ii. Mature heifers / cows can be inseminated artificially.

BREEDING TIME:

Bulls may be kept together with cows and where bulls are allowed to mate the cows throughout the year. This is called continuous breeding: alternatively the bulls may be kept separately from female cattle and allowed to make certain period of the year. This is known as CONTRLLED/ SEASONAL BREEDING.

SUPPLIMENTARY FEEDING: Heifers: When they reach 15-18 months old (maturity) they should1 be fed on concentrates, with at least 19% and protein (CP) at a rate of 1.5-2kg/day.

Suitable breeding time

- Heifer/ cows reach seasonal maturity when an ovum is released from one of the ovary.

Sighs of heat

- Restlessness
- Isolation from other cows: tend to stay away from others.
- Mounting other cows
- Jelly like fluid discharged from vulva.
- Drop in milk yield

Calf management

Immediately after it's born: Nose and mouth cleaning, placenta removed after birth and colostrums provision within 4days.

Colostrum: First milk from cow within 2-3 days rich in immunoglobin

Functions:

- Laxutive i.e. helps calf to be ejected, the first faces accumulate in alimentary canal of the calf as it grows.
- Digestive system of a calf is able to absorb antibodies or immuneglobin
- Highly digestible and nutritive rich in vitamin A.

HOW TO MAKE ARTIFICIAL COLOSTRUM

Mix the following: 1litre of fresh milk, 250 ml of fresh water,1/2-1teaspoonful of Castrol oil, antibiotics and one fresh of raw eggs. OR: Water 75%, egg 20%, cooking oil 4%, mineral premix 0.5% and oral antibiotics 0.5%

NB: The mixture is fed 3 times a day.

SCHEDULE OF FEEDING WHOLE MILK TO A CALF

AGE OF CALF(weighs)	1st-4thday	1st-2nd week	3rd-4th week	5thweek	6thweek	7thweek	8thweek
QUANTITY OF MILK(litres)	5(colostrum)	4.5	4.5	4	3	2	2
FREQUENCY OF FEEDING(days)	3	3	2	2	2	2	2

COMPOSITION OF CONCENTRATES FOR FEEDING DAIRY CATTLE

ALTERNATIVE A-Whole maize meal-75%, sunflower cake-15%, bone meal-7%, mineral mix-3% ALTERNATIVE B-Whole maize meal-78%, cotton seed cake-19%, mineral pre-mix-3%

ALTERNATIVE C-Whole maize meal-40%, whole sorghum meal-35%, green/ black grain meal 15%, coconut cake-7%, mineral mix-3%

FEEDING SYSTEM

i. Bucket feeding

ii. Natural suckling

iii. Multiple suckling i.e. a cow suckles calves in addition to her.

General points to consider in rearing calves

- Avoid over feeding the calves and ensure cleanliness.
- Minerals and clean water should be provided.
- Calf pen must be open on one side for ventilation and light.
- Calves should be realized occasionally for exercises and any feed change should be done easily.
- Sick calves should be isolated and treated.

INTRODUCTION OF PASTURES AND CONCENTRATES

- After 4 months of age it is good to start giving concentrates and grass to calves.
- Pasture must be included gradually at a rate of 0.5kg per day.
- Concentrates feeding start at the age of one month. Other management operation

Dehorning: This is done by removing of horns also called disbudding so as to increase space and to prevent injury to each other and man during handling.

This is done by: Use of dehorning wire, hot iron, and chemical e.g. KCL, Elastrator rubber band.
Castration: This is the removal of epididymis of male calves not intended for breeding process so

as to control breeding, to make animal docile and to improve the appearance of neck muscles. This is done by: Used of burdizzo to crush the spermatic cord (closed bloodless method)

- Surgical (vasectomy) i.e. small portion of the scrotum is out and testicles are pulled out.

- Elastrator rubber band or ring (close method) Identification of marks: Is done by

    - Branding: This involves making numbers, letters or any mark on the skin by using hot iron, branding iron chemicals.

    - Tattooing: By using tattooing machine i.e. lateral or numbering pins are attached and then the skin is punctured especially the inner part of ears and tall base by use of special link.

