

Principles of Livestock Production

Livestock refers to domesticated animals like cattle, sheep, goats, poultry, pigs, rabbits, bees, camels, donkeys and fish.

Value and Uses of Livestock

- (i) Provides man with eggs, meat, milk, hides and skins.
- (ii) Cultural values
 - As a sign of wealth.
 - Used in social ceremonies, e.g. cleansing, prayers for rain, reconciliation between two parties and thanksgiving.
 - Traditional use e.g. paying of bride price.
- (iii) Economic uses
 - Source of power e.g. oxen, biogas, etc.
 - Provides employment directly and indirectly.
- (iv) Miscellaneous uses e.g. sporting purposes, for scientific experimentation and for shows.

Breeds, Origins and Characteristics of Livestock

Cattle

There are three types of cattle breeds; dairy, beef and dual purpose breeds.

Cattle can also be classified as exotic or indigenous.

Indigenous Cattle

There are three types of indigenous cattle in East Africa.

- (i) Zebu e.g. Boran, Nandi, Bukedi, Masai cattle.
- (ii) Sanga e.g. Ankole cattle.
- (iii) Nganda (crosses of the two above).

Exotic Cattle

Beef cattle

Examples: Aberdeen Angus, Hereford, Shorthorns, Galloway, American brahman, Charolais and Santa Getrudis, etc.

Characteristics of Beef Cattle

- Blocky or square conformation.
- Have thick muscles or are well fleshed.
- Early maturing.
- Deep chest and girth and short legs.
- Straight top and lower lines.

(a) *Aberdeen Angus*

Origin: North East Scotland

Colour: Black

Shape: Cylindrical, compact and deep, polled.

Size: Mature bulls weigh 900kg.

Mature cows weigh 720kg. Found in Timau area of Kenya.

(b) *The Hereford*

Origin: England.

Colour: Deep red and white-faced.

Size: Average weight of bulls is 817kg.

Found in areas like Naivasha.

(c) *Shorthorns*

Origin: England. Has easy fleshing ability.

Colour: Red, roan or white.

Size: Bulls 700-900kg, cows 545-630kg.

- (d) *Galloway*
Origin: Scotland
Colour: Black.
 Kept at highland areas like Molo in Kenya.

Dairy Cattle

Examples: Friesian, Ayrshire, Guernsey and Jersey.

Characteristics of Dairy Cattle

- Wedge or triangular in shape.
- Large stomach.
- Docile with mild temperament.
- Large, well suspended udders and teats.
- Lean bodies.
- Lean and smooth neck.
- Large and long mammary milk wells and veins.
- Cylindrical, uniform and well spaced teats.
- Wide and well set hindquarters to accommodate the udder.

- (a) *Friesian Holstein (largest of all dairy breeds)*
Origin: Holland.
Colour: Black and white.
Size: Cow weighs 600kg; Bull weighs 950kg.
 Highest milk producers of all dairy breeds, but with least butterfat content; 3% - 4%.

- (b) *Ayrshire*
Origin: Scotland.
Colour: White with brown markings.
Size: Cows 360-590kg; Bull: 500-720kg.
Conformation: Straight top lines, horns are long and face upwards. Milk production is second to Friesian with butterfat content of about 4%.

- (c) *Guernsey*
Origin: Guernsey Island off the coast of France.
Colour: Yellowish brown to red with white legs, switch and girth.
Size: Bull 780kg, cow 500kg.

Conformation: Udders are less symmetrical.

Average milk production is about 2600kg with a butterfat content of 5% hence the yellow colour of milk.

- (d) *Jersey (smallest of all the dairy breeds)*
Origin: England.
Colour: Yellow brown with black muzzle and switch.
Size: Bull 700kg, cow 400kg.
Conformation: Dished forehead, have straight top-line and level rumps with sharp withers. Have protruding black eyes.
 Average milk production is 2300kg per lactation of butterfat content 5% - 6%. They tolerate high temperatures.

Dual Purpose Breeds of Cattle

Examples: Sahiwal, Red poll and Simmental.

- (a) *Sahiwal*
Origin: India and Pakistan.
Size: Bull 650kg, cow 400kg.
Colour: Reddish brown.
Conformation: It is a hornless animal with deep body, sloping rump, broad forehead, distinct dewlap and resistant to tropical diseases and high ambient temperatures.
 Kept in semi-arid areas e.g. Naivasha and Nanyuki.

- (b) *Red poll*
Origin: England
Colour: Deep red with a white nose.
Conformation: Polled-deep girth and short legs.
 Kept in semi-arid areas e.g. Nakuru, Mogotio.

- (c) *Simmental*
Origin: Switzerland
Colour: Light red and white patches on head.
Conformation: It has broad and straight back, with well-sprung ribs and deep girth. It is well fleshed at rear quar-

ters, has well suspended udders and large teats.

Sheep

Purpose of keeping Sheep

- (i) Meat (mutton).
- (ii) Wool production.
- (iii) Dual purpose (both meat and wool).

Exotic Sheep

- (i) Wool breeds e.g. merino.
- (ii) Dual purpose e.g. Corriedale, Romney marsh.
- (iii) Mutton breeds e.g. Hampshire Down, Dorpers.

(a) Merino

Origin: Spain.

Conformation: It has white face and its lips and nostrils are pink in colour. Rams have horns which are spiral in shape. It is susceptible to foot rot, worm and respiratory diseases.

(b) Corriedale

Origin: New Zealand.

Size: Ram 80-120kg

Ewe 60-85kg.

This is a dual-purpose breed with white open face and white spots on the legs. It is hornless and hardy.

(c) Romney marsh

Origin: England:

Size: Ram 100-115kg.

Ewe 84-100kg.

It is a dual purpose breed which is hornless with wide poll and black nostrils and lips. It is average in prolificacy.

(d) Hampshire Down

Origin: England.

Size: Ram 125kg.

Ewes 80-100kg.

It is a mutton breed which is early maturing, hardy and prolific. Fleece is of poor quality because of the black fibres. Lambing percentage is 125-140.

(e) Dorper

Is a cross-breed of Dorset horn and Black head Persian sheep. It is mutton breed.

(f) Dorset horn

Dual purpose breed of sheep.

Indigenous Breeds of Sheep

Their bodies are covered with hair. Their classification is based on their tails and their names vary according to different tribes.

- Thin tailed sheep found in West Africa.
- Fat tailed e.g. Masai sheep.
- Fat rumped sheep.

(a) Masai sheep

Found in South West Kenya and Northern Tanzania.

Size: Ram 38kg, Ewe 20-30kg.

Colour: Red and brown.

These are early maturing with long legs and small pointed horns.

(b) Black head Persian sheep

Origin: South Africa.

Colour: White with black head and neck. It is polled with big dewlap, fat rump and a curved tail.

Goats

Goats are well adapted to a wide range of environmental conditions because of the following characteristics:

- They feed on a wide range of vegetation.
- They require very little amount of water.
- They are tolerant to high temperatures.
- They are fairly resistant to diseases.

Indigenous

- (a) *Galla* (white in colour): Adult female can weigh 25kg.
- (b) *Somali (Boran)*: Found in Northern Kenya (white in colour).
- (c) *Turkana/Samburu*: (Long hair and bearded).

- (d) *Mubende* - (Black) (40-45kg).
These are small and hardy and are kept for meat and milked by the pastoralist.

Exotic Breeds

- (a) *Boer*
Origin: South Africa
Colour: White
Has long ears and long hair on their bodies.
- (b) *Anglo-Nubian*
Origin: North East Africa.
Colour: Roan and white.
These have long legs, lopped ears and are polled. They produce 1-2 litres of milk per day.
- (c) *Jumnapari*
Origin: India
Colour: White, black and fawn.
They are horned, have large lopped ears and produce 1-1½ litres of milk per day.
- (d) *Toggenburg*
Origin: Switzerland
Colour: White patches on the body, white stripes on the face and neck. Erect forward pointing ears and polled. Can produce 2-3 litres of milk per day.
- (e) *Saanen*
Origin: Switzerland
Colour: White
They have erect, forward pointing ears and polled. Can produce 2-3 litres of milk per day.
- (f) *Angora*
Origin: Angora in Asia.
Colour: White
It is kept for wool production.
- (g) *French alps*

Pigs

Characteristics

They withstand cold: they have a layer of fat.

- Pigs wallow when it is hot due to absence of sweat glands.
- They breathe fast when it is hot.
- Poorly insulated since they have no wool.
- Bodies covered with bristles over layer of fat.

Breeds

- (a) *Large white*
Origin: Britain.
- Kept for bacon and pork production.
- Long, large and white in colour.
- Ears straight and erect.
- Has dished face and snout.
- Most prolific and with good mothering ability.
- Fairly hardy.
- (b) *Landrace*
Origin: Denmark.
- White and longer than large white.
- Ears are drooping.
- Good for bacon production.
- Very prolific with good mothering ability
- Requires high level of management.
- (c) *Wessex saddle back*
Origin: England
Colour: Black with white fore legs and shoulders.
- Straight snout and drooping ears.
- Good for bacon and pork.
- Good for keeping outdoors.
- Excellent mothering instinct.
- Others*
Include Berkshire, Middlewhite and Duroc jersey pig. Pigs can be crossed to obtain hybrids or crosses.

Advantages of crosses

- Increased litter size.
- Early maturing.
- Increase in body length.
- High proportion of lean meat to fat.

Poultry

There are three types of chicken:

- (i) The light breeds kept for egg production.
- (ii) The heavy breeds kept for meat production.
- (iii) Dual purpose breeds - kept for both eggs and meat production.

(a) *Characteristics of light breeds*

- Never go broody hence poor sitters.
- Excellent layers (over 220 eggs per year).
- Poor meat producers (hens can attain 2kg; cocks 3kgs).
- Very nervous and exhibit high degree of cannibalism.
- Hen's comb is large and bend over one eye and cock's comb is large with 5 or 6 serrations.

Examples: Leghorns, Anconas, Silkies, Minorcas, etc.

(b) *Characteristics of heavy breeds*

- (i) Can lay few eggs and provide good meat as broilers.
- (ii) Can go broody.
- (iii) Heavier and bigger in size.
- (iv) Grow fast.

Examples: Light Sussex, Cornish Dark and White, etc.

(c) *Characteristics of dual-purpose breeds.*

- (i) Go broody.
- (ii) Have good meat.
- (iii) Disease resistant (do not require high standard of management).
- (iv) Rarely exhibit cannibalism.

Examples: Rhode Island Red.

(d) *Hybrids*

These are developed by crossing two different breeds.

They are superior in performance i.e. can attain 2kg in 56 days for broilers and lay over 200 eggs per year for layers.

Examples: Shavers, Thornbers, Isabrown, etc.

Camels

Kept for transport, racing, to provide milk, meat, wool, etc. There are two species of camels.

(a) *Dromedary (Camelus dromedarius)*

Origin: Arabia and Syria.

Are single humped, have light body hence good for racing and rapid transport.

(b) *Bacterian (Camelus bacterianus)*

Origin: Central Asia.

- Has double humps, heavier and has shorter legs.
- Can live in cold regions hence thick and long coat acts as an insulation.
- Capable of shedding the coat during spring.

Rabbits

Kept for the following reasons:

- (a) To provide meat, fur, hair or wool.
- (b) To provide skin for leather.
- (c) To provide manure.
- (d) As pet animals.
- (e) Used for research purposes.

Breeds

- (a) *Californian* (white, very prolific with black ears, nose and feet).
- (b) *New Zealand white* (white with pink eyes - good for meat).
- (c) *Flemish giant* (dark grey - good for meat).
- (d) *Angora rabbit* (white, kept for wool production).
- (e) *Chinchillah* (greyish, kept for its fur).
- (f) *Earlops*.
- (g) *Kenya white* (white, smallest of all breeds).

Livestock Nutrition

This is the provision of nutrients to livestock.

Classes of Food

Includes water, protein, carbohydrates, fats and oils, vitamins, mineral salts.

Water*Sources*

- (i) Free water (through drinking).
- (ii) Bound water (contained in feeds).
- (iii) Metabolic water (obtained from oxidation of food).

Functions

- (i) Regulates body temperature.
- (ii) Transport agent in the body.
- (iii) Universal solvent in the body.
- (iv) Gives shape to the cells (turgidity).
- (v) Acts as a lubricant.
- (vi) Acts as constituent of body fluids.

Factors determining the requirement of water by livestock

- (i) Production level.
- (ii) Amount of dry matter eaten.
- (iii) Temperature of the surrounding area.
- (iv) Type of animal.

Protein

Sources: Groundnut cakes, cotton seed cakes, fish meal, meat meal, etc.

Function

- (i) Growth of new tissues.
- (ii) Repair of worn out tissues (body building).
- (iii) Synthesis of antibodies.
- (iv) Synthesis of hormones and enzymes.

Digestion of Proteins

In non-ruminants, protein digestion takes place in the stomach.

- (i) Food is subjected to mechanical breakdown through chewing into small particles.
- (ii) Protein is acted on by enzymes to turn into amino acid which is assimilated into the bloodstream.

In ruminants, protein digestion initially takes place in the rumen.

- (i) Food is acted on by micro-organisms into microbial protein.
- (ii) Later, enzymatic action takes place in

the "true stomach" where proteins are broken into amino acids which are then assimilated into the bloodstream.

Carbohydrates

Sources: Cereals, tubers and commercially mixed feeds.

Function

- (i) Supply energy and heat to the body.
- (ii) Excess is stored in form of fat.

Digestion of Carbohydrates

In non-ruminants carbohydrate feeds are broken down by chewing into small particles. Then enzymatic action further breaks down carbohydrates into glucose, fructose and galactose which are then assimilated into the bloodstreams.

In ruminants mechanical breakdown of carbohydrate feeds is followed by microbial activities which break down cellulose into volatile fatty acids. These are absorbed through the rumen walls. Some carbohydrates are broken down by enzymatic action in the "true stomach."

