

AGRICULTURE FORM III NOTES

17.0.0 Livestock Production (Selecting and Breeding) (12 Lessons)

18.0.0 Livestock Production (Livestock Rearing) (10 Lessons)

19.0.0 Farm Structures (18 Lessons)

20.0.0 Agricultural Economics II (Land Tenure and Land Reform) (20 Lessons)

21.0.0 Soil and Water Conservation (19 Lessons)

22.0.0 Weeds and Weed Control (15 Lessons)

23.0.0 Crop Pests and Diseases (14 Lessons)

24.0.0 Crop Productivity VI (Field Practices II) (17 Lessons)

25.0.0 Forage Crops (9 Lessons)

26.0.0 Livestock Health III (Diseases) (20 Lessons)

Livestock Production III... (Selection and Breeding)

Introduction

- The breeding of animals is under human control, and the breeders decide which individuals shall produce the next generation.
- The breeder makes a choice.
- The breeding of animals is based upon the fact that certain qualities are genetic ,hence valuable qualities are passed on from parents to off -springs.
- The qualities can be maintained or improved in the next generation.

The performance of an animal is influenced by two major factors;

- Genetic potential
- The environment, which includes:
 - Feeding,
 - Health,
 - Care
 - The ecological conditions.
- The genetic potential of an animal is inherited from its parents.
- In selection and breeding animals with superior characteristics are selected and allowed to mate.

- In the process they transmit the superior characteristics to their offspring.
- When this is done over a long period of time, it results in livestock improvement.

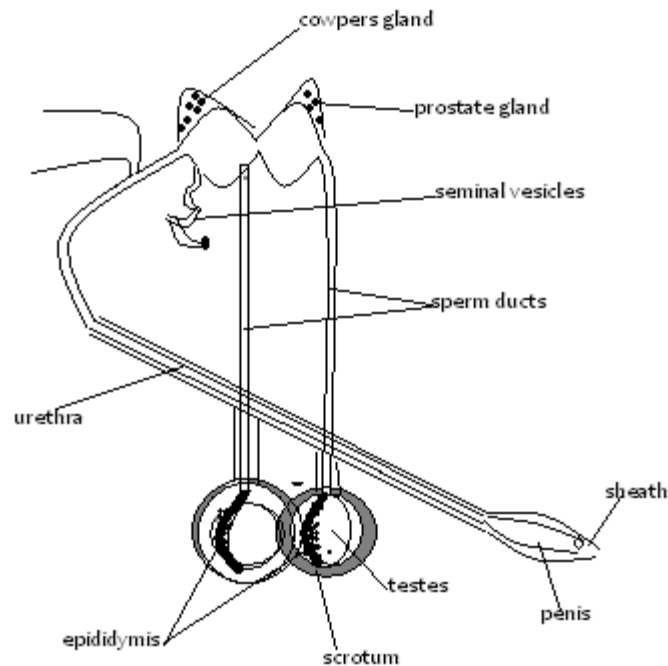
Reproduction and Reproductive Systems

- Reproduction is the process by which off-springs are produced.
- All farm animals multiply by means of sexual reproduction.
- It begins with fertilization which is the fusion of male and female gametes to form a zygote.
- Fertilization takes place internally in the body of the female.
- The embryo(zygote) formed develops inside body of mother, fed and protected until end of gestation period.
- In poultry, the process is different in that eggs are fertilized internally but laid and development of the chick takes place outside during incubation.
- In both male and female, certain organs are specialized for the process of reproduction.
- Some of these organs secrete fluids which are necessary for the movement and survival of the gametes(reproductive cells.)

Reproduction in Cattle

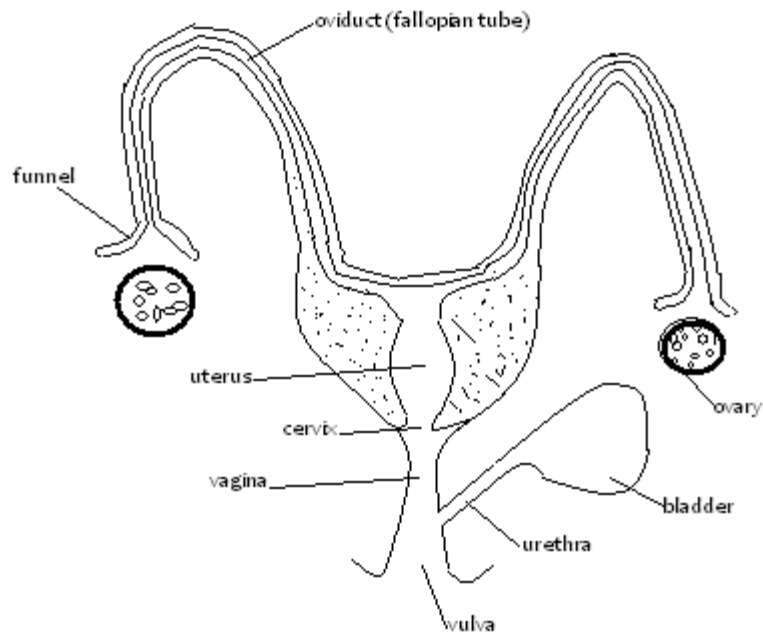
- The male reproductive organs produce the male gametes, the spermatozoans.
- These are introduced into female reproductive system, where they fuse with the sperm to form zygote.

Reproductive system of a bull



- **The testis:**
 - There are two testes hanging loosely between hind legs.
 - Enclosed by loose skin (scrotum)scrotum regulate temperature of testis for optimum production of sperms.
 - Produce spermatozoa(sperms)which are stored in coiled tube called epididymis.
- **Epididymis:** Storage of spermatozoa.
- **Sperm ducts:**
 - Conveys sperm from the testis and urine through the penis.
 - sphincter muscles contract to allow each to pass separately.
- **Seminal vesicles produce fluid called semem.**
- semen carries sperms out of penis in fluid form.
- **Prostate gland** -produce fluid that neutralize the acidic effects of urine in the urethra preventing death of sperms.
- **Accessory glands:** Include seminal vesicles cowpers gland and prostate gland.
- **Urethra:** Conveys urine and semen.
- **Penis:**
 - Surrounded by a sheath which is an extension of skin.
 - It introduces sperms into the vagina of a cow through the vulva during mating.
 - It is a copulatory organ, also used for urination.

Reproductive system of a cow



Ovaries and fallopian tubes(oviduct)

- Two ovaries located in abdomen, left and right.
- Produce ova/eggs and hormones which control sexual cycle.
- Oestrogen produced by graafian follicle inside ovary induces oestrus
- ie. Heat period so that the cow shows signs of heat
- After every 21 days the ovary releases a mature ovum and the cow comes on heat.
- The ovum travels through the fallopian tubes to the uterus.
- The release and movement of the ovum down to the uterus is called **ovulation**.
- If mating is done at this time, fertilization will take place.
- The fertilized egg implants itself onto the endometrium(walls of uterus)and develops into foetus.

Fallopian tubes:

- Fertilization takes place here.
- Also a passage for the egg from the ovary to the uterus.

The uterus:

- Embryo develops here.
- The cervix: Closes the uterus.

The vagina and Vulva:

- Vulva is the external opening of female reproductive system.
- It allows mating to take place so that sperms are deposited into the vagina.
- The foetus and urine are removed through the vulva.

Pregnancy

- Is period between fertilization of ova and the expulsion of the foetus through the vulva.

- Also called **gestation period**.
- In cattle gestation period is 270-285 days.
- Ends with the birth of a calf.
- The reproductive tract undergoes a period of rest during which it is repaired and returns to normal.
- During pregnancy, hormone called **progesterone** is produced by the placenta to maintain the foetus in the uterus.

Parturition(giving birth)

- Act of giving birth called parturition.
- This time the foetus expelled through the birth canal.

When an animal is about to give birth, it shows signs;-

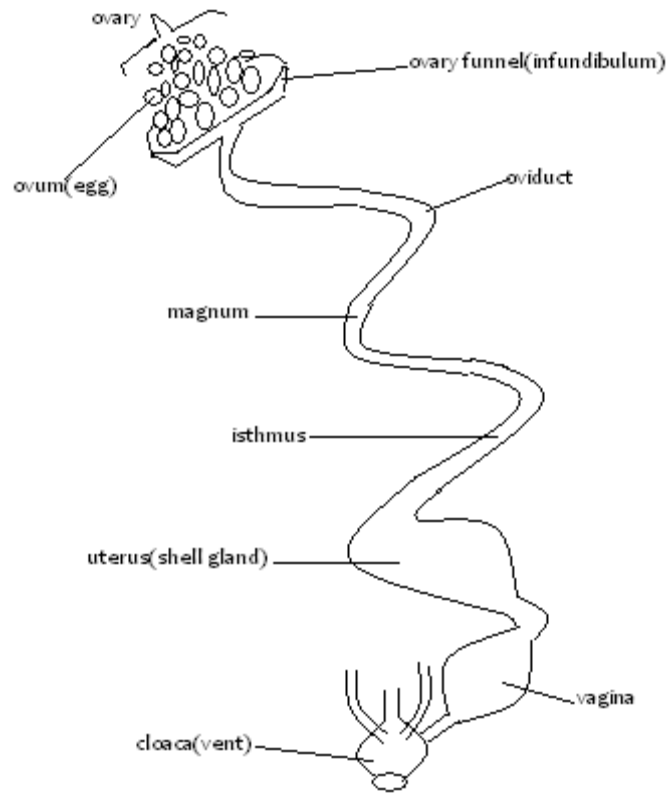
- Distended udder which produces thick milky fluid called colostrums.
- Swollen vulva producing thick mucus.
- Loose and slackened pelvic girdle.
- Visible pin bones.
- General restlessness.
- Animal parturates within 2-3 hours after this signs.
- The correct presentation is with the front feet first ,and the head outstretched and resting in between the fee.
- Any other presentation called **mal-presentation or breech presentation** and requires assistance.

Reproduction in Poultry

- The cock has no penis but a small opening near the vent through which sperms are emitted.
- Cock has testes within the body.
- The hen has elongated oviduct for formation of an egg.
- Fertilization occurs internally.
- During mating the cloaca of the hen and the vent of the cock fit into each other and then semen is poured into the cloaca ,then sucked to the oviducts.

The Reproductive System of a Hen

Reproductive system of a hen



Ovary

- Hen has two ovaries but one functional.
- Ova formed in ovaries.
- 3500-4000 ova present inside ovary held by follicle.
- Mature ovum released via rapture of follicle.
- It moves into oviduct received by the funnel.

Funnel (infundibulum)

- Fertilization occurs here.
- Chalazae also added to yolk.
- Time here is 15 minutes.
- It is 11.6cm long.

Magnum

- Thick albumen is added.
- Stays for 3hrs. its 33cm long.

Isthmus

- Its 10.6cm long.
- Shell membranes added.
- Determines shape of egg.
- Water, mineral salts and vitamins added.
- Takes 15 minutes.

Uterus (shell gland)

- Calcium deposited gie. shell added around the egg.

- Pigments added.
- Addition of albumin finished.
- Stays here for 18-22hours.

Vagina

- Short, 6.9cm long.
- For temporal storage of egg before laying

Cloaca

- Egg moves out of cloaca through the vent.
- The cloaca extends out to prevent the egg from breaking.

NB;

- Egg formation not depended on fertilization.
- Egg formation takes 24-26hours.
- The components of egg are obtained from body reserves of the hens body.

Selection of a Breeding Stock

- Selection is used as a tool for livestock improvement.
- A breeding stock is a group of males and females which act as parents of future generations.
- Selection is the process of allowing certain animals to be parents of future generations while culling others.
- Culling is the removal of animals which do not perform to the desired level, from the herd.
- The animals retained have certain desirable characteristics which make them produce more.
- Selected animals make up the breeding stock.
- The breeding stock should pass the good qualities to their offsprings for better performance, to improve the livestock.
- Selection process repeated for many generations increases chances of formation of desirable qualities in an animal.
- Genetically termed as gene frequency(occurrence of the genes that carry desirable characteristics.)
- Selection increases occurrence of desirable genes and decreases occurrence of undesirable genes.
- During selection, the characteristics to be selected for are first studied closely to ascertain that it is not influenced by the environment, but mainly by the genetic make-up.
- Selection helps improve characteristics which are highly heritable.
- Heritability means the likelihood of a particular trait to be transmitted to the offspring and they are strongly inherited.
- A character like milk yield is lowly heritable, i.e. it is weakly inherited and a bigger percentage of the character is affected by the environment.

The degree to which selection affects a character depends on the following factors;

- The heritability of the character
- The intensity with which the selection is done
- The interval between generations and kind of selection being practiced.

Factors To Consider When Selecting A Breeding Stock.

- Age
- Level of performance
- Physical Fitness
- Health
- Body Conformation
- Temperament or Behaviour
- Quality of products
- Mothering Ability
- Adaptability
- Proliferation

- **Age**
 - Young animals,
 - Those that have not parturated for more than 3-times, should be selected.
 - They have a longer productive life.
 - Old animals are poor breeders and low producers.
 - Production and breeding efficiency decline with age.
- **Level of performance**
 - Animals with highest production level selected.
 - Performance best indicated by records.
- **Good performance of animal indicated by;**
 - High milk, wool and egg production,
 - Good mothering ability
 - High prepotency which is the ability of a parent to pass good qualities to their offsprings.
 - The animals with poor performance should be culled.
 - Good records kept and used by the farmer for this purpose.
- **Physical Fitness**

Animals selected should be free from any physical defect
e.g.

 - mono-eyed,
 - limping,
 - irregular number of teats,
 - scrotal hernia,
 - defective and weak backline
- **Health**
 - Sick animals do not breed well and are expensive to keep.
 - Animals that are resistant to diseases pass these characteristics to their offsprings
- **Body Conformation**

- Animals for breeding to be selected according to proper body conformation.
- A dairy cow should be wedge-shaped with a large udder, thin legs, long neck.
- **Temperament or Behaviour**
 - Animals with bad behaviors should be culled.eg
 - Cannibalism, egg eating, aggressiveness, kicking
- **Quality of products**
 - Select animals that give products of high quality.
- **Mothering Ability**
 - Animals selected should have a good mothering ability,
 - That is animals with good natural instinct towards their young ones.
 - This will enable them to rear the young ones up to weaning.
- **Adaptability**
 - Animals selected should be well adapted to the prevailing climatic condition in the area.
- **Prolificacy**
 - Animals selected should be highly prolific.
 - That is, animals with the ability to give birth to many offsprings at a time(larger litter).
 - This is a quality that should be considered when selecting pigs and rabbits.

Selection in cattle, and sheep,

Selection in cattle

Consider the following;

- Level Of Performance Which Include;
 - Milk Yield Buter Content.
 - Length Of Lactation Period.
 - Calving Intervals.
- Age Of The Animal,
- Fertility,
- Physical Fitness,
- Health Of The Animal,
- Body Conformation,
- Suitability Of The Enterprise-Milk Or Beef

Selection in sheep

Consider the following;

- Level of performance which includes;
 - Mothering ability
 - Growth rate
 - Wool quality

- Carcass quality
- Twinning rate
- Age
- Suitability to the enterprise-wool or mutton
- Flocking instinct
- Health of the animal
- Physical fitness
- Inheritable defects
- Fertility
- Inheritable defects.
- Fertility.

Selection in Goats

Consider the following:

- Fertility.
- Mothering ability.
- Growth rate.
- Twinning rate
- Carcass quality/dressing percentage.
- Growth rate.
- Suitability to the enterprise - milk or mutton.
- Health of the animal.
- Age.

Selection in Pigs

- Consider the following:
- Carcass quality/dressing percentage.
- Suitability to the enterprise (bacon or pork)
- Growth rate.
- Health of the animal.
- Mothering ability.
- Prolificacy.
- Number of teats.
- Temperament.
- Body formation.
- Age.
- Heredity defects

Selection in Camels

- Health of the animal.
- Age.
- Temperament.
- Foraging ability.

- Fertility.
- Level of performance-milk, meat, fur and transport.

Method of Selection

These include:

- **Mass selection** - Animals with superior characteristics are selected from a herd and then allowed to mate among each other.
- **Progeny testing** - assessing on the breeding value of an animal on the basis of performance of its offsprings.
- **Contemporary comparison** -comparison of performance between heifers of the same age and sexual maturity.

Breeding

- Process of mating selected males and females to produce offspring with the desired characteristics.

Reasons:

- To expand the inherited potential of the animal.
- To improve production.
- To overcome production problems created by the environment.
- To satisfy consumers taste.
- For economic reasons.

Terms Used in Breeding

Inheritance

- Genetic transmission of characteristics from parents to offsprings.
- The mechanism of inheritance is carried by the sex cells (gametes) and is controlled by genes found in the chromosomes.
- Genes are very tiny units of inheritance carrying particular characteristics, such as colour, body shape and amount of milk production.
- Chromosomes are genetic materials which carry genes.
- They exist in pairs (paternal and maternal) in the nucleus of the body cells.
- They are always constant in number.

Dominant and Recessive Characteristics

- A dominant gene is one that suppresses the other.
- It produces a dominant characteristic.
- A recessive gene is one that is suppressed by the other.
- It produces a recessive characteristic.

Hybrid and Hybrid Vigour

- **A hybrid** is an animal which is the product of crossing animals of two different breeds.
- **Hybrid vigour or heterosis** is increased vigour and performance resulting from crossing two superior breeds.

Epistasis

- This is the masking of the effect of one gene by another gene which is non-allelic, that is situated on different locus.

Breeding Systems

Inbreeding

- Mating of animals which are related. *Reasons:*
- To increase genetic uniformity in a herd.
- Used to fix the required characteristics in new breeds.
- To increase phenotypic uniformity.
- To get proven sires.

Limitations

- It can bring about loss of hybrid vigour.
- It may lead to decline in fertility.
- It may lead to high rate of pre-natal mortality.

Systems of Inbreeding

- **Close Breeding:** mating between very closely related animals, for example sib-mating and parents sib-mating.
- **Line Breeding:** mating of distantly related animals that had a common ancestor for example cousins.

Outbreeding

- Mating of animals which are not related.

Reasons:

- To introduce new genes in an existing breeding herd.
- To exploit heterosis resulting from a cross between two breeds.
- To develop a new breed or a grade animal.

Limitations

- Lack of uniformity in animals that result from outbreeding.
- Desirable characteristics may be lost due to variation.

Systems of Outbreeding

- **Cross-breeding**
Mating of animals from two different pure breeds.
- **Out-Crossing**
Mating of unrelated animals from the same breed.
- **Upgrading/Grading up**
Mating where the female of a cow grade stock (locals) is mated with a pure breed sire.

The resultant animal is referred to as a high grade.

Mating in Livestock

Mating in Cattle

- Heat signs occur every 21 days.
- The heat period last for 18-30 hours on average 24 hours.
- Cow should be served 12-18 hours after showing the first heat signs.

Heat Signs

- Restlessness.
- Mounting on others and when mounted on she stands still.
- Rise in body temperature.
- Drop in milk production in lactating cows.
- Vulva swells and becomes reddish.
- Clear or slimy mucus from the vulva.
- Bellowing or mooing frequently.

Mating in Pigs

- Heat signs in pigs occur after every 21 days.
- The heat lasts about 72 hours.
- Sows or gilts should be served in 18- 36 hours of the heat period.

Signs of Heat

- Restlessness.
- Frequent urination.
- Swelling and reddening of the vulva.
- Clear or slimy discharge from the vulva.
- Frequent mounting on others.
- It responds very well to the 'riding test'.

Mating in Rabbits

- Does are ready for mating 6-7 months of age.
- Heat signs occur every 14 days.
- The doe should be taken to the buck and not vice versa.

Signs of Heat

- Restlessness.
- Frequent urination.
- Swollen vulva.
- The doe throws herself on the side.
- The doe rubs herself against the wall or any other solid object.
- The doe tries to contact other rabbits in the next hutch by peeping.

Methods of Service in Livestock

Natural Mating

Advantages:

- It is more accurate.
- It is less laborious.
- Useful when heat signs of females cannot be easily detected.

Disadvantages

- Inbreeding is not easily controlled.
- Transmission of breeding diseases.
- Extra feed for the male is required.
- Large males can injure small females.
- Wastage of semen.
- It is cumbersome and expensive to transport a bull to remote areas.

Artificial insemination

- Introduction of semen into the female reproductive tract by artificial means.

Advantages

- There is economical use of semen.
- It controls transmission of breeding diseases.
- Sires that are unable to serve cows due to heavy weight or injury can produce semen to serve cows.
- It prevents large bulls from injuring small cows.
- It reduces the expenses of keeping a male animal.
- A small scale farmer who cannot afford to buy a superior bull can have the cows served at a low cost.
- Semen can be stored for long.
- It helps to control inbreeding.
- It eliminates the threat of keeping dangerous bulls from the farm.
- It makes research work easier.

Disadvantages

- Harmful characteristics can be spread quickly by one bull to the offsprings.
- It requires skilled labour.
- Low chance of conception due to death of semen during storage.
- It is laborious:

Embryo Transplant

- It is the implantation of an embryo (fertilized ova) from a high quality female (donor) in the uterus of a low grade female (recipient).

Advantages

- Faster multiplication of an animal with superior characteristics .
- It is easier to transport embryos than the whole animal.
- Embryos can be stored for a long period awaiting the availability by recipient females.

- It stimulates milk production in a female (recipient) that was not ready to produce milk.
- Low grade animals can be used in production and rearing of high quality animals.
- Offsprings of a superior female can spread quickly in an area.

Disadvantages

- It is expensive.
- It requires skilled personnel.
- It requires special equipment for fertilization and storage of embryos.

Signs of Parturition in Livestock

- Parturition is the act of giving birth in female animals.

Parturition in Cattle

- The gestation period in cattle is 270-285 days averaging 280days.

Signs of Parturition

- Restlessness
- Enlarged or swollen vulva.
- Clear mucus discharge from the vulva.
- Slackening of the pelvic muscles.
- Full and distended udder.
- Thick milky fluid from the teats.
- A water bag appears and bursts just before calving.

Parturition in Pigs

- The gestation period in pigs is about 4 months or 3 months, 3 weeks and 3 days.

Signs of Parturition

- Restlessness.
- The vulva turns red and swells.
- The udder becomes full with a milky fluid the sow starts to prepare a nest by collecting some beddings at one corner of the pen.

Parturition in Rabbits

- The gestation period in rabbits is 28-32 days.

Signs of Parturition

- Preparing a nest by plucking off hair from her belly.
- Goes off feeding
- Restlessness.
- The udder distends.

Livestock Production IV

(Livestock Rearing Practice)

Introduction

- In the management of livestock there are many activities that are carried out on animals to enhance production.
- They require care in feeding, health, breeding.
- Specific management also important in bee and fish farming.

Routing livestock rearing practices.

- A routine is a fixed/regular way of doing something.
- done repeatedly after a certain period of time

Feeding Practice

- Animals are fed to cater for both maintenance and production requirements.
- These are special types of feeding carried out on certain animals to cater for specific needs.

These include:

Flushing

- The practice of giving extra quality feed to an animal around service time.
- In sheep it is done 2-3 weeks before tupping and 3 weeks after tupping.
- In pigs it is done 3-4 weeks before service.

Importance of Flushing

- It increases conception rates.
- It enhances implantation of the zygote.
- In sheep it increases twinning percentage by 15-20%.

Steaming Up

- Giving extra quality feed to an animal during the last weeks of gestation.
- In cattle it is done 6-8 weeks before calving.

Importance Steaming Up

- It provides nutrients for maximum foetal growth.
- It helps in the build up of energy for parturition.
- It ensures the birth of a healthy animal.
- It promotes good health of the mother.
- It increases and maintains high milk yield after birth.

Creep Feeding

- Feeding of young animals from birth to weaning.

Piglets

- 10 days old - introduced to creep pellets.
- 5 weeks old - creep pellets mixed with sow and weaner meals.

- 8 weeks old - weaning.

Lambs

- Run with their mothers for natural suckling.
- Bucks - introduced to succulent feeds and concentrates.

Kids

- Meat goats kids suckle naturally.
- Dairy goats, fed on milk artificially,
- Given 0.5-1.25 litres up to the third week.
- Introduced to concentrates at 3-4 months.
- Weaned at 6-8 weeks of age.

Parasite and Disease Control Practices

Vaccination

- Introducing active disease organisms which are reduced in strength or virulent into the animals' body to induce immunity.

Administration of Vaccination done through:

- By injection.
- Orally through the mouth.
- By inhalation through the nose.
- Eye drops.

Deworming

- Practice of killing/removing internal parasites by administering drugs known as dewormers / anthelmintics.

Hoof Trimming

- Cutting back overgrown hooves with the help of a hoof trimming knife, a hoof cutter or a hoof rasp.

Importance

- Facilitate easy movement.
- Control of foot rot disease.
- Facilitate mating - prevent the ram from injuring the ewe during tupping.

Docking /tailing

- This is the removal (cutting off) of tails in sheep during the first week after birth.

Importance

- Even distribution of body fat.
- Facilitate easy mating in adult life.
- Minimise fouling of the wool with faeces.
- Reduce incidences of blowfly infestation.

Methods of Docking /tailing

- Cutting with sharp knife or scalpel.

- Use of elastrator and rubber ring.

Dipping and Spraying

- These are methods of applying acaricides on the animals to control external parasites.

Dusting

- It is the application of chemical powders on the animal body or on the walls of the animal house to control external parasites.
- It is used to control stick-fast parasites and fleas in poultry.

Breeding Practices

These are practices carried out to enhance successful breeding.

- **Crutching and Ringing**

- Crutching - cutting of wool around the external reproductive organs of female sheep.
- Ringing - trimming wool around the sheath of the penis of the rams to facilitate mating.

- **Tupping and Serving**

- Tupping refers to mating in sheep and goats.
- Serving refers to mating in cattle and pigs.

- **Raddling**

- This is the practice of fitting the rams with breeding chutes which are painted in different colours during mating
- to identify mated ewes and to indicate the active rams hence help in culling of the weak rams.

Identification

The practice of putting identification marks on animal.

- **Branding** - burning marks on the animals skin.
- **Ear tagging** - placing marked plastic or metallic tags on the animals ears.
- **Ear notching** - cutting different shapes bearing different values on the ear lobes.
- **Tattooing** - use of permanent ink or dye to mark animals with light skin.
- **Neck strap or chain** - Fixing of tags round the animals neck with a chain or a strap.

Importance/ purpose of Identification

- record keeping
- Settling disputes in case animals get mixed up in the pasture.

Debeaking

- Cutting about 1/3 of the upper beak with a knife, scissors or hot iron.
- **Importance**
- Control egg eating.
- Control cannibalism.

Tooth Clipping

- The removal (clipping) of the needle (canine) teeth in piglets 24 hours after birth.

Culling

- Removal of undesirable animals from a herd.

Dehorning

- Removal of horns or horn buds from an animal.

Importance

- It prevents animals from injuring each other.
- It makes the animal docile and therefore easy to handle.
- For easy transportation and feeding.
- Prevents destruction of farm structures.

Shearing

- The practice of cutting wool from all over the body of a sheep.
- It starts at the age of 8 months and then done once a year.
- Should be done during the dry season.
- Tools used: wool shears.
- Care must be taken not to cut the skin, testicles, udder, vulva and penis.

Castration

- It is the rendering unserviceable the testicles of a male animal.

Importance

- To control breeding diseases.
- To control breeding.
- For faster growth rates.
- Increase quality of meat by removing unpleasant smell especially in goats.

Methods Used:

- **Closed/bloodless method**
 - involves use of burdizzo or rubber ring and elastrator.
 - Animals do not bleed but may not be 100% effective.
- **Open method**
 - A surgical method used for castrating cocks, piglets and rabbits whose testes are internal.
 - Also used for lambs, kids and calves.
 - Animals bleed a lot.
 - However, it is 100% effective.
 - It is not recommended for mature adults.
- **Caponisation**

- It is the practice of making male birds lose their male characteristics by use of hormones.
- Hormones used include stilboestrol which is injected into the birds when they are one day old and female hormones implanted beneath the skin at the neck.
- Birds which have lost their male characteristics in this way are referred to as capons.

Management During Parturition

- Parturition is the act of giving birth to fully grown foetus.

Parturition in Cattle

- It is referred to as calving.
- Gestation period lasts 270-285 days after conception.
- When the signs of parturition are observed the cow should be separated from the rest of the herd.
- Normal calving should take 2 hours and the normal presentation is the muzzle, face or fore head on top of the forelegs first.
- In case of other presentations the mother should be assisted.
- Provide the mother with plenty of water and feed after parturition.
- If the after birth does not come out within 48 hours a veterinarian should be called to remove it.

Parturition in Sheep

- It is referred to as lambing.
- Gestation lasts 21 weeks (150 days) after conception.
- The ewe lamb naturally without any problem.
- If complications arise the ewes should be assisted.

Signs of Parturition in Sheep

- Udder becomes full.
- Teats are bright red in colour.
- Restlessness and bleating.
- Slackening of the hip muscles.

After these signs are seen the ewes should be separated from the others.

- The normal presentation is forelegs and head first.
- After birth the mother should be allowed to lick the lamb to ensure the coat is dry.

Parturition in Goats

- It is referred to as kidding.
- It takes place 150 days after conception.
- Nannies carrying twins, kid a few days earlier.
- Kidding nannies should be kept in a clean dry place which should be well sheltered.
- Signs of parturition are similar to those of ewes.
- Kidding nannies should be kept with another female for company.

Parturition in Pigs

- It is referred to as farrowing.
- Gestation period 113-117 days (4 months).

Signs of Farrowing

- The sow becomes restless.
- There is enlargement of the vulva .
- Muscles on each side of the tail slacken.
- There is loss of appetite.
- The udder and the teats become enlarged.
- The sow collects bedding material in one corner to build a nest.
- Milk present in the teats 24 hours before farrowing.

After the signs are seen;

- Farrowing takes about 2-6 hours under normal condition.
- An attendant should be there to assist the mother and piglets.
- Ensure the removal of the after birth to prevent the sow from eating it.
- The sow should be fed well and given plenty of clean water.

Parturition in Rabbits

- It is referred to as kindling.
- It takes place 28-32 days after conception.
- Provide a nesting box and plenty of dry soft beddings in the hutch towards the fourth week of gestation .

Signs of Parturition

- The doe plucks off the fur from her body.
- Uses the fur to build a nest about 3-10 days earlier.

Bee Keeping (Apiculture)

- Bees are insects which live in very well organised colonies.

Each colony consists of:

- Queens - fertile females that breed to ensure the continuity of the species.
- Drones - fertile males that mate with the queen for reproduction process.
- Workers - non-fertile or sterile females that maintain the colony.

Duties of Workers

- They rear and nurse the brood (eggs, larvae and pupae), queen and drones.
- They collect nectar and make honey.
- They make the honey combs.
- They protect the hives.
- They clean the hive.

Importance of Bees

- Collect nectar from flowers.
- Make honey - a nutritious product used by man as food.

- Helps in crops pollination of plants.
- Bees produce wax used to make candles.
- They make propolis - a bee product which is medicinal.

Routine Management

Siting/locating of an Apiary

Factors to consider;

- Nearness or accessibility to nectar or flower-producing vegetation.
- Areas with shade. Bees are sensitive to the sun's heat and require some shade to protect them.
- Safe distance from human residence and other livestock.
- Bees are stinging insects and can be a hazard to humans or other animals.
- Nearness to a source of water for use in their nutrition.
- A good distance from source of noise and other disturbances.
- Safety from predators for example honey badgers, ants (safari ants), birds and other parasites such as wax moths.

Feeding

- Normally bees are self-sufficient in providing their food from the honey they make.
- However, during the dry season, their feeding should be supplemented by providing a solution (syrup) of sugar water or giving molasses.
- This should be placed strategically so that it is easily accessible to the bees.

Parasites

- Ants
- Wax moths
- Bee louse
- Honey badger

Control of Parasites

- Use of physical barriers such as Vaseline/grease to control ants.
- Smoke the hive to control bee louse.
- Suspend the hive to control honey badgers.
- Burn infected combs to control wax moths.

Diseases and Control

- African bees are seldom attacked by diseases.

Harvesting Honey

Factors to consider;

- **Stage of ripening:** Honey must be harvested when it is fully mature.
- **Season of the year:** Harvested at the end of the rainy season.

Procedure

- Blow light smoke through the hole.
- This makes bees suck honey and become engorged and docile.

- Lower the hive to the ground.
- Open the hive to expose honey combs.
- Brush the bees off the honey combs.
- Cut the honey combs, leaving a small margin on the bars and keep them in a closed container.

Honey Processing

- Using heat in a water bath to melt the honey.
- Crushing and straining.
- Using a centrifugal extractor.

Precautions When Handling Bees

- Avoid excessive smoking.
- This kills the brood and lowers quality of the honey.
- Use protective clothing to avoid sting.
- Protect the hive from rain water.
- Use clean equipment and containers to avoid contamination of the honey.
- Use recommended method of extracting honey.
- Use recommended type of hive such as Kenya top bar hive.

Fish Keeping (Aquaculture)

Introduction

- The rearing or keeping of fish is called fish farming and is normally carried out in specially prepared ponds.

A good fish-pond should have the following features:

- Site should be on a fairly level ground with a permanent supply or source of water.
- The area should have clayey soil to avoid loss of water through seepage.
- Water must be free from any pollutants such as chemicals and other wastes.

Construction should provide for:

- an inlet for fresh supply of water,
- a spill way channel to take off overflow or excess water,
- an outlet to drain off the water when it is necessary to replace pond water,
- a fence to keep off predators and other intruders.

Feeding Fish

- Fish naturally feed on worms, insects and algae in the ponds.

These sources of food must be supplemented by throwing in the pond ;

- kitchen wastes,
- chopped vegetable materials such as cabbage leaves,
- cereal brans
- brewers' grain .

Management Practices to Ensure Maximum Harvest of Fish

- Control of stocking rate, that is to, have the recommended population of fish in a pond at anyone time.

- Harvest at the correct maturity stage.
- This is done by using the fishing net with correct mesh sizes to avoid catching the fingerlings.
- Avoid water pollution in the ponds which may poison fish.
- Ensure adequate supply of food in the pond.
- Water in the ponds should be kept in motion to facilitate aeration.
- Maintain appropriate depth (level) of water.
- Control predators and/or thieves.
- Drain and refill ponds with fresh water as necessary.

Harvesting Fish

- Harvesting or extracting fish from the fish ponds for consumption

Two main methods:

- *Hook-and-line method:*
 - This is slow, injures small fish and is inefficient.
 - It is only suitable for small-scale fishing.
- *Use of fishing nets:*
 - This is the most efficient method as long as a net with the correct mesh sizes is used.
 - Harvesting may be done 6-8 months after the introduction of fingerlings into the fish pond.

Maintenance of the Fish Pond

- Repairing the dyke or any structure on it.
- Cleaning the pond and removing foreign materials.
- Planting grass where necessary.
- Removing undesirable vegetation.
- Removing the silt.

Fish Preservation

Practices before preservation:

- Clean the fish to remove mud and any worms.
- Removing scales and slime.
- Opening the fish on the side to remove the gut and the intestines referred to as gutting.
- Cleaning the abdominal cavity thoroughly.
- Keeping fish in open containers.

Methods of Preservation

- Freezing
- Salting
- Sun drying
- Smoking

Appropriate Handling of Livestock During Management

- Physical beating should be avoided.

- Structures which help in restraining animals should be used whenever applicable.
- The correct methods of securing and casting animals should be used.
- Use as little force as possible.
- Equipment such as ropes, halters, lead stick and bull rings are used to handle animals appropriately.

Farm Structures

Introduction

- Farm structures are physical constructions on the farm used to increase efficiency in production.

Construction of Farm Structures

Involves:

Planning for farm structures ;

Consider;

- Farm activities.
- Size of the enterprise.
- Future of the enterprise.
- Accessibility.
- Soil type.

Siting farm structures;

Consider:

- The location of the homestead.
- Accessibility.
- Security.
- Drainage/topography.
- Wind direction.
- Relationship between the structures.
- Proximity to social amenities.
- Farmer's taste and preference.

Materials for Construction

Structural Materials and Use

Factors which determine the type of materials to use are;

- durability,
- strength,
- labour,
- availability,

- workability,
- serviceability,
- cost
- sanitation.

Stones and Bricks

Advantages

- Stones and bricks are durable, easy to disinfect, resistant to weather and insects decay and are easily available.

Disadvantages

- They are bulky and require skilled labour to make them.

Plastic and Synthetic Materials

These include;

- glass,
- asbestos fibre
- polythene materials.

Advantages

- Light,
- cheap depending on quality,
- easy to disinfect,
- can be moulded into any shape,
- are durable,
- cannot be destroyed by insects and fungus
- are water-proof.

Disadvantages

- Are easily destroyed,
- fragile,
- very expensive
- require skilled labour.

Wood (Timber)

Advantages

- They are workable,
- cheap,
- can be re-used

- are fairly strong.

Disadvantages

- They can catch fire easily,
- decay if exposed to water
- are affected by fungus and insects.

Concrete

- Is a mixture of cement, sand, aggregate and water
- e.g. in making blocks the ratio is 1:2:3; one part cement, two parts sand and three parts aggregate.

Uses

- Making posts for fencing.
- Making walls and floor of buildings.
- Making gabions and water channels to prevent erosion.
- Making water troughs.

Advantages

These materials are;

- durable, workable,
- easy to disinfect,
- cheap to maintain,
- fire resistant

Disadvantages

- These materials are ;
- expensive,
- require skilled labour,
- bulky,
- cannot be reused

Animal handling structures

- The crush –used when doing following activities;
 - Spraying livestock to control ticks,
 - milking,
 - examining sick animals,
 - artificial insemination,
 - treating animals, eg drenching, vaccination,
 - doing routine jobs such as dehorning, identification marks,
- The spray race-used in the control of ticks by spraying livestock with acaricides
- The dip- machakos type, and the pludge dip. This is used in the control of ticks by dipping livestock

Farm Buildings

Factors to be considered in site selection;

- Security

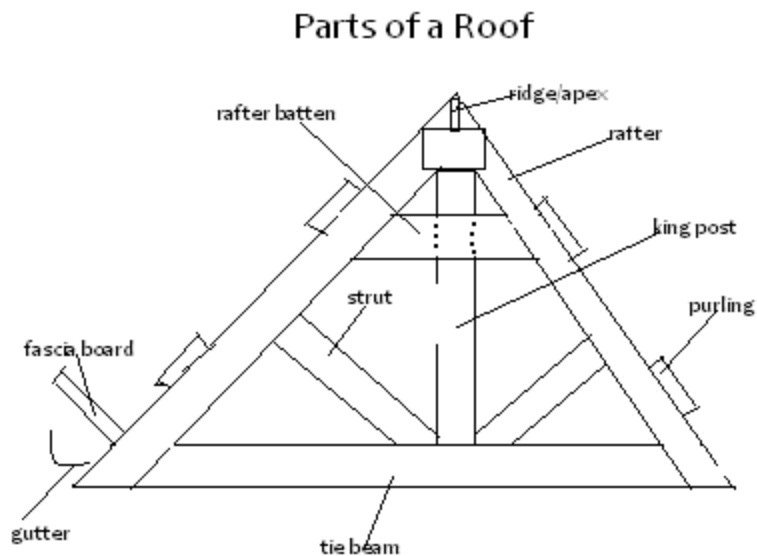
- Nearness to a source of water
- Topography
- Direction of the prevailing wind
- Direction of the sun
- Personal whims/tastes and preference
- Nearness to means of communication.

Types of farm buildings

- Houses for farm animals.
- Stores for farm produce.
- Stores for equipment, tools and supplies.
- Buildings for growing crops e.g green house.
- Building for processing plant e.g milk plant.

Parts of a building

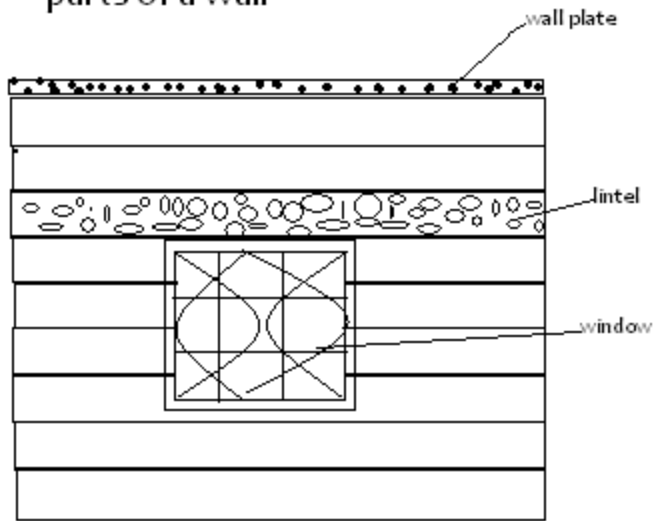
- The foundation,
- The walls,
- The roof



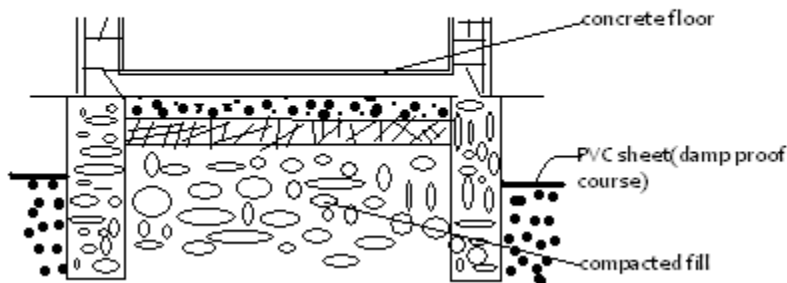
Include;

- kingpost,
- rafters,
- struts,
- tie beam,
- rafter batten

parts of a wall



Parts of the foundation



Include;

- concrete floor,
- foundation wall,
- PVC sheet (damp-proof course)
- the compacted fill (hard core).

Fences

- Importance of Fence in a Farm
- Keep out intruders to the farm,
- Define the boundary lines of the farm.
- Paddocking of fields to make rotational grazing possible.
- Live fences serve as windbreaks.
- Fences are used in mixed farming to protect crops from damage by livestock.
- Fences add aesthetic values to the farm.
- It is easy to control breeding.
- It is easy to isolate sick animals from the rest of the herd.

Types of Fences

- Dead fences.
- Barbed wire fences.
- Electric fence.
- Concrete fence.
- Chicken wire fence (mesh wire fence).
- Woven wire fence (chain link).
- Wooden fence.

Fencing Practice

- Materials include;
 - wires,
 - staples,
 - nails,
 - posts,
 - droppers
 - concrete materials.
- Size of posts:
 - General purpose 2.5m by 25cm in diameter
 - Strainer units and corner posts 3m by 30cm in diameter:
- Distance between the posts:
 - 3m between posts, 10m if droppers are to be used.
 - 200m between strainer units.
- Depth of holes - 60cm.

Gate Posts, Gates and Strainer Units

- Gates should be hung on posts separate from the fence.
- Mechanical implements for example tractors require 4.0-4.5m width of gate.
- Entrance gates for pedestrians can be accommodated within the fence.

Steps in Fencing

- Locate the corners
- Clear the fencing area.
- Mark gates, strainers, pass places and standards by pegging.
- Dig holes to proper depths.
- Fix the standard posts.
- Firm around posts or apply concrete.
- Fix wires on posts.
- Fix the droppers.

Agricultural Economics II **(Land Tenure and Land Reforms)**

Introduction

- Land is an important factor of production.
- Without land it is impossible to practice the agricultural business.
- However the efficiency of utilization of land is influenced to a large extent by the condition of holding the land.

Land Tenure

- Land tenure is defined as the possession of the legal rights to the use of land.
- Various kinds of rights to the use of land give rise to different tenure systems.

Land Tenure System

- All land tenure systems fall into two major classes, namely:

Collective Tenure Systems

This includes:

Communal Tenure Systems

- This involves the possession of rights over land by the whole community.
- It works quite well under conditions of unlimited land resources.

Advantages of Communal Tenure

- Landless problem does not exist.
- Land is not fragmented.
- Allows for free movement of animals in search of better pastures and water.
- Promotes community spirit among the members.

Disadvantages of Communal Tenure

- No incentive among the users to conserve the land resources.
- Everybody strives to maximize returns from the land without the drive to invest, for example, in terms of soil conservation and maintenance of soil fertility.
- There is a tendency of overstocking and continuous cropping; which leads to soil erosion and loss of land productivity.
- As a result of communal grazing of livestock, it is impossible to improve livestock through;
 - controlled breeding,
 - proper feeding,
 - disease and parasite control.
- Since there is no title deed, (certificate of ownership) it is virtually impossible to secure loans to develop the land.

Co-operative Tenure System

- This category includes various collective arrangements under the government or other authorities.
- Farmers voluntarily group together and buy land which they subsequently operate on co-operative basis.
- Examples are co-operative ranches.

Advantages of Co-operative Tenure

- No land disputes.
- Labour is well utilized.
- Profit is distributed according to the number of shares.
- Resource use is enhanced for high production.

Disadvantages of co-operative tenure.

- In case of poor management everybody will lose.

- No individual title deed hence cannot secure loans.

State ownership

- Land is owned by the whole state and is referred to as government land.

Examples in Kenya;

- Areas not allocated to individuals
- Land under local county councils/cities and towns
- Land under forest, game reserve and parks, land for infra-structure and public utility

Advantages of state ownership

- Generation of income for the state
- All the citizens benefit from whatever comes out of the land.

Disadvantages

- Non-competitive in terms of production
- No individual motivation when working on the land.

Individual Tenure system

The various forms of individual land tenure are;

- **Owner operator,**
- **Plantation and Concession,**
- **Land-lordism/Tenancy**

Owner operator

- This category includes all persons who operate on land to which they have absolute individual rights.
- Examples are the majority of individual land owners in areas where demarcation and registration of land has taken place and title deeds issued.

Advantages

- The owner is free to make permanent production plans.
- The owner can pledge the land title deed to secure loans(credit) from lending agencies for further development
- An individual is motivated to work harder than when under communal arrangement
- Managerial failures usually affect small units of production and are therefore negligible.
- It is easy for the owner to get agricultural advice.

Disadvantages

- Cost such as machinery for processing may be too high for the individual owner
- Innovation may be inadequate due to low levels of education.
- Lack of capital to invest.

Plantation and concession

- In this form of land tenure, the individual is usually a company or a corporation.
- Most of them engage in the production of only one commodity
- They are rigid in their production plans and in most cases labour is hired on wage basis.

- Example are coffee, tea, sugarcane, sisal estates in Kenya.

Advantages

- High production from the land hence high economic gains
- Allows foreigners to use and develop land
- No land disputes
- Create employment for the local people
- Generate government revenue through taxation.

Disadvantages

- Individuals own large pieces of land while others are landless
- Large areas of land may be left underdeveloped.
- Foreigners may repatriate profit to their countries.

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Landlordism and tenancy

- The arrangement here involves the ownership of land by one individual or group of individuals (landlord) who lease it to another individual (tenant).
- A legal lease specifies the length of time during which the tenure is operative; and that serves as a security of tenure to the tenant.
- The efficiency of production in this arrangement is greatly affected by the length of lease, its legal backing and rent payable.

Advantages

- A person without land can get a chance to use land.
- A landlord who cannot operate the land, for any reason, can still earn income by leasing it to a needy tenant.
- It is a flexible arrangement; that is, it allows room for change of production plans should need arise.
- Security of tenure gives the tenant incentive to invest depending on the length of tenure.

Disadvantages

- Poor land use and low production if the tenant does not have enough funds to improve on land.
- Tenants cannot produce long term crops,
- Landlords can exploit the tenants by overcharging.
- Lack of incentives to improve land by the tenants since it does not belong to them.

Land Reforms

Definition

- Land reform is any organized action designed to improve the structure of land tenure and land use.

Forms of Land Reform

Land Consolidation

- This means bringing or putting together, into one piece; fragmented parcels or pieces of land scattered over a large area.

The objective of land consolidation are :

- To save on time spent while moving from one piece of land to another.
- To facilitate effective and efficient farm planning.
- To create an incentive among land operators to invest on and develop land.
- To facilitate mechanization and improve production through efficiency.
- To improve level of production through effective supervision of the labour force and sound farming methods,

Land Fragmentation and Sub-division

- This is the subdividing of a (large) piece of land into smaller portions.
- Sometimes it becomes necessary to sub-divide land for the following reasons:
 - To sell part of the land.
 - The parent may wish to subdivide and distribute his land among the sons, daughters and other dependants.
 - The government may decide to subdivide large farms in order to settle landless citizens.

Land Adjudication and Registration

- Land adjudication involves;
 - Establishing the legitimate ownership,
 - Measurements (to make permanent boundaries)
 - Recording of land details.
- Once land has been adjudicated, and any disputes concerning the same land are settled,
- It is then registered in the "**Register of Land**".
- And the owner is issued with a land title deed or certificate of legal ownership.

Importance of land title deed

- The legal owner of the land has security of tenure and hence an incentive to invest and improve productivity.
- A farmer can mortgage the land by offering land title certificate as a security to loaning agencies to secure capital to finance development projects.
- If a farmer who cannot operate the farm, he can still earn income from it by leasing it.
- Disputes concerning land boundaries and/or land ownership no longer arise.

Land Settlement and Resettlement

Definition

- Land settlement means the occupation of land which was previously uninhabited.
- Land resettlement, on the other hand, is the transfer of people from an already densely populated area to a sparsely populated one.

Objectives

- To settle the landless citizens.
- To relieve population pressure in densely populated areas.
- To increase or promote agricultural productivity by farming on land that was previously unused or lying idle.

- To create self-employment thus improving the living standards.
- Land reclamation, especially by creating tsetse fly-barriers.

Soil and Water Conservation

Introduction

- Soil and water are two very important natural resources in farming.
- They should therefore be well maintained and used without wastage to sustain continuous production.
- Water loss during the rainy season should be prevented and excess water conserved for use during scarcity.
- Soil erosion must be controlled at whatever cost if soil is to be conserved.

Soil Erosion

- It is the removal and carrying away of the top soil by the action of water or wind.

Factors Influencing Soil Erosion

- **Amount and intensity of rainfall.**
 - The steeper the land the higher the velocity of surface runoff.
 - The higher the velocity of surface runoff the greater is its erosive power/effect.
- **Type of soil** for example sandy soils are more easily detached and carried away than clayey soils.
- **Soil depth;**
 - The deeper the soil, the longer it takes to be saturated with water.
- **Land use:**
 - **Overstocking** leads to bareness of the land and looseness of the soil.
 - **Deforestation** - indiscriminate removal of trees leads to exposure of soil to heavy rainfall and high temperatures.
 - **Indiscriminate burning of vegetation** exposes the soil to erosive agents.
 - **Clean weeding** leaves the soil bare.
 - **Ploughing along the slope.**
 - **Monoculture** or continuous cultivation.
- **Ground cover**
 - Trees act as windbreakers.
 - Roots of vegetation cover hold the soil particles together.
 - Leaf fall act as mulch which reduces erosion.
 - Leaves of vegetation cover intercepts raindrops reducing their erosive power.

Agents of Erosion

- **Water** - moving water has erosive power.
- **Wind** - wind carries away soil.
- **Human beings** - through man's activities such as cultivation and mining.
- **Animals** - through overgrazing and creating footpaths where soil erosion takes place.

Types of Erosion

- **Raindrop (splash)** - displacement of the soil caused by raindrops.
- **Sheet** - uniform removal of soil in thin layers from flat or gently sloping areas.
- **Rill** - removal of soil from small but well defined channels or rills.
- **Gulley** - removal of soil from channels which become progressively deeper and wider.
- **Riverbank Erosion** - removal of soil along river banks by the river water.
- **Solifluction** - gravitational flow of soil saturated with water.
- **Land slides** - mass movement of rock debris and soil down a slope,

For example;

- Slip movement of earth or rock masses for a short distance.
- Debris slide - materials move at a greater speed.
- Debris fall - movement of materials/debris along vertical cliff.
- Rock fall - movement of rock down a very steep slope.
- Rock slides - mass of rock materials that slide along a bedding plane, a joint or a fault face.

Soil Erosion Control Measures

Soil conservation measures can be classified into:

- Biological or cultural control
- Physical or structural control

Biological or Cultural Control Measures

These measures are applicable where land slope is between 2-12%.

- **Grass strips/filter strips;**
 - These are narrow uncultivated strips along the contour left between cultivated strips.
- **Cover cropping ;**
 - The establishment of a crop that spreads out over the surface of the soil to provide it with a cover.
- **Contour farming ;**
 - Carrying out all land operations along the contour.
- **Mulching ;**
 - Covering of the soil with either organic or synthetic materials.
- **Proper cropping systems** such as:
 - Crop rotation
 - Correct spacing
 - Inter-cropping
 - Ridging/furrowing
 - Strip cropping
- **Controlled grazing;**
 - Proper stocking rate, rotational grazing.
- **Strip cropping;**
 - Growing crops which give little ground cover in alternate strips with crops such as beans which have a good ground cover.
- **Afforestation/re-afforestation.**
 - **Afforestation** - growing of trees where non-existed.
 - **Re-afforestation** - growing of trees where they have been cut down.

- **Agroforestry** - land use that involves the growing of trees in combination with crops and pastures on the same piece of land.

Physical or Structural Control Measures

- These are soil and water conservation measures which involve mechanical constructions on the earth.
- They are used in areas of moderate slope between 13-55%.

They include:

- **Trash or stone lines;**
 - These are rows of heaped crop' residues or stones made along the contours.
- **Filter strips;**
 - It involves the growing of an open crop in the upper side of the slope followed by a dense crop to reduce speed of water.
 - This increases infiltration.
- **Terraces;**
 - Are structures constructed across a slope to reduce the length of a slope thus reducing run-off.
- **Bench terraces;**
 - Are constructed where the slope is 35-55%.
 - Tree crops are suitable for such areas.

Importance of a Bench Terrace: -

- Reduces slope of the land.
- Conserves soil moisture.
- Better retention of soil fertility.
- **Narrow based terraces** –Cannot allow cultivation by machines.
- **Broad based terraces** - Is wide enough to allow cultivation by machines.
- **Graded terraces:**
 - Have a drainage channel to lead off excess water to a vegetated place.
 - They should be about 100m in length.
- **Level terraces:**
 - Have no outlet channels,
 - The aim is to have water infiltrating,
 - Hence no water can flow from the ends of the terrace.
- **Fanya juu:**
 - A ridge made by digging a channel and throwing the soil uphill.
- **Fanya chini:**
 - In this case the soil is heaped on the lower side of the channel.
- **Bunds:** heaps of soil (earth) made along the contour.
- **Cutoff drains:**
 - An open trench with an embankment on the lower side into which water from the farm drains.

Water from the trench should be discharged into;

- Natural waterways,
- Artificial waterways,
- Rocky ground

- Grassland
- **Gabion/Porous dams:**
 - Galvanized wire mesh boxes filled with stones which are built across slopes and gullies.
- **Dams and reservoirs ;**
 - Dams - barriers built across a river/waterway to hold and store water. It reduces speed of runoff.
 - Reservoirs - these are large storage tanks.
- **Ridging** - heaps of soil to reduce the speed of water, They retain the water for some time.

Water Harvesting Methods

- Water harvesting and storage should be done during the rainy seasons to avoid wastage.

This should be done using the following methods:

- **Roof catchment** - trapping and collection of rain water from roof tops.
- **Rock catchment** - water is harvested by constructing a barrier on the lower side of a large impervious rock to trap surface runoff from the rock.
- **Weirs and dams.**
 - **Dam** - a barrier constructed across a river or a dry valley so that it can hold water.
 - **Weirs** - barriers constructed across a river or a stream to raise the water level and still allow water to flow over it.
- **Ponds** - water retention excavations made to hold excess surface water.
- **Retention ditches/level terraces.**-These are terraces constructed with blocked ends to retain water.

Micro-Catchments

- A system of harvesting limited rainfall and storing the water in the ground for use by the planted crops.

Types of Microcatchments;

- **Triangular/V-shaped/Negarims;**
 - V-shaped bunds measuring 25cm
 - Are built with soil from the excavated planting holes to direct runoff water towards the basin area around the base of each plant
- **Semi-circular bunds;**
 - Formed around the growing plant to hold water around the plant.
- **Trapezoidal bunds;**
 - Trapezoidal shaped bunds, which enclose a large area where the crops are grown.
- **Contour bunds/furrows ;**
 - These are furrows made along the contours between the rows of crops where agroforestry trees are intercropped with annual crops.
- **Planting holes/pits ;**
 - These are extra large planting holes made and filled with dry plant materials before filling in with soil.

Use of Micro-Catchments

- Slow down the speed of surface runoff.
- Used during landscaping of the compound, parks and roadside nest areas.
- Reclamation of land for food crop in dry areas.
- Water collected and stored can be used for irrigation
- Afforestation in dry areas.

Weeds and Weed Control

Introduction

- Weeds cause heavy crop losses if not controlled.
- Their control is important so as to maintain high quality and quantity produce.

Definition:

- A weed is any plant growing where it is not required.
- And whose economic disadvantages outweigh the advantages.

Harmful Effects of Weeds

- Weeds compete with crops for nutrients, space, light and soil moisture.
- Some weeds, for example, *Striga spp* are parasitic to cultivated crops such as maize.
- Some weeds lower the quality of agricultural produce for example:
 - Mexican marigold gives undesirable flavour to milk if dairy cows feed on it.
 - Devils horsewhip, black jack, bristly fox-tail and others get attached to sheep wool thus lowering its quality.
- Some weeds are poisonous to human beings and livestock for example:
 - Thorn apple (*Datura stramonium*)
 - Sodom apple (*Solanum incanum*)
- Some weeds have allelopathic effects to cultivated crops.
- Water weeds block irrigation channels.
- Aquatic weeds such as *Salvinia* in Lake Naivasha and water hyacinth in Lake Victoria affect fishing.
- Some weeds are alternate hosts for insects, pests and disease causing organisms for example:
 - Wild oat (*avena fatua*) is an alternate host for rusts.
 - Mallow (*malva verticillata*) is an alternate host for cotton stainers.
- Weeds lower the quality of pasture for example:
 - Tickberry (*Lantana camara*)
 - Nut grass (*Cyperus rotundus*),
 - Manyatta grass (*Eleusine jaegeri*)
- Some weeds irritate workers thus reducing the efficiency in which they are controlled for example:
 - Double thorn (*Oxygonum sinuatum*),
 - Stinging nettle (*Urtica massaica*) ,
 - Devil's horse whip (*Achyranthes aspera*).

Factors Contributing to the Competitive Ability of Weeds

- They produce large quantities of seeds for example pigweed and black jack.
- Their seeds remain viable in the soil for a long time awaiting conducive germination conditions.
- They have effective seed dispersal mechanisms.
- Some weeds propagate by means of elaborate underground storage structures.
- They are efficient in utilizing little moisture, nutrients and sunlight.
- Some have short life cycles.
- They have elaborate root systems for supporting the plant and absorbing nutrients and water.

Weed Classification

It is based on:

- **Life cycles** for example:
 - **Annuals** - complete their life cycle in only one season.
 - **Biennials** - complete their life cycles in two seasons only.
 - **Perennials** - complete their life cycle in more than two seasons.
- **Morphology** - leaf formation such as size, shape and venation.
 - **Broad leaved weeds** for example black jack, lantana, pig weed, oxalis and others.
 - **Narrow leaved weeds** for example couch grass, setaria, nut-grass, manyatta grass and others.
- **Habitat** - some weeds are terrestrial (grow on land) while others are aquatic (grow on aquatic/marine conditions).

Weed Identification

- Weeds are identified by their common (individual) names and botanical names.
- They are named according to specific features or according to person who identified them.

Common Name

Botanical Name

- Black Jack *Bidens pilosa*
- Mexican marigold *Tagetes minuta*
- oxalis/sorrel *Oxalis spp.*
- Double thorn *Oxygonum sinuatum*
- Thorn apple *Datura stramonium*
- Couch grass *Digitaria scalarum*
- Nut grass *Cyperus rotundus*
- Wandering Jew *Commelina bengalensis*
- Sow thistle *Sonchus ole race us*
- Devil's horsewhip *Achyranthes aspera*
- Macdonald's eye/ Gallant soldier. *Gallinsoga parviflora*
- Sodom apple *Solanum incanum*
- Black night shade *Solanum nigrum*
- Chinese lantern..... *Nicandra physalodes*
- Bracken fern *Pteridium aquillium*

- Love grass/ Bristly foxtail*Setaria verticillata*
- Cleavers*Gallium spurium*
- Stinging Nettle*Urtica massaica*
- Fat hen/Goose foot*Chenopodium spp.*
- Rape weed*Brassica nap us*
- Wild oats*Avena fatua*
- Lantana/Tick berry*Lantana camara*
- Water hyacinth*Eichhornia crassipes*
- Striga/Witch weed*Striga hermontheca*
- Creeping indigo*Indigofera spicata*

Weed Control Methods

The methods of weed control determined by:

- The weed being controlled.
- Weather conditions.
- Capital availability.
- Effect on environment.

METHODS OF WEED CONTROL INCLUDE:

Chemical Weed Control –

- The use of chemicals known as herbicides to control weeds.

Classification of Herbicides

Based on:

- **Formulation** - the physical form of the herbicides for example:
 - Liquids
 - Wettable powders
 - Emulsion
 - Dust
- **Time of Application**
 - Pre-emergence - applied before the planted crop germinates.
 - Post emergence - applied after the planted crop germinates.
- **Selectivity**
 - Selective.
 - Non selective.
- **Mode of Action**
 - Contact - herbicides that kill only the parts of the plant which it comes into contact.
 - Translocated systemic herbicides that will kill the whole plant even if it comes into contact with only a small part of it.

Methods of Herbicide Application

- Spraying - application of solutions.

- Dusting - application of dusts.
- Fumigation - application of fumigants into the soil.

Safety Measures in the Use of Chemicals

- Read manufacturer's instructions and follow them.
- Wear protective clothing such as overalls, breathing mask, gloves and boots.
- Avoid inhaling the herbicides.
- Wash thoroughly after handling chemicals.
- Do not blow or such blocked nozzles.
- Avoid herbicide drift to unintended crops and other plants.
- Avoid herbicide drift to livestock feed and water.
- Avoid spilling herbicides in pastures and fodder crops.
- Dispose off the empty containers properly for example burying them in the soil.
- Do not wash spraying equipment in water sources used by animals and human beings.
- Store chemicals in a safe place.
- Wash the spraying equipment thoroughly.
- Sink left over chemicals into the soil after the day's work.

Advantages of Chemical Weed Control

- It is less laborious.
- Effective in the control of difficult weeds such as couch grass and sedges.
- It does not disturb crop roots and other underground structures.
- It makes the control of weeds in certain crop easier.
- It is efficient in both wet and dry conditions.
- It does not destroy soil structure.
- Cheaper in large scale production than the use of manual or mechanical cultivation.

Disadvantages of Chemical Weed Control

- It requires skilled labour in mixing and application.
- Cause environmental pollution.
- Herbicides have long residual effects which may interfere with future crops.
- It is very expensive.

Mechanical Weed Control

- It involves the following operations:

Tillage/Cultivation

- This is the opening and loosening up of the soil.
- It can be done by hand tools or tractor drawn implements.

Advantages

- Cheap in small scale production.
- Increases water and air infiltration into the soil.
- Incorporates crops residues into the soil.
- The earthing-up done during tillage encourages root growth.

Disadvantages

- If done repeatedly it destroys soil structure.
- It is laborious and expensive in large scale production.
- It may not effectively control weeds.
- It may lead to soil erosion and loss of soil moisture.
- Damage crop roots.

Slashing/Mowing –

- Mechanical removal of shoots from weeds.
- It is effective in the control of annual weeds.

Uprooting

- It is done when the crops are too close
- To allow mechanical cultivation or where weeds are scattered.

Cultural Weed Control

It involves the following practices:

- Mulching.
- Cover cropping.
- Crop rotation.
- Timely planting.
- Use of clean seed/planting materials.
- Proper spacing.
- Proper seedbed preparation.
- Flooding.

Biological Weed Control

- The use of living organisms to control weeds.

Examples are:

- Use of livestock to graze and control growth of weeds especially in plantations.
- Use of weed eating fish to control aquatic weeds.
- Use of moths to control cactus.
- **Limitations:** the method is not reliable.

Legislative Weed Control/ Quarantine

- It involves government laws and regulations which prevent the introduction and spread of foreign weeds in a country or an area. Done by KEPHIS.
- **Limitations:** Only samples are checked while the bulk of the materials may have some weed seeds.

Crop Pests and Diseases

Introduction

- Crop pests and diseases lead to high losses in crop production hence efficient control measures are needed.
- Proper control measures require the farmers to be able to;
 - Identify these organisms,
 - Know their life cycles, feeding habits
 - The damage they cause to crops.

Crop Pests

Definition of a Pest:

- It is a living organism that destroys crops/ trees either directly or indirectly by introducing pathogens (disease causing germs).

Classification of Pests

Pests are classified according to the following:

- **Mode of Feeding**
 - Pests with biting and chewing mouth parts - they cause physical damage and reduce the photosynthetic area of the plant.
 - Pests with piercing and sucking mouth parts - they suck out the nutritious plant sap and in the process may introduce disease causing organisms.
- **Crops Attacked**
 - Some crop pests attack specific crops for example, stem borers prefer cereal crops.
- **Stage of Growth of Crops Attacked**
 - There are pests of seedlings attack when the crop is young, for example cutworms.
 - Pests of fruits - attack the crops at fruiting stage.
 - Pests of grains attack the crops when the grains are formed.
- **Field and Storage Pests**
 - Some pests attack the crops while in the field.
 - Other pests attack the produce after it has been harvested and stored.

Identification of Common Pests

Name of Pest	Crop Attacked	Damage Done	Control Measures
Armyworms (<i>Spodoptera</i> <i>exempta</i>)	Cereal crops Sugar cane (iii) Grasses	Defoliate the whole plant	(i) Early planting (ii) Use of effective insecticides
Cut worms (<i>Agrotis Spp.</i>)	Young seedlings	Cut the seedlings at the stem base	(i) Early planting (ii) Use of soil applied insecticides (fumigants) (iii) Flood/irrigation
Boll worms (<i>Heliathis migera</i>)	Cotton, citrus, maize, beans, millet,	Eat and destroy the fruits and seeds	(i) Crop rotation (ii) Field hygiene (iii) Spraying with insecticides

	legumes		(iv) early planting
Maize stalk borer (<i>Busseola fusca</i>) and (<i>Chilo partellus</i>)	Maize sorghum	Destruction of the stem and young growing tissues	(i) Early planting (ii) Field hygiene (iii) Crop rotation (iv) Use of stalk borer dust.
Loopers (<i>Ascotis selenaria</i>)	Coffee	Make windows in crop leaves	(i) Use of effective (ii) Use of parasitic wasps, and chameleons
Leaf Miner (<i>Leucoptera meyricki</i> and <i>L. caffearia</i>)	Coffee	Make mines in the leaves reducing photosynthetic area.	Use of parasitic wasps (enemies) (ii) Use of effective
Stainers (<i>Dysdercus spp.</i>)	Cotton	Stain the cotton lint reducing quality	Use of parasitic tachinid Spraying with insecticides. Control alternate hosts. Crop rotation
Aphids (<i>Aphis spp.</i>)	Several crops as citrus, maize, cotton, beans. cabbages and others	(i) Transmit viral diseases. (ii) Suck out sap leading to stunted growth.	Natural enemies for lady birds (ii) Overhead irrigation (iii) Use of insecticides

Other Crop Pests Include:

- Mealy bugs - coffee
- Thrips - coffee
- Beetles - field and storage pests.
- Birds - field pests - cereals and fruits.
- Rodents - field and storage pests ,cereals and tubers.
- Nematodes - soil borne pests - tomatoes, potatoes, sunflower, beans.

Harmful Effects of Crop Pests

- Pests such as squirrels and rodents, unearth planted seeds, resulting in poor germination.
- Some pests like nematodes, termites and moles damage crop roots causing wilting and death of the crops.
- They lower the quality and quantity of farm produce.
- They increase the cost of production since farmers will incur expenses in purchasing chemicals to control them.
- They transmit diseases to crops for example, aphids transmit streak virus disease in maize.
- Chemicals used to control the pests cause pollution to the environment.
- They exterminate the crop by feeding on them for example eating embryo of the seed.

Control of Pests

- If pest population causes damage beyond tolerance then it is said to have reached economic injury level (EIL) hence control measures should be effected before this level.

Before any control measure is effected ,the following should be considered:

- Know the life cycle of the pest.
- Correct identification of the pest.
- Correct assessment of the damage.
- The weather conditions.
- The value of the crop in question.
- The cost factor of the control method.

Methods of Controlling the Pests

- Cultural methods.
- Physical/mechanical measures
- Biological methods.
- Chemical methods.
- Integrated pest management.

Cultural Methods:

- These are farming practices which aim at reducing the pest population by destroying the life cycle of the pests either by exposing them to adverse conditions or denying them food.

These include:

- **Timely planting** to escape pest attack.
- **Timely harvesting.**
- **Proper tillage.**
- **Close season:** this is the period when a susceptible crop is not grown in order to control a certain pest.
- **Trap cropping:** These are crops which attract pests diverting them from the main crop. The trap crop is grown together with the main crop.
- **Crop rotation:** It breaks the life cycle of the pest.
- **Planting resistant varieties:** These are plants with natural protective mechanisms against pest for example hairy cotton against jassid bugs, goose necked sorghum against birds, high tillering in sorghum against shoot fly.
- **Field hygiene:** This includes rogueing and removal of crop residues which harbour pests from field.
- **Alterations of environmental conditions,** such as, creating a microclimate which is not conducive to pests for example open pruning in coffee.
- **Crop nutrition:** application of fertilizers and manures to make the crop strong and able to escape pest attacks.
- **Destruction of alternate hosts,** for example, weeds like mallow which harbour cotton stainers.
- **Use of clean planting materials.** This helps to prevent introduction of crop pests.

- **Proper spacing:** if well spaced some pests find it difficult to move from one plant to another.
- **Use of organic manure,** for example, farmyard manure discourages eel worms (nematodes).

Chemical Control

- Chemicals used to control pests are known as pesticides.
- Pesticides are administered through dusting, spraying or fumigating.

Classification of Pesticides:

Pesticides are classified on the basis of:

Mode of Entry

- Stomach - ingested by the pest together with the crop materials.
- Contact - absorbed through the body tissues.
- Fumigants - through the breathing mechanism.
- Systemic - translocated to all parts.

Mode of Action

- Respiratory poisons - interfere with breathing mechanisms.
- Coagulants - cause the blood of the pest to coagulate.
- Neurotoxins - act on the nervous system.
- Protoplasmic poisons - cause the cells to disintegrate.

Target Pests

- Insecticides - kill insect pests
- Molluscicides - kill snails and slugs.
- Rodenticides - kill rodents.
- Nematocides - kill nematodes.

Formulation .

- Dusts, granules and powders
- Emulsifiable concentrates.
- Miscible liquids.
- Wettable powders.
- Fumigants.

Factors That Affect the Efficiency of Pesticides

- Concentration of the pesticides.
- Weather conditions at the time of application.
- Timing of application - efficiency is high if applied when the pest is most susceptible.
- Persistence of the pesticide having long residual effect in the soil.
- Resistance of the pests.

Advantages of Chemical Pest Control

- Faster
- Immediate results are achieved.
- Low labour requirements.

Disadvantages of Chemical Pest Control

- Expensive to buy.
- Cause pollution to the environment.
- Require skilled labour to apply.
- Some pesticides may kill beneficial organisms and predators.
- Some target pests may build up resistance.

Mechanical Pest Control/Physical

- This involves the killing of the pests using physical methods.
- Or creating physical barriers to prevent pests from getting into contact with the crops

Example:

- Flooding/irrigation; for example, moles are suffocated through flooding.
- Use of lethal temperatures: either too cold or too hot.
- Suffocation; commonly used in grain storage bins by being made air tight.
- Trapping and killing, for example, rats.
- Creation of physical barriers, such as, rat bafflers, sticky materials on tree trunks.
- Proper drying: this makes them too hard to be destroyed by pests.
- Scaring devices especially in rice plantations to control birds.
- Use of explosives thrown at breeding places of birds to kill or scare them away.

Biological Pest Control

- It involves the use of living organisms to reduce the pest population.

Predator

Target Pest

- Parasitic wasp-----White fly in citrus, boll worms, stalk borers
- Birds-----Crickets, locusts, caterpillar llars.
- Lady Bird -----Aphids
- Trachnid flies -----cotton stainer
- Praying mantis-----giant loppers
- Majimoto ants -----scales
- Cats -----moles,rats,mice
- Brachonid wasps-----mealy bugs
- Chicken -----cotton stainer, larvae of beetles, grasshoppers, crickets

Advantages

- Cheap
- No environmental pollution
- Saves on labour.

Disadvantages

- Takes too long to get the correct agent
- Difficult to control the pest effectively.

Integrated Pest Management

- It is a new method which involves the combination of the methods mentioned above.
- The aim is to have least hazards to the user and to the environment.
- Example, attractant-pheromones are used to attract pests to one place where they are sprayed and eradicated.

Legislative Method/Quarantine

- Legislative measures of pest control are effected by the Kenya Plant Health Inspectorate Service (KEPHIS) through seed inspection.

Crop Disease And Their Control

- A disease is any deviation from the normal performance or functions.
- A plant disease is any harmful physiological disorder in a plant caused by pathogenic agents such as virus, bacteria, fungi.
- The study of plant disease is called plant pathology.

Economic importance of crop diseases

- They lower crop yield
- They reduce the quality of the produce thus reducing their market value
- They cause food poisoning. E.g ergot in wheat, aflatoxin in grain crops by fungus.
- They reduce photosynthetic area of the plant.

Classification and identification of plant disease

- Plant disease are classified according to their causal agents;

Fungal diseases;

- Fungi are non-green plant-like.
- Some are parasitic and others are saprophytic.

Parasitic fungi divided into;

- **Obligate parasites**- those that depend on other living organisms for food.
- **Facultative parasites**-those that are able to live on both the living and dead tissues.

Examples of fungal disease

- **Panama disease**(*Fusarium oxysporum*—bananas)
 - **Cigar-end rot**(*Verticillium theobromae*)-bananas
 - **Die back** –attack the tips of shoots and roots
 - **Mildews**-foliar disease of several crops
 - **Armillaria root rot**(*Armillaria mellea*)-coffee and tea
 - **Damping off-disease** of seedlings in the nursery
 - **Anthraxnose** (*Colletotrichum* spp)-coffee,beans,tomatoes.
- Fungus also cause damage to stored grains which are not properly dried or if the store is damp.
 - Fungus cause food poisoning and lower seed viability for example *Aspergillus flavus* which produces a highly toxic compound called **aflatoxin**.

Examples of fungal disease

Disease/cause	Crops attacked	Symptoms of attack	Control measures
Late blight (<i>Phytophthora infestans</i>)	Members of Solanaceae family (potatoes, tomatoes)	Dry patches on the leaves and fruits (necrotic lesions)	-Crop rotation -effective fungicides -treated seeds -resistant varieties
Rusts (<i>Puccinia</i> spp)	Rice, wheat, sorghum, maize	Red and brown pustules on the leaves, shriveled grains	-resistant varieties -Recommended fungicides -Early planting
Smuts(<i>Ustilago</i> spp)	Wheat, maize, sugarcane	Black powder mass on the spikes and the ear	-Field hygiene, -certified seeds,

			-resistant varieties, -crop rotation
Blasts(<i>Piricularia oryzae</i>)	Rice	-Small blue sports on leaves with grey centre. -Attack inflorescence to cause "empty heads"	-Seed dressing -Resistant varieties eg sindano -Destruction of affected plants -fungicides
Coffee Berry Disease(CBD) (<i>Colletotrichum coffeanum</i>)	Coffee	-Dark blotches spots on the flowers -Brown concentric rings on the leaves -Dark sunken wounds on the berries.	-Resistant varieties eg Ruiru 11 -Proper pruning -Effective fungicides -stripping

Bacterial Diseases

- Bacteria are microscopic single-celled organisms which reproduce by binary fission
- **Transmission;** Through irrigation water, seeds, fertilizers, manures, wind ,
- raindrop splash, insects, soil and mechanical means.

Symptoms of Bacterial Diseases

- Wilting
- Cankers(necrotic tissues)localized necrosis
- Gall formation in infected tissues.

Examples of bacterial diseases

Disease/Cause	Crops Attacked	Symptoms of Attack	Control Measures
Halo blight (<i>Pseudomonas phaseolicola</i>)	Beans	i. Irregular dark lesions on leaves and pods. ii. Yellow band round the lesions called "halo". iii. Water soaked lesions	i. Use of resistant varieties for example Wairimu. ii. Effective fungicide. iii. Crop rotation
Fusarium wilt (<i>Fusarium oxysporum</i>)	Tomatoes	i. Stunted growth. ii. Yellowing and shedding of leaves. iii. Wilting of the plant.	i. Use of resistant varieties.
Black arm (<i>Anthonomus malvacearum</i>)	Cotton	i. Small round spots on the cotyledons of young seedlings. ii. The spots elongate to form black lesions on the stem.	i. Field hygiene. ii. Use of certified seeds.
Bacterial wilt (<i>Pseudomonas solanacearum</i>)	Tomatoes and potatoes	Uniform. wilting of the whole plant even with enough water.	i. Use of certified seeds. ii. Crop rotation.

Viral Diseases

- Viruses are small living organisms which can only be seen under a very powerful electronic microscope.
- Viruses interfere with photosynthesis, respiration, transpiration and nitrogen utilization

Symptoms of Viral Infection

- Leaf chlorosis.
- Leaf curling.
- Mosaic(light green or yellow patches).
- Malformation(distortion)of plant parts.
- Rosettes; Development of abnormally short internode.

Transmission

- Through the use of infected vegetative materials and insect vectors like aphids, mealybugs and leafhoppers.

Viral diseases

<i>Disease/Cause</i>	<i>crops Attacked</i>	<i>Symptoms of Attack</i>	<i>Control Measures</i>
Ratton stunting	Sugar cane	Red discoloration on the vascular bundles.	Use of clean materials. Treatment of seed canes.
Maize streak	Maize	Yellow stripes alternating with green, parallel to the midrib.	Control leaf hopper. ii. Use if certified seeds. iii. Field sanitation.
Greening disease	Citrus	i. Yellow mottling of the leaves. Die back. iii. Premature leaf fall.	i, Use of clean tools when budding. Control of insect vectors.
Leaf mosaic	Suzgar cane, cassava. sweet potatoes.	i. Yellow mottling. Necrosis of stem.	Control of aphids. ii. Use of clean materials. Seed treatment.
Tristeza	Citrus	Dwarfing of Die back.	i. Stripping affected fruits. ii. Use of clean equipment of budding.

Other Causes of Crop Diseases

- Flooding forming ammonia which is poisonous to the crops causing a burning effect on leaves.
- Chemicals: some may be toxic.
- Poor weather: Extremes of day and night temperatures.
- Stress: such as irregular watering as in tomato blossom end rot.

Control of Crop Diseases

- Cultural method: This involves use of
- Healthy planting materials.
- Practicing field hygiene.

- Proper seedbed preparation.
- Proper spacing.
- Heat treatment of the planting materials for example sugar cane.
- Proper drying of cereals and pulses to 13%M.C.
- Growing disease resistant varieties.

Legislative Method

- Involves the imposing of regulations and laws especially in case of disease outbreaks to prevent the introduction and spread of diseases.

Chemical Control

- Used as a last resort.

Chemical control measures include:

- Seed dressing before planting.
- Soil fumigation to control soil borne diseases.
- Spraying: application of fungicides.

Crop Production VI

(Field Practices II)

Introduction

- There are many crops cultivated in Kenya.
- These crops are grown for various uses and require different ecological conditions.

Definitions:

- **Hybrids** - These are crop varieties developed by crossing two pure lines.
- **Composites** - These are crop varieties developed through repeated mass selection.
- **Cultivars** - these are varieties of crops which are cultivated in a given area.

Maize

- **Main growing areas:** Trans-Nzoia, Nakuru, Uasin Gishu, Laikipia districts and others.
- **Ecological Requirements**
 - **Altitude:** Upto 2000m above sea level.
 - **Temperature:** About 25°C
 - **Soils:** Freely draining, fertile loam soils.
 - **Rainfall:** 750-1250mm critical at silking and pollination stage.
- **Varieties**

- High altitude areas: Hybrids 611, 613 and 614C.
- Medium altitude areas: 511,512,622 and 632.
- Marginal rainfall areas: Katumani composite and Makueni composite.
- Coast regions: Coast composite and Katumani composite.

Seedbed Preparation

- Ploughing should be deep and done during the dry season to eradicate weeds.
- Require medium tilth.
- Plant spacing 75-90cm x 20-30cm.
- Planting done at the onset of the rains. This helps to reduce pest attack.
- Dry planting in areas with inadequate rainfall is necessary.

Field Maintenance:

- Apply phosphatic fertilizer during planting at a rate of 120kg/ha P₂O₅
- Also nitrogenous fertilizers as top dress at the rate of 200kg of ASN or CAN.
- Control weeds by cultivation, use of appropriate herbicides, uprooting, slashing and mulching.

Pest Control

- **Maize Stalk Borer:**
 - Nature of damage: Boring the leaves causing windowing effect, boring the stems and cobs.
 - Control: Destruction of previous years crop residue, closed season and apply chemicals
- **Maize Weevils:**
 - it is a storage pest.
 - *Damage:* Bores holes into the maize grains, eating the contents.
 - *Control:* Proper hygiene and sanitation in the stores.
 - Use of chemicals such as Actellic Super.

Disease Control:

- **Rust**
 - *Cause:* Fungus.
 - *Symptoms:* Red or brown pustules on the. leaves.
 - *Control:* Plant resistant varieties and crop rotation.
- **Smuts**
 - *Cause:* Fungus
 - *Symptoms:* Black sooty mass of spores on maize heads or cobs(ear).
 - *Control:* Crop rotation, growing resistant varieties and destruction of affected plant parts.
- **Maize Streak Virus**

- **Cause:** Virus
- **Symptoms:** Yellow longitudinal stripes parallel to the midrib.
- **Control:** Certified seed, early planting and rogueing.

Harvesting

- Harvest the crop 3-9 months after planting depending on variety.
- Maize stalks are cut and stocked in the field.
- Cobs removed by hand.
- For large scale harvesting, combined harvesters are used.
- Yields about 3,000kg and 4500kg/ha.

Bulrush Millet

Areas where grown:

- Lower areas of Kirinyaga,
- Embu,
- Meru,
- Parts of Machakos
- Kerio Valley.

Ecological Requirements

- **Altitude:** Does well in areas below 1200m.
- **Rainfall:** 500-600mm per annum.
- **Soils:** Light sandy soils.
- **Varieties:** Serere 2A, 3A, 6A, 17, 16/9

Seed Bed Preparations

- Ploughing of land during the dry season.
- Soil should be of fine tilth since the seeds are small.

Planting:

- Done at the onset of the rains.
- Planted by broadcasting and row planting at a spacing of 60cm x 15cm.

Field Maintenance:

- Weeding is done until tillering.
- Top-dressing is done by use of sulphate of ammonia.

Pest Control

Birds

- **Nature of Damage:** Eats the seeds at milky stage.
- **Control:** Bird scaring devices.

Disease Control

Ergot

- **Cause:** Fungus.

- **Symptoms:** Heads become sticky.
- **Control:** Use of certified seeds, crop rotation and destruction of affected crops.

Downy Mildew

- **Cause:** Fungus.
- **Symptoms:** Long, whitish lines on the leaves.
- **Control:** Crop rotation and field hygiene.

Harvesting

- Done by cutting off the heads.
- Drying of the heads.
- Threshing and winnowing of the grains.
- Stored under well ventilated dry conditions.
- Yields about 1000kg/ha with good management.

Finger Millet

- **Areas where grown:** Western Kenya and Uganda.

Ecological Requirements

- **Altitude:** 0-2400m above sea level.
- **Rainfall:** 900mm, drought resistant in the early stages.
- **Soils:** Free draining fertile soils.

Varieties:

- Serere varieties developed at Serere in Uganda.
- Ultra lupin
- 5.18 oats.

Land Preparations

- The seedbed should be thoroughly prepared to a fine tilth due to the small size of the seeds.
- It also helps to control weeds.

Field Operations

Planting

- Finger millet should be planted as early as possible in the season.
- It is usually broadcasted by hand.
- If planted in rows, the furrows should be 30-33cm apart and the plants should be thinned to 5cm apart within the rows.

Fertilizer Application

- Sulphate of ammonia at the rate of 125kg/ha is recommended for topdressing finger millet.

Weed Control

- Clean seedbed preparation
- Uprooting

Pest Control:

- *Birds are controlled through scaring.*

Disease Control

Head blast:

- *Cause:* Fungus
- *Symptoms:* Brown spots with grey centres on the leaves and stems below the inflorescence.
- *Control:* Use of resistant varieties.

Harvesting

- Individual heads are cut with knives.
- Heads are dried, threshed and winnowed.
- Yields 1650kg/ha with good management.

Sorghum

- It is grown in Western, northern, Rift Valley, Eastern and some parts of Central Province.

Ecological Requirements

- *Altitude:* 0-1500m above sea level.
- *Rainfall:* 420-630mm. It is drought resistant.
- *Soils:* Fairly fertile and well drained soils.

Varieties

- Dobbs variety.
- Serena variety.

Field Operations

Planting

- Broadcasting the seeds on the firmly prepared seedbed.
- Intercropped with other crops especially maize and beans.
- Can be planted in pure stands at a spacing of 60cm x **15cm**

Fertilizer Application

- Responds well to farmyard manure (FYM).
- Inorganic fertilizers are not commonly used in growing sorghum.

Pest Control

- **Bird pests: They are the most common sorghum pests.**
- **They include**
 - **quelea,**
 - **aethiopica (Sudan Dioch),**
 - **weaver birds,**
 - **starling bird**
 - **bishop's bird.**
- **They are controlled through;**
 - killing them using explosives,
 - poison spraying in their breeding places
 - use of flame throwers.
- Sorghum shoot-fly controlled by early planting, closed season and application of insecticides.
- Stem borer - control by use of insecticides and field hygiene.

Disease Control

Common sorghum diseases include:

- Leaf blight
- Anthracnose.
- Sooty stripe.
- Loose smut
- Head smut

Smuts are controlled by seed dressing-while the other diseases are controlled by growing resistant varieties.

Harvesting

- Sorghum is ready for harvesting 3-4 months after planting.
- Heads are cut off using a sharp knife after which they are sun-dried, threshed, winnowed and stored.
- Up to 3000kg/hectare can be obtained with good management.

Beans

- Grown in all provinces where maize is grown.

Ecological Requirements

- **Altitude:** 10.00-2100 metres above sea level.
- **Rainfall:** Average of 625mm per annum.
- **Soils:** Well drained loamy soils rich in organic matter.

Varieties

Varieties for dry beans:

- Rose Coco,
- Mwezi Moja,
- Canadian Wonder,
- Wairimu,
- Haricot,
- Mwitemania.

Variety for canning: Mexican 142.

Varieties for French Beans:

- Primeur,
- Long Tom,
- Saza,
- Master Piece
- Monel.

Seedbed Preparation

- Land should be prepared early.
- Primary and secondary cultivation done to control perennial weeds.

Seed Selection and Treatment

- Select wholesome seeds free from damage and wrinkles.
- Seeds are dressed against bean fly.
- Seeds should be inoculated with appropriate bacteria (none dressed seeds)

Planting

- Planted at the onset of the rains.
- Spacing 30-45cm x 15cm.
- Apply phosphatic fertilizer during planting time.
- Plant 2-4 seeds per hole.

Field Maintenance

- Provide sticks for the climbing varieties.
- Control of weeds through shallow cultivation.
- Top-dress with nitrogenous fertilizer for example CAN.

PestControl

- **Bean-Fly**
 - *Nature of damage:* Feeds on the stems causing swelling at the roots.
 - This results in wilting and death.
 - *Control:* Dressing of seeds, early planting and spraying with insecticides.
- **Bean Bruchid (Storage Pest)**
 - *Nature of damage:* Make dark circular windows on the grains.
 - *Control:* Clean stores, fumigation, and seed dressing.

Diseases Control

- **Bean Anthracnose**

- Cause: Fungus
- Symptoms: Brown or black lesions on the underside of the leaves, pods and stems.
- Control: Growing resistant varieties, crop rotation, destruction of crop residues and spraying with fungicides.

- **Bean Rust**

- Cause: Fungus
- Symptoms: Red brown pustules on the leaves.
- Control: Planting resistant varieties and spraying copper fungicides.

Harvesting

- Done during the dry season for dry beans and when the pods are dry.
- Threshing and winnowing done.
- Sorting of rotten, off types and damaged ones.
- Sold to National Cereals and Produce Board when dry.
- For French beans, pick the pods when soft and green.
- Market immediately to avoid shrivelling.

Rice Production

Areas where grown;

- Mwea Tabere Irrigation Scheme
- Ahero Pilot Scheme in Kano plains.
- Bunyala in Busia.
- Bura in Tana River.

Land Preparation

- Plots of 0.4 hectare are made with bunds constructed around them.
- Plots are flooded for four days.
- Rotavators/jembes are used to work the flooded fields on the fifth day.
- The land is then levelled and allowed to drain.

Water Control

- During land preparation, water level should be about 7.5-10cm.
- During levelling water level should be 5cm
- Water is drained off completely for direct sowing.
- For transplanted rice, water level should be 5cm at transplanting.
- Water level should be maintained at 1/3 the height of plant until maturity.
- Water should be allowed to flow slowly through the fields.
- Old water should be changed every 2- 3 weeks if the flow of water is not possible.
- Water introduced should always be warm to ensure pollination.

Fertilizer Application

- S.A applied in the nursery.
- Rate of 25kg SA for every nursery unit of 18.5m x 18.5m.
- Phosphatic fertilizers broadcasted in the field.
- Rate of 120kg ha DSP before planting.
- S.A applied in the field in two splits before and after transplanting at a rate of 250kg/ha

Flooding in Rice

Flood water in rice production is important for the following reasons;

- It provides good conditions for growth such as high humidity.
- Kills soil organisms.
- Prevents denitrification.

Weed Control

- Controlled through flooding.
- Appropriate herbicides such as propanil and butachlor are also used.

Harvesting of Industrial Crops

- cotton, pyrethrum, sugarcane, coffee and tea.

Harvesting of Cotton

Stage of harvesting

- Takes 4 months to mature.
- Harvest when bolls are dry and fully opened.

Method and Procedure

- In Kenya cotton is picked manually.
- Sort out grade AR (safi) from grade BR
- (fifi) into separate containers.

Precautions

- Harvest during dry conditions to prevent dirtifying the lint.
- Avoid use of gunny bags to prevent contamination.
- Avoid picking leaves.
- Harvest on weekly basis.

Harvesting of Pyrethrum

Stage of harvesting

- Takes 3-4 months to mature.
- Harvest the flowers with disc florets which have assumed a horizontal position.

Methods and Procedure

- Pyrethrum is picked manually.
- Flowers are picked by twisting the heads so that no stem is attached.

Precaution

- Clean harvesting should be done.
- Avoid picking leaves.
- Flowers are placed in woven baskets.
- Overblown flowers are picked and thrown off.
- Pick the flowers when the dew is dry.
- Harvested flowers should be taken to the factory the same day.
- Avoid compaction of flowers in the basket.
- Harvesting interval, once in two weeks during the wet season and once in a month during the dry season.

Harvesting Sugarcane**Stage of harvesting;**

- Take 14-20 months for the plant crop to mature and 12-16 months for the ratoon crop.
- Sampling of cane is done before harvesting to ascertain the correct sugar content.

Methods and Procedures

- Cut the cane at the ground level to avoid yield loss.
- The green tops are removed from the canes.
- Harvesting machet is used for cutting the cane.

Precaution

- Cane should be harvested immediately at maturity to avoid lowering quality.
- The green tops should be removed immediately after cutting to avoid reduction of sugar content by enzyme invertase.
- Burnt cane should be harvested immediately after burning to prevent rapid inversion to monosaccharides.
- The cane should be processed within 48 hours.

Harvesting of Coffee**Stage of harvesting;**

- Takes 2-4 years depending on the pruning system.
- Harvest only ripe berries.

Methods and Procedures;

- Hand picking is done so that ripe berries can be selected.
- During picking hooked sticks can be used to bend the tall trees.

Precautions

- Only the uniformly ripe berries should be picked.
- Over-ripe and under-ripe berries should be dried and sold as buni.
- Ripe cherries should be processed on the same day they are picked.

Harvesting Tea

Stage of harvesting

- It takes 2-4 years for tea to mature depending on the method of bringing young tea into bearing.

Method and Procedures

- Tea harvesting is known as plucking.
- Fine plucking - 2 leaves and a bud are removed.
- Coarse plucking - 3 leaves and a bud are removed.
- A straight fitto (straight stick) is used to guide the plucker on the plucking table.
- Tipping is done by cutting off shoots that appear above the fitto.

Precautions

- Plucked tea is placed in woven (well ventilated) baskets to prevent fermenting before it reaches the factory.
- The plucked tea should be kept in a cool place awaiting transport.
- It should be processed within the same day of harvesting.
- Harvesting is done on a weekly basis under wet conditions and once after every two weeks under dry conditions.
-

Forage Crops

Introduction

- These are plants which either grow naturally or are cultivated by man to be used for feeding livestock.
- The term forage crops include pasture and fodder crops.
- Fodder crops are purposely grown for feeding livestock.
- They are cut or uprooted when ready
- Pasture is a ground cover of grass or a mixture of grass and legumes grazed directly or cut and fed to livestock.

Classification of Pastures

- **According to type of stand.**
 - Either pure
 - Mixed stands.
- **According to ecological zones .**
 - Low altitude,
 - Medium altitude,
 - High altitude pastures
- **According to the establishment .**
 - Natural
 - Artificial pastures.

Examples of grasses

- Napier,
- Rhodes,
- Setaria,
- Molasses,
- Congo signal,
- kikuyu,
- star,
- Guatemala,
- Sudan

- Guinea.

Examples of legumes;

- Lucern,
- Clover,
- Desmodium,
- Glycine,
- Stylo,
- Centrio,

Pasture Establishment

Seedbed Preparation

- This involves clearing the land, primary and secondary cultivation to a fine tilth because the seeds are small.
- This is done during the dry season.

Selection of planting materials

- Select seeds of high germination percentage,
- Free from impurities or buy certified seeds.
- If vegetative materials are used, select from high yielding, vigorous-growing and healthy plants.

Treatment of legume seeds

- Legume seeds are inoculated with the correct strain of bacteria which fix nitrogen for the crop.

Planting

- This is done at the beginning of the rains

Methods of sowing are;

- **Direct sowing,**
- **Under sowing,**
- **Over-sowing**

Oversowing

This is introduction of a pasture legume in an existing grass pasture.

Undersowing

The establishment of a pasture in an already existing crop which acts as a cover crop.

Seeds rate depend;

- On purity of seeds,
- Pasture species
- Whether pure or mixed stand.

Apply phosphatic fertilizer when planting and later top-dress with nitrogenous fertilizer.

Pasture management

- **Re-seeding or gapping;** Re-seeding is done if the grass is completely denuded.
- But if partially, gapping can be done
- **Control of weeds** by slashing, uprooting and mowing
- **Fertilization of pastures**-done by use of manures and nitrogenous fertilizer.
- **Topping;**This is the removal of stemmy fibrous material left behind after grazing.It allows new growth after the rains
- **Control of pests**-done by trapping of moles, use of pesticides and biological means.

Pasture Utilization

- Pastures should be utilized at maturity when nutritive value is high.

It is utilized through the following methods:

- **Direct grazing** - this can be done through rotational grazing or herding.
- **Zero grazing** - this is where the pasture is cut and fed to the animals in the stalls.

Common fodder Crops

Edible Cana

- **Altitude:** 1500 - 2000m above sea level.
- **Establishment:** Young tubers or bulbs are used.
- **Spacing:** 1m x 1m.
- **Management:** Does well with application of farmyard manure and requires fertile land.
- **Utilization:** Tops and tubers are sliced and fed to livestock.
- **Conservation:** Bulbs or tubers are sliced and stored.

Napier Grass

- **Altitude:** 0 - 2000m above sea level.
- **Establishment:** Stem cuttings or splits.
- **Spacing:** 1 m x 50cm.

Management:

- Apply phosphatic fertilizers during planting time.
- Top-dress with nitrogenous fertilizers in split application.
- Clean weeding when young.
- Cut when 6-8 weeks or 1m-1.5m in height.
- **Utilization:** Cut stem is fed to livestock.
- **Conservation:** Ensiled when in plenty.

Types of Napier Grass:

- **Bana grass** (broad-leaved with hairy leaves)
- **Clone** (thin-stemmed and hairless)
- **French Cameroon** (thin-stemmed and not hairy).
- **Pakistan hybrid** (thin-leaved with hairy leaves).
- Used for silage making.

Lucerne

- **Altitude:** 1500 - 2500m above sea level.
- **Soil:** Deep red soil are ideal.
- **Establishment:** Inoculated seeds are planted 30-50cm apart in the rows.
- **Management:** Weeding and fertilizer application.
- **Utilization:** Cut wilted and fed to livestock before flowering stage.
- **Conservation:** Hay, silage, dried materials such as cubes or pencils.

Mangolds

- Is a root crop.
- Root is utilized as livestock feed.
- Ripe ones are used.

Kales

- Leaves used as livestock feeds.

Guatemala Grass

- Leaves and stems used as livestock feed.

Sorghum Grass

Two varieties:

- **Columbus grass**
- **Sudan grass.**
- Established from seeds which are drilled or broadcasted.
- Columbus grass should be dried before feeding to animals to avoid hydrocyanic and prussic acid poisoning.

Desmodium (*Desmodium spp*)

Two varieties ;

- **Green leaf**
- **Silver leaf.**
- Established from seeds on thoroughly prepared clean beds.
- Can also be inter-planted with Napier grass.
- Cut and wilted before feeding to livestock.

Agroforestry, trees used as fodder crops include:

- Leucaenia
- Calliandra
- Atriplex
- Sesbania.

Forage Conservation

Forage can be conserved as;

- Hay,
- Silage
- Standing forage.

Importance of forage conservation:

- To reserve excess forage for use during time of shortage.
- To avoid unnecessary wastage of forage.
- Conserved forage can be sold.
- To have sustained supply of feed for livestock throughout the year.

Methods

Hay Making

- This is the dehydration of green pastures to a moisture content of 16-20 per cent.

Steps in hay making:

- Cut the crop when the sun is shining.
- Dry the materials for 1-2 days.
- Windrow the dry material to allow for further drying.
- Bale the dry materials for storage.

- Store under shed or shelter.

Factors Determining Quality of Hay

- Stage of growth at which forage is harvested.
- Leaf content of the forage material.
- Method of handling and curing the hay.
- Form in which material is fed to livestock.
- Species of forage used.
- Amount of foreign materials in forage.

Silage Making

- This is a feed produced by conserving forage in succulent form through the process of fermentation by anaerobic bacteria.

Steps in silage making:

- Cut the crop and transport it to the silo,
- Material with a high moisture content is wilted in the sun for 4-48 hours before ensiling
- Material is chopped to reasonable size pieces before filling in the silo.
- Spread the chopped material evenly.
- Check temperature if below 31°C, needs further filling; if above 31 °C compaction is necessary.
- Filling should be complete by the end of the third or fourth day.
- The silo is covered with 15cm of straw, sawdust then 15cm of soil to make it air and water tight.
- A trench is dug round the silo to keep off surface water.

Factors Affecting the Quality of Silage

- Maturity stage of the crop when cut.
- Type of crop.
- Moisture content of the material
- Additives such as molasses.
- Degree of compaction.
- Size of pieces ensiled.
- Amount of foreign materials included in the silage.
- Amount of leaf of the ensiled material.

Standing Forage

- This is forage left in the field to be used during the dry season.

Livestock Health III: (Diseases)

Introduction

Livestock diseases are classified according to causative agents as follows:

- Protozoan diseases - caused by protozoans.
- Bacterial diseases - caused by bacteria:
- Viral diseases - caused by virus.
- Nutritional diseases - brought about by nutritional disorders.

Protozoan Diseases

- East coast Fever (ECF).
- Anaplasmosis (gall sickness)
- Coccidiosis
- Trypanosomiasis (Nagana)

East coast Fever

- *Animals attacked:* Cattle
- *Cause:* Protozoan. (*Theileria parva*)
- It is a tick-borne disease transmitted by red-legged tick and brown ear tick.

Symptoms

- Rise in body temperature.
- Swelling of lymph glands below the ear.
- Difficulties in breathing.
- Dullness.

Control and Prevention

- Control of vectors through dipping and fencing.
- Treatment by use of clexon in the early stages.

Anaplasmosis (gall sickness)

Animals attacked:

- Cattle between 2 months and 2 years.
- Poultry.
- Lambs and kids.
- Rabbits.

Cause: Protozoan (*Anaplasma marginale*)

- Transmitted by the blue tick
- contaminated surgical instruments and hypodermic needles.

Symptoms

- Fever/rise in body temperature.
- Constipation or hard dung.
- Paleness in the gums, eyes and lips.
- Drop in milk production.

Control

- Tick control.

- Intramuscular injection of antibiotics and iron giving injections.
- Coccidiosis

Coccidiosis of Poultry

- Cause: Protozoan (*Eimeria spp.*)

Symptoms

- Sudden death of chicks.
- Whitish, yellow and blood stained diarrhoea.
- Ruffled feathers.
- Chicks become paralysed before dying.
- Chicks become anaemic and dull.

Control

- Disinfection of chick house.
- Prevention of contamination of food and water with droppings.
- Use of prophylactic drugs for example, Coccidiostats.

Trypanosomiasis (Nagana)

- Animals attacked: cattle, sheep and goats.
- Cause: Protozoan of the trypanosome species,
- Vector-tsetse flies.

Symptoms

- Fever.
- Dullness.
- Anorexia/loss of appetite.
- Loss of body condition/emaciation.
- Swollen lymph nodes.
- Lachrimation which leads to blindness.
- Diarrhoea
- Rough coat and sometimes without hair and may be cracked.
- Swelling in parts of the belly.
- Drop in milk production in lactating cows.
- Loss of hair at tail end.
- Anaemia.
- Abortion may occur in pregnant females.

Control

- Treating animals with trypanocidal drugs.
- Effective vector (Tsetse flies) control
- Confinement of wild animals in game parks.

Bacterial Diseases

- Fowl typhoid

- Foot rot.
- Contagious abortion.
- Scours.
- Blackquarter.
- Mastitis.
- Anthrax.
- Pneumonia.

Fowl Typhoid

- *Animals attacked:* All domestic birds which include chicken, turkey and ducks.
- *Causes:* Bacteria (***Salmonella gallinarum***)

Symptoms

- Depression/appearing very sick.
- Respiratory distress.
- Dullness.
- Drooping wings.
- Sleepy eyes.
- Anaemia resulting in pale and shrunken combs and wattles.
- Greenish yellow diarrhoea.

Control

- Killing all affected birds and proper disposal of the carcasses.
- Maintaining hygiene in the poultry house.
- Ensuring that the house is dry and well ventilated.
- Obtaining chicks from reliable sources.
- Treatment using sulphur drugs which are mixed in drinking water or mash.
- For example: application of Furazolidone (Furazol) at the rate of 0.04% in mash for 10 continuous days treats the disease effectively.

Foot Rot

- It is also referred to as foul-in-the foot.
- ***Animals attacked:*** cattle, sheep and goats.
- However, it is most serious in sheep.
- ***Cause:*** Bacteria (***Fusiformis necrophorus*** and ***Fusiformis nodosus***).

Symptoms

- Animal's foot becomes swollen.
- Lameness is observed.
- Pus and rotten smell come out of the hoof.
- Sheep are found kneeling while grazing when the front feet are affected.
- Animals spend most of their time lying down when the hind feet are affected.
- Emaciation due to lack of feeding.

Control

- Hygiene in the living places.
- Regular foot examination and hoof trimming.

- Use of a foot bath of copper sulphate solution at 5-10% solution or formalin at 2-5% solution.
- Treating wounds on the feet with antiseptics.
- Affected animals should be given antibiotic injections.
- Isolation of sick animals from healthy ones.
- Avoid dampness and muddy conditions.

Contagious Abortion (*Brucellosis/ Bang's Disease*)

- *Animals attacked:* cattle, sheep, goats and pigs.
 - It also affects man.
- *Cause:* Bacteria
 - ***Brucella abortus*** in cattle,
 - ***Brucella suis*** in pigs
 - ***Brucella malitensis*** in goats and sheep.

Symptoms

- Spontaneous abortion or premature birth.
- Retained placenta if abortion occurs during the later stages of pregnancy.
- Infertility in cows while bulls have low libido and inflamed testis also known as orchitis.
- A yellowish brown, slimy, odourless discharge from the vulva may occur after the abortion.

Control

- Use of artificial insemination.
- Slaughtering affected animals followed by proper disposal of their carcasses.
- The attendant to the animals should avoid contact with the aborted foetus.
- A blood test should be carried out for all breeding animals to detect the infected ones.
- Hygiene in the animals' houses.

Scours (*white Scours*)

- *Animals attacked:* calves, piglets, lambs and kids.
- *Cause:* A bacterium which attacks young animals in the first week of life.

Symptoms

- White or yellowish diarrhoea.
- Pungent smelling faeces.
- Fever.
- Anorexia/loss of appetite.
- Listlessness.
- Sunken eyes.
- Undigested milk and mucus with blood spots observed in the faeces.
- Faecal matter sticks to the hind quarters.
- Sudden death if no treatment is given.

Control

- Maintaining hygiene in the young animal housing units.

- Avoiding dampness on the floor of the house.
- Fingers of the attendant training calves to drink milk from a bucket must be disinfected.
- Calving should be carried out in a clean area.
- Have separate attendants for the infected calves to prevent disease spread.
- Replacing milk with warm water mixture.
- Treating affected animals with antibiotics.

Black Quarter

- It is also known as black leg.
- *Animals attacked:* All ruminants aged between 8 - 18 months.
- *Cause:* Bacteria (***Clostridium chauvei*** and ***Chauvei septicum***)

Symptoms

- Lameness.
- Fever.
- Fast and heavy breathing.
- Cracking on the swollen parts if touched.
- Swelling of the affected parts usually the hindquarters, shoulders and chest or back.
- Dullness.
- Anorexia.
- Grunting and grinding of teeth.
- Animal stops chewing cud.

Control

- Treating with recommended antibiotics.
- Vaccinating using black quarter vaccine known as blanthax.
- Burying the carcass deep or burning it completely.

Mastitis

- Is an inflammation of the udder.
- *Animals attacked:* Goats, cows, pigs and human beings.
- *Cause:* Bacteria (***Streptococcus spp.*** or ***Staphylococcus spp.***)

Pre-disposing Factors:

- Incomplete milking.
- Injuries on the udder and teats.
- Weak sphincter muscles of the teats allowing free flow of milk.

Symptoms

- Milk is watery, blood stained or clotted.
- Swollen udder

Control

- Proper milking techniques.
- Treatment by use of antibiotics.
- Culling of animals which are often attacked.

Anthrax

- Attacks all domestic animals.
- Cause: Bacteria (***Bacillus anthracis***)

Symptoms

- Sudden death.
- High fever.
- Grinding of the teeth.

Pneumonia

- It is an inflammation of the lungs.
- *Animals attacked:* Calves, kids, lambs, piglets and poultry.

Cause:

- Bacteria (***Mycoplasma mycoides***)
- dust
- worms in the lungs.

Symptoms

- Dullness.
- Anorexia/loss of appetite.
- Staring coat.
- Emaciation.
- Breathing rapidly.
- Abnormal lung sounds when breathing.
- Coughing if the chest is pressed.
- Fluctuating body temperature.
- Nasal discharge.

Control

- Keeping young animals in warm pens.
- Proper sanitation.
- Isolation of the affected animals.
- Treating using antibiotics.

Viral Diseases

- Rinderpest.
- Foot and mouth disease (FMD).
- New Castle
- Fowl pox
- Gumboro
- African swine fever

Rinderpest

- *Animal attacked:* Cattle and wild game.
- Cause: virus.

Symptoms

- Harsh staring coat.
- Rise in temperature.
- Eye discharge (Lachrimation)
- Diarrhoea and dysentery.
- Ulcers in the mouth.

Foot and Mouth Disease

- *Animals attacked:* Cattle, sheep, goats and pigs.
- *Cause:* Virus .

Symptoms

- Sharp rise in temperature.
- Blisters in the mouth, hooves, udder and teats.
- Loss of appetite.

Control

- Vaccination.
- Quarantine
- nursing wounds with disinfectant.

New Castle

- *Animals attacked:* Poultry.
- *Cause:* Virus.

Symptoms

- Difficulties in breathing.
- Beaks remain wide open and necks are strained.
- Birds become dull.
- The birds stand with eyes closed all the time.
- Anorexia/loss of appetite.
- Nasal discharges which force the birds to shake their heads to clear it.
- Birds walk with a staggering motion.
- Paralysis of wings and legs may occur.
- Birds have their beaks and wings down.
- Birds produce watery greenish diarrhoea.
- Birds lay soft shelled eggs.

Control

- Killing all birds and burning them followed by cleaning and disinfecting the houses before bringing in new stock.
- Vaccination should be done during the first 6 weeks and then 2-3 months later.
- Quarantine.

FowlPox

- *Animals affected:* Poultry.
- *Cause:* A virus known as *avian fox*.

Symptoms

Two types of fowl pox with different symptoms.

- Cutaneous type
- Diphtheritic type

The cutaneous type affects the skin and has the following signs:

- Injuries on the combs and wattles, legs, vent and under the wings.
- Loss appetite.

The diphtheritic type affects internal membranes and has the following symptoms:

- Injuries in the inside of the throat and mouth membranes resulting in difficult breathing and swallowing.
- Eyes and nose produces a watery liquid.
- Loss of appetite.
- Dullness.
- Emaciation.

Control

- Killing all affected birds followed by proper disposal of their carcasses.
- Vaccinating remaining healthy birds.

Gumboro

- It is also referred to as poultry AIDS.
- *Animals attacked:* Poultry.
- *Cause:* A virus known as Birna virus.

Symptoms

- The glands above the vent (bursa) become swollen.
- Drop in egg production.
- Birds develop respiratory distress.
- Loss of appetite.
- Low water intake by birds.
- Loss of immunity making the birds more susceptible to opportunistic diseases.

Control

- Vaccination.
- Administering vitamins and especially B12.

African Swine Fever

- *Animals attacked:* All domesticated pigs.
- *Cause:* A virus known as Irido virus.

Symptoms

- Fever.
- Loss of appetite.
- Depression/dullness.
- Emaciation.
- Coughing.
- Nasal discharge.
- Diarrhoea in serious conditions.

Control

- Vaccination.
- Quarantine.
- Killing all affected animals and proper disposal of their carcasses.
- Double fencing to keep wild animals away.

Nutritional Diseases/Disorders

Milk Fever

- It is a non-infectious disease brought about by calcium deficiency in animals which have recently given birth.
- *Animals attacked:* Cows, goats and pigs that have recently given birth.

Causes:

- Due to low calcium levels in the blood.
- Which leads to an increase in the magnesium and sugar level in the blood.
- Mostly occurs in high producing cows in the first few months of lactation.
- This is because these animals lose more calcium through milk secretion than they are getting from the diet.

Symptoms

- Dullness.
- Muscular twitching causing the animal to tremble.
- Staggering as the animals move.
- Animal falls down and becomes unconscious.
- The animal lies down on its side and the whole body stiffens.
- Body functions such as urination, defecation and milk secretion stops.
- Stomach contents are drawn into the mouth which later cause lung fever when breathing in.
- Loss of appetite.

Treatment

- Intravenous injection of soluble calcium salt in form of calcium boro-gluconate ,60gms dissolved in 500cc of water.
- Keeping the animal in a comfortable position on its sternum.
- Giving fresh water.

Note: The animals suffering from milk fever should not be given medicine orally for the following reasons:

- It will not be able to swallow medicine.
- The medicine may get into the lungs thereby promoting lung fever.

Control

- Partial milking for the first 10 days.
- High yielding cows should be given rations containing phosphorus and calcium.
- Giving high doses of Vitamin D.

Bloat

- *Animals attacked:* Cattle and sheep.
- *Cause:* Accumulation of gases as a result of fermentation in the rumen.

Symptoms

- The left side is blown up.
- Sudden death.

Control

- Relieve by use of trocar and cannula.
- Chasing the animal around if noticed early.
- Drenching by use of stop bloat.
- Feeding ruminants with dry roughages during the wet season before grazing on lush pastures.