HEIFER REARING

- After wearing heifers should be properly managed for proper growth where silage, hay and good pastures provide in calf heifer

- Continue to milk and in calf heifer/ cow for 7 months after conception twice a day.

- Feed the cow properly through the gestation period according to the level of milk yield 1.8-2 kgs/day.

- Stop milking 2months before calving i.e drying period.

- At the dry-off period the udder must be treated with antibiotics to control mastitis. Aims of steaming and drying off

- To improve body condition of the in calf animal.

- To ensure growth of the fetus.

- To let cow accustomed to the milking place and concentrate feed.

CALVING DOWN

2-3days before calving date the animal should be separated from others and given a closed watch

Sign of calving: Lying down, discharge from vulva, and detention of udder with fluids coming out from teats.

- When the calf is born then after birth, mucus can be removed from its mouth and nose. Normally membranes of mucus come out 2hours after birth if not a veterinarian officer should be called.

- Difficulties may arise due to the following: shoulder and body and hind legs come first, hands come first , front legs are bent inward or head is bent sideways *Normally front line of legs come out first.

MANAGEMENT BURRING LACTATION

THE LACTATION CURVE OF A DAIRY COW

STAGE A: Represent the daily lactation 2months after calving

- The milk yield will increase steadily until a peak is reached. At this stage cow is not in calf.

STAGE B: Represent the mid lactation when the yield is steadily declining.

- The cow is usually in calf for a period of 7 months.

STAGE C: Represent the dry when is not being milked. During this stage the unborn calf is growing rapidly.

NB: The cow should be well fed in stage A and C

MILKING AND MILK PRODUCTION

Milk is made in the udder from the food which animal eat.

- In the upper of the udder there are millions of cells where milk is made known as alveoli.

- The alveoli are drained by a large network of ducts leading to the lower part of the udder.
- The cells take blood sugar, amino acids, fatty acids and manufacture them into lactose (milk sugar), lasem (milk protein) and butter (milk fat)
- Other compound e.g. vitamins and minerals are taken from blood and appear in milk by filtering through the cells.

Milk let down

- This is the process whereby milk is removed from alveoli cavity and a mall duct system to the lower part of the udder.
- This is accomplished by a hormone called OXYTOCIN, which is secreted by the small gland at base of the brain.
- When the udder is washed the nerve cell in the udder send the message to oxytocin to the blood stream.
- When the hormone gets into the udder causes contraction of muscle fiber surrounding the alveolus, this squeezing action forces the milk into the teat system.

External factors influencing the release of oxytocin

- Feeding
- Presence of calf
- Noise associated in milking.

NB: If the cow is frightened adrenalin hormone is secreted, limiting blood supply to the udder preventing oxytocin from reaching the missile fiber around the alveoli.

MILKING: This is the process of removing milk from the gland through teat system either by hand or machine.

1. HAND MILKING

a) Preparation before milking: The following should be in hard : milk buckets, weighing scale for volumetric contain clean towel, strainer (clean sheet and cloth), warm water with disinfectant, tea cups, brooms and brushes for cleaning, ointment (oil applied to udder)

b) Preparation of cow

- Give cow plenty of water to drink before milking
- Put suitable dairy cow concentrates feed ratio in the feed trough.
- Call each cow by name and bring the cow into the milking parlor with minimum disturbance.
- Dip a clean towel in warm water mixed with disinfected and washes and massage the udder thoroughly.

a) Milking

- Milk the cow as quick as possible.
- Put the milk bucket below the udder
- Rub palms with ointment.
- Grasp 2teats at a time, one in each hand and press or squeeze the whole teat using palms do not pull.
- Squeeze each teat gently in order to empty thoroughly.
- Measure or weigh the quantity of milk obtained.
- Cleaning the milk place and utensils.
- Wash all the cleaning equipments and container used starting with cold water finishing with warm water.
- Put the utensils upside down on a clean place to drain and dry.
- Put and wash the floor of the milking per cow with water which I s mixed with disinfectant.

2. MACHINE MILKING

Preparation is similar to hand milking and the procedure is almost similar.

- However in machine milking, the mark is drown out by means of machine with dusters of heat cups (each duster has 4 teats and cups)
- During milking process, vacuum is created by machinery to the teats cups which forces milk to be drawn.
- Teat cups must be removed soon after milk is finished to avoid damaging the udder.

HAND MILKING	MACHINE MILKING
-Low initial cost	-High initial cost especially milking machine
-Can be done even few number of animals	-Not suitable for Small herds of cow
-Can be done even to cows with variable sized Teats	-Require cow with uniform teat size.
-Does not need skill	-Require skilled personnel in operating the machinery.

MILK COMPOSITION: The milk of farm animals consist of 5 major components i.e. water, milk protein, milk sugar, milk fats and minerals. The percentage content of each content is shown below

AVERAGE MILK COMPOSITION OF DIFFERENT ANIMAL SPECIES

	COW MILK	GOAT MILK	SHEEP MILK	HUMAN MILK
%fat	4.0	4.1	8.9	3.4
% protein	3.4	3.7	6.2	1.6
%lactose	4.7	4.6	5.0	6.4
%ash	0.8	0.8	1.0	0.3
%water	87.1	86.8	78.9	88.3
%TOTAL	100.0	100.0	100.0	100.0

Factors affecting milk composition

i. Animal breed: e.g. Jersey cow secrete milk with high fat content than other exotic breeds.

ii. Feed eaten by animals: When concentrates are feed to locating animal's level of fat increases while grasses decreases.

iii. Age of animals: Higher fat content is obtained from animals giving birth for the first time.

iv. Climate: When temperatures are low animals produce milk with less total solids.

v. Health: When an animal is sick milk composition is affected. e.g. occurrence of mastitis

vi. Drug treatment: When locating animals are treated with certain drug, milk composition is affected.

vii. Lactation stage: Fairly milk i.e. colostrums has high content of total solids compared to later stages of lactation.

viii. Milk yield: High milk yielding animals have milk with less percentage of solids especially fat e.g. zebu compared to exotics.

NB: Characteristics of clean milk are: It is free from harmful bacteria, has normal composition and desirable flower. This can be obtained by: Making cow's clean, use of clean milking utensils and clean handling of milk after milking.

MILK PROCESSING AND PRESERVATION

Preservation ways and methods

i. Pasteurization: This is the process of killing micro- organisms by heating at a controlled temperature that do not change the natural characteristics. This is done as

a) High temperature holding methods: Milk is heated to 71.1c for 15seconds and rapidly calved to 10c. Equipment used expensive.

b) Low temperature holding methods: Milk is heated to 2-8c for 30minutes and rapidly cooled to 10c. Equipment used are cheap.

ii. Sterilization: This method reduces protein and vitamin content. This is done by

a. In bottle process: Milk is heated in bottle to a temperature of 104-115c for 15-60 minutes.

b. Milk is heated before: Milk to high temperature for 20 seconds and then paced in a bottle and seated to prevent bacterial infection.

Processing: Products of milk include: Ghee, Butter, Cheese, Yoghurt, Powdered milk.

Butter: Cream is separated from slim milk. It is canned until the fat separate from the butter milk.

- T he buttermilk is then removed and salted.

Ghee: Is made by leaving butter in an open pan. Water separates and solids settle to to the bottom of the pan.

- The butter is then removed, this is the Ghee.

Cheese: The sour milk is heated to produce solid and called cheese. The card is drained to obtain the required part and removing moisture is removed by raising temperature to 32c.

Powdered milk: Can be made from other whole or shimmed milk in both cases the milk is drained into a powder.

Factors affecting milk production

1. Physiological status of the cow: Cow on heat cut milk for a day, pregnant cows yield less.
2. Age of cow: Mature yield high than immature one.
3. Health of cow: Poor health result to low yield.
4. Nutritional status before and after giving birth i.e. If underfed in late pregnancy stage, milk produce is lowered.
5. Breed: Genetic potential of breeds cause variations in milk production.
6. Milking routine: Fluctuating milking routine, lower milk production.
7. Effect of climate: High temperature cause heat stress with low yield in take thus lowering milk yield.

Record keeping: Record of the following should be kept: Health record, Heat/ service record, Cow card, Bull card, Milk records, Calf/ wiener book, Grazing record book, Sales record and

Farm diary.

PASTURE UTILIZATION AND FODDER AND CONSERVATION FOR THE DAIRY CATTLE

Pasture: Is an area of grazing livestock e.g. cattle, grass legumes and other type of plants grow in the pasture. A good pasture for dairy cattle has only grass and legumes mixture grown.

Qualities of good pasture grass and legumes

- Should be liked by livestock i.e. palatability.
- Have a good proportion of 1protein in leaves (protein content)
- Should be able to grow rapidly and suppress weeds and drought resistance.
- Should persist as pasture for a period (long) i.e. long life span and be able to produce a lot of leaves.
- Should have the ability to re grow quickly after grazing and should have pests (host plants) which can affect animals.

Types

a) Temporary pasture: This is a land on which grassland (legumes) are green for a certain period in order to graze, just for several years after which the land is cultivated. Grass and Legumes are planted in alternation with arable crop called LAY FARMING.

b) Permanent pasture: This is a land on which grassland (legumes) grow continuously year to year grazing is done in padlock.

Management of Pastures:

Involve

- Fencing the pastures
- Planting shade trees or building shades
- Planting suitable grass
- Making fire breaks along the border
- Providing water troughs
- Application of fertilizers on pastures.

CONSERVATION: In wet season grass and legumes can be harvested and preserved as:

i. Hay: Guinea grass, Guatemala grass and Rhode grass can be cut dried and tied up as hay.

ii. Silage: Green fodder (e.g. plant stocks) legumes can be preserved in a pit called SILO and later used silage.

DISEASES

A. INFECTIOUS DISEASES

1) **RINDERPEST:** Highly contagious and infectious viral disease affecting mucus membrane of the alimentary canal.

- In East Africa the cases are becoming rare due to routine vaccination. A killer disease

Symptoms:

- High fever over 40c, severe dullness and loss of appetite- Running nose, constipation.

- Profuse diarrhea and blood stained faces- Mouth and nose will be not with fast breathing.
- Rapid dehydration resulting in emaciation with sunken eyes.

Control:

- No treatment- Vaccination of all cattle from about 1year immunity last 3-6months.
- Affected animals and whole herd must be slaughtered.
- Quarantine wherever there is out break.

2) FOOT AND MOUTH DISEASE (FMD)

- Highly contagious and infectious viral disease affecting mucus membrane of the mouth.
- The disease is very severe in cattle and pigs but mild in sheep and goats.
- Is an endemic disease in East Africa and killer of exotic breeds but not zebu

Symptoms:

- Fever, dullness and loss of appetite.
- Loss in milk production and emaciation.
- Profuse and continuous salvation in mouth.
- Wounds or blisters on tongue and gums.
- Death may occur or animals get thin till recovery

Control

- No treatment

- Vaccination every month
- Quarantine
- Slaughtering of affected animals.

Other diseases: Pneumonia, Anthrax, Calibaciuosis or scours, Black Quarter.

3) **MASILISLS:**

Cause: Mainly Bacteria streptococcus and staphylococcus groups.

Effects: Affect the mammary glands of mammals.

Symptoms: Milk containing blood turn watery, swollen reddish udder and teats, death may occur.

Control:

- Treats early cases with antibiotics given through teat canal.
- Milk out teats and massage with hot water.

4) **FOOT ROT**:

Cause: Bacterium: Fusiffomos spp

Effect: Attack leaves of all animals

Symptoms: Swollen and painful hoof, making animal go limb. Part of hoof may contain pus and smell rotten.

Control:

- reat with antibiotics
- Provide foot bath with CuSo4
- Routine streaming and examination of feet
- Isolate the animal.

- Trim properly and remove the affected part of rotten hoof.

VECTOR TRANSMITTED DISEASES

5) TRYPANOSOMIASIS (EAST COAST FEVER/ NAGANA):

Cause: Protozoa by tsetse fly. Effect: Causing steeping sickness diseases.

Symptoms:

- Fever, dullness and loss of appetite
- Marked anemia, resulting in licking of soil.
- Swollen lymph node
- Death may occur
- Emaciation

Control:-Provide drugs e.g. Barenil, anticide, Somara etc Used for prevention and cure.

- Control tsetse fly by bush cleaning.

6) HEART WATER:

Cause: Tick-borne disease Anibyloccina ssp

Effect: Causing: Ricketier disease

Symptoms:

- Fever of 39c-41c dullness and loss of appetite.
- Animals more in cycle become restless. Placing their heads against hard objects and eyelids twisted.
- When it falls the legs leap in the air.

Control:

- Treat early cases with tetra cyclone antibiotic
- Ticks control by routine dipping.

FARMING BUSINESS ECONOMICS AND AGRICULTURAL EXTENSION

THEME 4.O: FARMING BUSINESS ECONOMICS AND AGRICULTURAL EXTENSION

FARM RECORDS: These are systematic facts and figures of the farm showing transaction and other events which happen either in the farm or in connection with the farm.

IMPORTANCE

i. As farm records enable a farmer to calculate at any particular time the profit losses that have been made over a certain period so as to known whether the farm is operating at a profit or loss.

ii. A farmer with good farm records is able to get a loan from lending institution (e.g. CRDB, NBC, NMB etc) as he can continue the bank that his business is profitable enough to enable him repay the loan.

iii. A farmer with good records can get a fair estimate of income tax by the income tax department.

iv. A farmer is able to find out whether he is making progress or not by comparing records of different periods.

v. A farmer is able to identify the projects which bring more profit on the farm than others by calculating the value of inputs and output for each project.

vi. Records provide facts and figures (data) for planting of future production and for checking whether production on the farm is being done according to the present production plan.

TYPES OF FARM RECORDS

i. Financial records (farm accounts): These are types of records showing the quantity and value of what the farmer sells for buys i.e receipts, payments, loans, etc. The purpose is to know the profitability of the farm business over certain period.

ii. Physical records: Records showing quantity of inputs used and or output obtained on each project or enterprise the farm or events which happen on the farm. The type of record kept in the farm depend on the enterprise that are present in the farm e.g. farm map, farm diary, livestock and crop production records.

Examples:

A. PHYSICAL RECORDS

i. A farm map: In the office of every farm these should be the whole farm drawn to scale drawn

- Different fields and their uses.
- Buildings and other structures.

ii. A farm diary: This is a record of important event that happen on the farm from day to day e.g. calving, weeding, fertilizer application, disease out breaks etc.

SAS FARM DIARY

DATE	EVENT
28thJuly	All poultry houses cleaned and disinfected
15thAugust	Outbreak of new castle disease50layersdied
12thAugust	Tractor was serviced
18thAugust	All cabbages from plot B harvested and sold

iii. Livestock and crop records: Different types of records need to be kept for different types of livestock

- Poultry: Rearing records, egg production and broiler record.
- Cattle: Herd record, calving record, milk production record, breeding record etc
- Pigs: breeding record, food consumption record etc
- Sheep and goats: Breeding records
- Crop: rotation records, fertilizer application, date of planting, variety, weeding date, spraying date, harvesting date, yield etc.

B. **FINANCIAL RECORD**: Record the same from the same text.

METHODS OF ACCOUNTING: Real accounting and Nominal accounting

a) Real accounting:

This involves financial transactions which include:

- All purchases of farm inputs
- Expenditures e.g. salary wages, rent, bills
- All sales including receipt for services rendered e.g. machinery hire.
- All debts owing to the farm and owing by the farm.

Real accounting: Is the basis of production for calculation of some important performance measure such as profit.

b) Nominal accounting: This involve inventory transactions i.e. inventory of all assets with full description and value of each item. It includes – Fixed assets e.g. buildings and movable assets like machines, equipment, livestock etc.

Books used in keeping accounts Inventory-show farms assets and their value.

i. Cash books: It is the major record for a farm finance accounted

ii. Cash journal: Is a chronological record of accounted transaction should show: Date of account to be credited, name of account to be debited, A reference page of folio where details of account are provided.

Balance sheet- contain liabilities and assets

Ledger: This is a group of accounts showing information to which has been reclassified and summarized account which was initially recorded in the journal.

DATE	DEBT	CREDIT	BALANCE
May1			9240.00
May31	8786.00		18026.00

Accounting Documents

a) Purchase order: Is a document in which a list of description and quantities of goods ordered from the supplier is shown

b) Delivery Note: Is a list and description of goods from the supplier to the purchaser according to the purchasing order usually accompanies the good delivered.

c) Invoice: This contains the quantities and description of goods supplied and their prices, where by the purchaser walks the invoice and the delivery note to ensure that charges and rose against goods supplied only.

d) Receipts: This is document showing the list of description of goods purchased and the total value, submitted to the purchases from the supplier upon cash payment.

e) Statement: Is a document issued by the supplier to the purchases showing a list of all goods supplied during a given period, usually a month, indicating, the prices of the goods and total charges as well as amount and discount is applicable.

RISK AND UNCERTAINTY

Agriculture production of any type has three important characteristics:

- Risk, Uncertainty and Time.

RISK: This is a situation where by there is sufficient knowledge or information for planning to be done, but the outcome of implementer the plan is not exactly known the outcome may be good or bad.

Examples of Risk

i. Health status of the farmer and other people on the farm: The health is not predictable; hence anyone may fall sick at anytime disrupting the smooth running of the farm.

Control: To buy a life or health insurance policy.

ii. Pest and diseases outbreaks: Crops and livestock may be infected by pest and diseases causing poor yield.

Control: To buy an insurance against crop/ animal loses through pest and diseases.

iii. Weather hovered: Adverse environmental conditions e.g. floods, drought etc may cause destruction to assets and crops/ livestock respectively.

iv. Fire hazards: May cause serious damage.

Control: Insure against fire hazards.

v. Theft: May steal farm assets, crops, livestock, machinery or other assets.

UNCERTAINTY: Is a situation where by there is imperfect knowledge on the outcome of implementing production plan on the farm e.g. the farmer cannot tell exactly the quantity of produce when he uses a certain quantity of inputs.

- Uncertainty cannot be insured like risks.

Examples:

i. agriculture good in expense of others change of land tenure rights etc.

ii. Changes in demand: This determines the prices of agriculture which will likely affect such products.

iii. Price fluctuation: Causes uncertainty in forming as planning of the farm is influenced by the prices changes in technology.

iv. Supply and availability of Agriculture inputs: Timely availability and sufficient amount of agriculture inputs is always very essential otherwise production will be affected.

METHODS OF REDUCING RISK AND UNCERTAINITY

- Insurance: The farmer may insure his crops, livestock, building machinery etc against hazard which may occur on the farm and cannot be predicted.
    - Only risks are insured.
- Diversification: Having more than once enterprise. This is a situation where by a farmer produce more than one product at the same time e.g. intercropping (if one crop fails the other may give yield) or mixed farming.
- Flexibility in production: This is the practice of making the farm easy to modify so as to make easier to change from on enterprise to another when consumer preference change e.g. building dual purpose poultry houses a farmer could easier change from broilers to layers.

- Maintaining liquidity: Is a situation where a farmer keeps cash which can be used to implement change in production plans quickly when there occurs a sudden change in market condition.

- Production of contact basis: To safe guard against uncertainty against market condition e.g. tenders for supply of goods product to school or hospital.

- To know marketing information: Provision of market information collection of market information by Bureau can help the farmer to adjust his production plans so as to reduce risk and uncertainty.

SOIL AND ITS AGRICULTURAL UTILIZATION

THEME 5.0: SOIL AND ITS AGRICULTURAL UTILIZATION

PHYSICAL PROPERTIES OF SOIL

SOIL TEXTURE: This refers to the relative proportion of various soil separates in soils.

SOIL SEPARATE: This is an individual particle occurring or aggregate e.g. Sand, silt, day, etc

Particle	Lessthan 0.002	0.002-0.02	0.02-0.2	0.2-2.0	2.0-20	20-200
Diameter	Clay	Silt	Finesand	Coursesand	Finegravel	Coursegrand

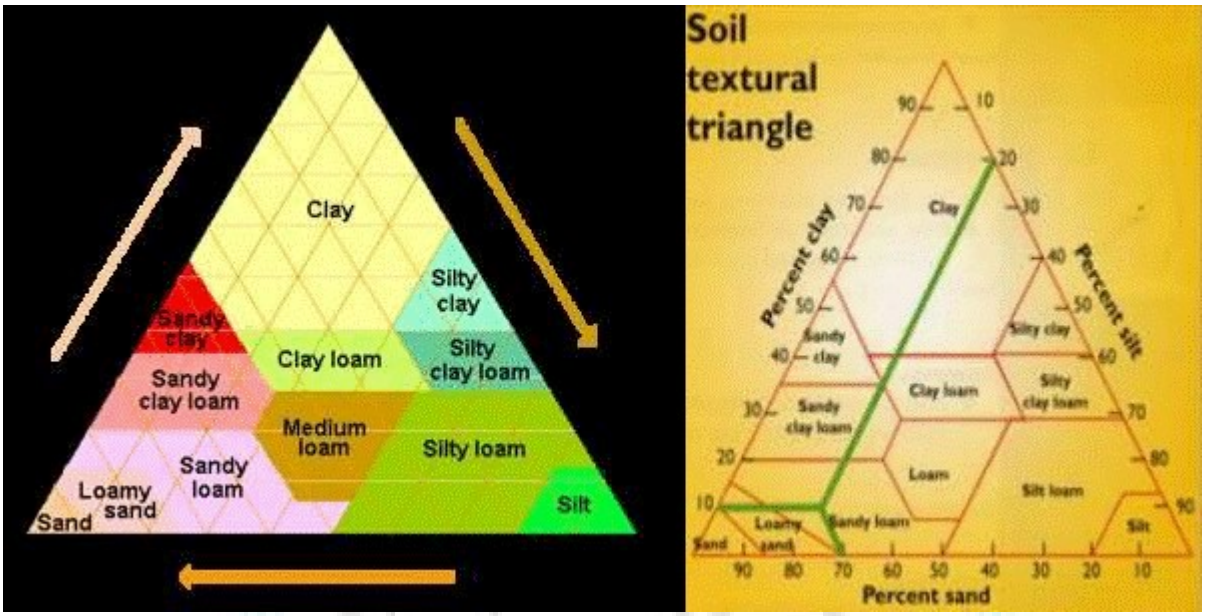
Particle size analysis

This is the process of determining the amount of the individual particles fraction done in the laboratory to get individual fractions sand, silt and gravel.

- The quantity of each group determines the % volume or weight of each group as calculated on the basis of the original sample.

- The % of clay sand, silt is then used to determine the soil texture using Textural Triangle.

Procedure of using the triangle



- The percentage of the silt and clay are located on silt and clay side respectively.
- Lines are then projected in wards.
- From the silt side, the line should pass in wards and parallel to clay side.
- From the clay side, the line should run in wards and parallel to sand side.
- From the clay side, the line should run in wards and parallel to sand side.
- The area within which these lines meet gives the texture of the soil in question.
- Normally, If the soil contains a lot of sand, It is cause textured and it is said to be sand. Since they easily mark able (i.e. cultivated) and soils are sand to be light.
- Silt soil with fine texture consists of larger day and silt. They are plastics, sticky and difficult to cultivate heavy soil.

Importance of soil texture as related to production

- Soil texture gently affected the rate of productivity of the soil for agricultural uses, coarse textured soil such as sand and loam sand cannot hold sufficient water and nutrients to produce top yield every year, and they require irrigation and frequent use of fertilizer.

- Fine textured soils such as clay and silt clay, may hold water and nutrients very tightly that may becomes un available to plant growth, difficult to till, become very poor water percolation hence reliable to water logging.

- Silt soils and silt loam give few agriculture problem of/ as they provide high agriculture production. They have good drainage and they can support a wide range of crops, root penetration, water infiltration and management.

Texture Classes: Sand, sandy loam, loam, silt loam, sand clay loam, day loam, silt clay, silt clay loam, clay and sand clay

1. SAND:

    - The grains are roughed or irregular in shape, can be felt and seen by naked eyes.
    - Consist of mainly original minerals.
    - It exposes little surface and chemically inactive.
    - Sand grains, primary farm the frame work of the skeleton of the soil.
    - Poor water holding capacity but well orated.
    - Contain more than 70% particles size distribution.

2. SILT

    - The separate include mainly original mineral fragments which are diverse in shape rarely smooth or flat. When dominant gives a soapy feel

3. CLAY

    - This fraction gives the finest particles in the soil.
    - These are secondary product of chemical weather.
    - They are active and have influence most of physical-chemical properties of soil.
    - They have ultra-microscopic structure and expose a large surface area.
    - Exhibit such properties as swelling, shrinking, plasticity and cohesion under various moisture conditions.
    - Particles are usually plate like in shape.

- Permit greater absorption and water retaination.
- Contain more than 35% particle size distribution.

4. LOAMS

- Soils containing sand and silt in almost equal proportion (usually 40% sand, 40%silt and 20%clay). The most important soils as they are ideate for the majority of agronomic crops.

SOIL PLANTS NUTRIENTS

Classification of soil plant nutrient

i.e. Macro nutrients-needed in large quantities, Micro nutrients- needed in small quantities.

NB: Both are termed as ESSENTIAL NUTRIENTS meaning that nutrients needed by plants for different function.

There are 17elements needed for plant growth

a) Those needed in high amount- Macro elements

b) Those needed in small amount- Micro elements

MACRO ELEMENTS: Nitrogen, Sulphur, Phosphorus, Potassium, Magnesium, Calcium, Hydrogen.

MICRO/ TRACE ELEMENTS: Carbon, Chloride, Manganese, Copper, Water, Oxygen, Zinc, Boron, Molyberium.

NB: If they are in excess become toxic to plants.

Occurrence of nutrients in the soil – found when

a) Combined with other elements in minerals e.g. K, AL, Silicate (KALSi3O5)

b) Dissolved in water as icons.

c) On the surface of organic nitrogen, sulphur.

FUNCTION OF PLANT NUTRIENTS

NITROGEN: Occurrence: In form of nitrate, Ammonia or organic matter. Functions:

- The quantities taken are larger than any other nutrients

- Formation of protein and Amino acids (green pigment)
- Facilitate carbohydrate utilization and uptake of phosphorus and calcium and increase vegetative growth.

Deficiency:

- Lack in sufficient N2 results to
- Carbohydrates deposition in the vegetative cell causing thickening of the cells.
- Poor photosynthesis
- Stunted growth and low yield.

Symptoms:

- Loss of green pigments i.e. yellowing of leaves.
- Firing of tips and margin of a leaf.
- Stunted growth. Correction:
- Use organic and in organic manure
- Crop rotation with legume inclusive
- Early planting to utilize early nitrogen

PHOSPHORUS:

Occurrence: In form of phosphorus ions e.g. H2PO4. Availability is low in acidic soils.

Functions:

It promotes the formation of lateral and fibrous roots increasing water nutrients absorption.

- Increase tell ring of cereals and straw strength
- Increase plants resistance to diseases and hastens crop maturity.
- Improve seed formation and fruiting.

Deficiency:

- Stunted growth
- Deficiency symptom zed by purplish colorization on the leaves.
- Poor root formation
- Delayed maturity

POTASSIUM:

Occurrence: In ionic form

Functions:

- 2nd element needed by plant in large quantity.
- Increases plant resisting to diseases and adverse weather.
- Increases efficiency of leaves to manufacture sugar and starch.
- It helps in better utilization of elements.

Deficiency:

- Weakness of plant
- Slow plant growth
- Shriveled seeds and fruits.
- Burning effect starting with older leaves.
- Low resistance to rust and other diseases

Correction:-Use of organic manure and inorganic manure e.g. Murrieta of potash (MODI Potassium

Sulphate)

CARBON, HYDROGEN AND OXYGEN: It is used to make carbohydrates.

CALCIUM:

- Promote the growth of root tips
- Increase stiffness of the straws
- Promote good seed production.

MAGNESIUM

- Essential in chlorophyll formation
- Increase efficiency of phosphorus intake
- Regulate good seed production

SULPHUR:-Essential in the formation of protein

- Stimulate root growth, seed setting and nodule formation. IRON:-Essential catalyst in the formation of chlorophyll
- Deficiency is symptom zed by chlorosis

LUXURY CONSUMPTION OF PLANT NUTRIENTS

Is the habit of some plant taking more potassium element than that their requirement for normal growth.

Effects:

- Increased synthesis of complex carbohydrate, protein and nucleic acids.
- Reduction the synthesis of sugar, amino acids and nuclei tides.

Correction:

- Increase La, K ratio in the solution by over limiting which reduce uptake of K and thus prevent it living consumption by plants.

*** THE END ***