Fats and Oils

Sources: Cotton seeds, soya beans and groundnuts, etc.

Functions

- (i) Supply energy and heat to the body.
- (ii) Excess is stored as fat adipose tissues.
- (iii) Source of metabolic water in the body.
- (iv) Required for the development of neural system.
- (v) Insulator in the body.

Digestion in Ruminants

- (i) Fats are hydrolysed in the rumen into fatty acids and glycerol.
- (ii) Others are fermented into propionic acid, the shorter chains are passed to the true stomach where enzymatic action takes place.

Vitamins

Sources: Green materials, dried grass, fish liver oil, etc.

Functions

- (i) Defend the body against diseases.

(ii) Regulate the functions of all parts of the body.

(iii) It acts as a co-enzyme in the body.

Examples: Vitamin A, vitamin B2, vitamin C, vitamin E and vitamin K.

Minerals

Sources: Salt licks, bone meal, legumes, cereals, etc.

Functions

(i) Form part of the tissues e.g. bones, teeth, etc.

(ii) Work together with the enzymes.

(iii) Act as acid - base balances.

(iv) Act as electrolyte in the body.

(v) Regulate osmotic balance in the body.

Examples: Calcium, phosphorus, magnesium, iron, iodine, sodium and chlorine, etc.

Calcium and phosphorus - teeth and bone formation. Lack of these minerals leads to rickets, osteomalacia.

Lack of iron leads to anaemia, etc.

Classification of Animal Feeds

This is based on nutrient composition:

(i) Roughages.

(ii) Concentrates.

(iii) Feed additives.

Roughages

Are feeds of low available nutrients per unit weight and high in fibre content.

Examples: Dry roughages, wet roughages, residues of agricultural by-products and conserved materials.

Characteristics

- Low level of available nutrients.
- Have high level of calcium especially in legumes.
- Good source of vitamin A.
- Can't be handled by non-ruminants.
- Have high fibre content.

Concentrates

Are feeds of high available nutrients per unit weight.

Examples: Maize germ and bran, brewer's grains, milk products, soyabeans, oil seed cakes, meatmeal, bonemeal and bloodmeal.

Characteristics

- Low fibre content.
- Feed content is consistently high.
- High digestibility of the feed.
- High in nutrient content.

Feed additives

These are substances added to feed to increase palatability or medication or hormones to make animals produce more.

There are two types

(a) Nutritive additives e.g. minerals (maelick).

(b) Non-nutritive additives e.g. medicants (coccidiostats), Stilboestrol (used in beef animals to increase meat to muscle ration and oxytocin (to increase milk let-down).

Functions

- (i) Stimulate growth and production.
- (ii) Improve feed efficiency.
- (iii) Prevent disease causing germs.

Compounded Feeds

These are the feeds prepared and mixed by use of machines. These feeds can be round, pelleted, pencils, cubes, etc.

Poultry feeds can be categorised as:

- (a) Chick mash having 20% D.C.P. given to chicks.
- (b) Growers mash having 16% D.C.P. given to growers.
- (c) Layers mash having 12-15% D.C.P. given to layers.

Meaning of terms used to express feed values

- (i) Nutritive ratio (NR): Is the proportion of protein to carbohydrates and fats. In young animals 1:3:6 In old animals 1:8
- (ii) Crude protein (C.P): Is the total amount of protein contained in a feed.
- (iii) Digestible Crude Protein (D.C.P.): Is the portion of crude protein which an animal is capable of digesting.
- (iv) Crude fibre (C.F.): Is the total amount of fibre contained in a feed. It is mainly lignin and cellulose.

- (v) Digestible fibre (D.F.): Is the portion of the total fibre contained in a feed which an animal is capable of digesting.
- (vi) Dry matter (D.M.): Is the material left in a feed after water has been removed.
- (vii) Starch equivalent (S.E): Is the amount of pure starch which has the same energy as 100kg of that feed.
- (viii) Total digestible nutrients (T.D.N.): Is the sum of all the digestible organic nutrients e.g. fats, proteins, carbohydrates and fibre.

Computation of Livestock Rations

Ration: Is the amount of food that will provide essential nutrients to an animal in a 24 hour period to enable that animal to meet its maintenance and production requirements.

Balanced ration: Is the ration that contains all the essential nutrients in required amounts and in the right proportions.

Maintenance ration: Is the portion of a feed required by an animal to continue with the vital body processes with no loss or gain in weight.

Production ration: Is the feed required by animals over and above maintenance ration to enable the animal to produce e.g. milk, eggs, wool, grow in size, perform work, reproduce and fatten, etc.

Steps in ration formulation

1. