**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;**

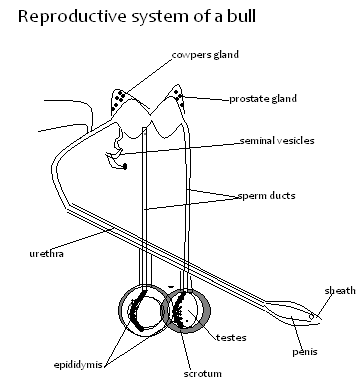
* Genetic potential
* The environment, which includes:
* Feeding,
* Health,
* Care
* The ecological conditions.
* The genetic potential of an animal is inherited from its parents.
* In selection and breeding animals with superior characteristics are selected and allowed to mate.
* In the process they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

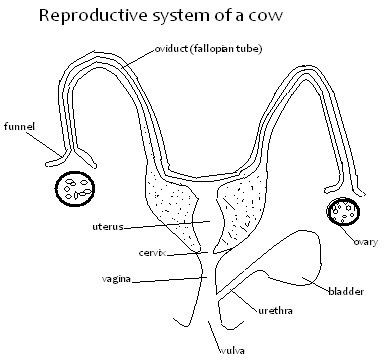
* Reproduction is the process by which off-springs are produced.
* All farm animals multiply by means of sexual reproduction.
* It begins with fertilization which is the fusion of male and female gametes to form a zygote.
* Fertilization takes place internally in the body of the female.
* The embryo(zygote) 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 secret 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.



* ***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 separetly.
* ***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.



**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.

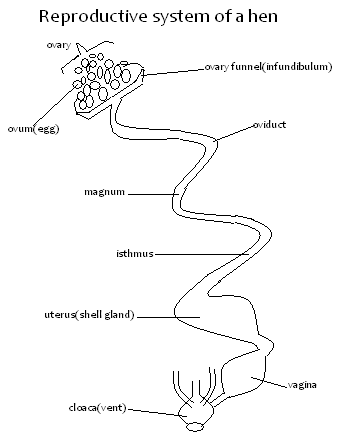
***When an animal is about to give birth, it shows signs;-***

* 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***



**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 9ie.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 extents 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 occurance 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
    - Twining 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.
* Twining 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 f 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 comer 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 organsms 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 / antihelmitics.

***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 oft) 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
* Setting 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 comer 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 un desirable 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,
* cheep 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,
* dong 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;***

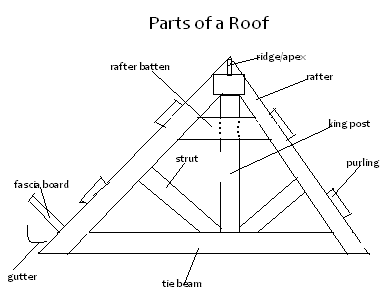
* Security
* Nearness to a source of water
* Topography
* Direction of the prevailing wind
* Direction of the sun
* Personal whims/tastes and preference
* Nearness to means of communication.

**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.

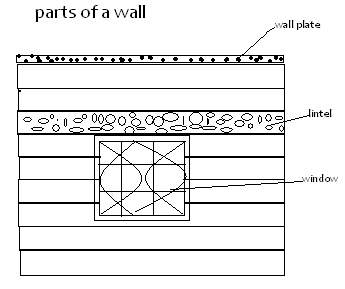
**Parts of a building**

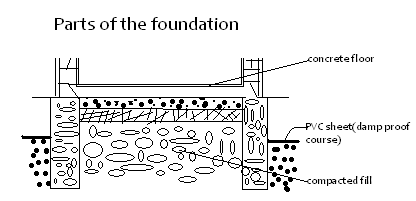
* The foundation,
* The walls,
* The roof



Include;

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





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.***

* Incase of poor management everybody will loose.
* No individual title deed hence cannot secure loans.

***State ownership***

* Land is owned by the whole state and is refered 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 Concestion,**
* **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.

***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 bur 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 plate, 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.
* ***Biennuals -*** 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*
* 0xalislsorrel ……………………..*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) | Cereal crops | Defoliate the | (i) Early planting | |
| *(Spodoptera* | (ii) | Sugar cane | whole plant | (ii) Use of effective insecticides | |
| *exempta)* | (iii) Grasses | |  |  |  |
| Cut worms | Young seedlings | | Cut the seedlings | (i) Early planting | |
| *(Agrotis Spp.)* |  |  | at the stem base | (ii) Use of soil applied insecticides | |
|  |  |  |  |  | (fumigants) |
|  |  |  |  | (iii) Flood/irrigation | |
| Boll worms | Cotton, tomatoes, | | Eat and destroy | (i) Crop rotation | |
| *(Heliathis migera)* | citrus, maize, | | the fruits and | (ii) Field hygiene | |
|  | beans, millet, other | | seeds | (iii) Spraying with insecticides | |
|  | legumes | |  | (iv) early planting | |
| Maize stalk borer | Maize sorghum | | Destruction of the | (i) Early planting | |
| *(Busseola fusca)* |  |  | stem and young | (ii) Field hygiene | |
| and |  |  | growing tissues | (iii) Crop rotation | |
| *(Chilo partellus)* |  |  |  | (iv) Use of stalk borer dust. | |
| Loopers | Coffee | | Make windows in | (i) Use of effective insecticides. | |
| *(Ascotis selena ria)* |  |  | crop leaves | (ii) Use of parasitic wasps, birds | |
|  |  |  |  |  | and chameleons |
| Leaf Miner | Coffee | | Make mines in | (i) | Use of parasitic wasps (natural |
| *( Leucoptera* |  |  | the leaves |  | enemies) |
| *meyricki and L.* |  |  | reducing | (ii) Use of effective insecticides. | |
| *caffeina)* |  |  | photosynthetic |  |  |
|  |  |  | area. |  |  |
| Stainers | Cotton | | Stain the cotton | (i) | Use of parasitic tachinid flies |
| *(Dysdercus spp.)* |  |  | lint reducing | (ii) | Spraying with insecticides. |
|  |  |  | quality | (iii) | Control alternate hosts. |
|  |  |  |  | (iv) | Crop rotation |
| Aphids | Several crops such | | (i) Transmit | (i) | Natural enemies for example, |
| *(Aphis spp.)* | as citrus, maize, | | viral diseases. |  | lady birds |
|  | cotton, beans. | | (ii) Suck out | (ii) Overhead irrigation | |
|  | cabbages and | | sap leading | (iii) Use of insecticides | |
|  | others | | to stunted |  |  |
|  |  |  | growth. |  |  |

***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 mearsures 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, afflatoxin 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.
* ***Falcultative parasites***-those that are able to live on both the living and dead tissues.

***Examples of fungal disease***

* ***Panama disease***(Fusarium oxysperium—bananas)
* ***Cigar-end rot***(Verticilium 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
* ***Anthracnose*** (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 ***afflatoxin.***

***Examples of fungal disease***

|  |  |  |  |
| --- | --- | --- | --- |
| Disease/cause | Crops attacked | Symptoms of attack | ***Control measures*** |
| Late blight  (*Phytopthora*  *infestans)* | Members of  Solanaceae family  (potatoes, tomatos) | Dry patches on the leaves and fruits (necrotic lesions) | -Crop rotation  -effective fungicides  -treated seeds  -resistant varieties |
| Rusts (*Pucinia spp)* | Rice, wheat , sorghum, maize | Red and brown pistules on the leaves, shriveled grains | -resistant varieties  -Recommendedfungicides  -Early planting |
| Smuts(*Ustilago spp)* | Wheat, maize ,  sugarcane | Black powder mass on the spikes and the ear | -Field hygiene,  -certified seeds,  -resistant varieties,  -crop rotation |
| Blasts*(Piricularia oryzae)* | 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) *(Colletotrichum coffeanum*) | 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  -strippung |

***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 | Beans | i. Irregular dark lesions on | | 1. | Use of resistant varieties |  |
| *(Pseudomonas* |  |  | leaves and pods. |  | for example Wairimu. | , |
| *phaseolicola)* |  | ii. Yellow band round the | | ii. Effective fungicide. | |  |
|  |  |  | lesions called "halo". | iii. Crop rotation | |  |
|  |  | iii. Water soaked lesions | |  |  |  |
| Fusarium wilt | Tomatoes | l. | Stunted growth. | i. Use of resistant varieties. | |  |
| *(Fusarium* |  | ii. Yellowing and shedding | |  |  |  |
| *oxysporum)* |  |  | of leaves. |  |  |  |
|  |  | iii. Wilting of the plant. | |  |  |  |
| Black arm | Cotton | i. Small round spots on the | | i. Field hygiene. | |  |
| *(Anthomonas* |  |  | cotyledons of young | ii. Use of certified seeds. | |  |
| *malvacearum)* |  |  | seedlings. |  |  |  |
|  |  | ii. The spots elongate to | |  |  |  |
|  |  |  | form black lesions on the |  |  |  |
|  |  |  | stem. |  |  |  |
| Bacterial wilt | Tomatoes and | Uniform. wilting of the whole | | i. Use of certified seeds. | |  |
| *(Pseudomonas* | potatoes | plant even with enough | | ii. Crop rotation. | |  |
| *solanacearum)* |  | water. | |  |  |  |

**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***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Disease/Cause*** | ***crops Attacked*** | ***Symptoms of Attack*** | | ***Control Measures*** | |
| Ratton stunting | Sugar cane | Red discoloration on the vascular | | I. | Use of clean materials. |
|  |  | bundles. | | 11. | Treatment of seed |
|  |  |  |  |  | canes. |
| Maize streak | Maize | Yellow stripes alternating with | | i. | Control leaf hopper. |
|  |  | green, parallel to the midrib. | | ii. Use if certified seeds. | |
|  |  |  |  | iii. Field sanitation. | |
| Greening | Citrus | i. Yellow mottling of the leaves. | | i, Use of clean tools when | |
| disease |  | ii. | Die back. |  | budding. |
|  |  | iii. Premature leaf fall. | | 11. | Control of insect vectors. |
| Leaf mosaic | Suzgar cane, | i. Yellow mottling. | | i. | Control of aphids. |
|  | cassava. sweet | II. | Necrosis of stem. | ii. Use of clean materials. | |
|  | potatoes. |  |  | iii. | Seed treatment. |
| Tristeza | Citrus | I. | Dwarfing of plants. | i. Stripping affected fruits. | |
|  |  | ii. | Die back. | 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:* 750-12S0rnm 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,OOOkg 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:***500-600mrn 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 *62Smm* 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 matchet 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 denudated.
* 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 - cause 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 attacke****d:*

* 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 prophylatic 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 atacked:* 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
* Diptheritic 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 diptheritic 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 Birma 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 loose 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 ands 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.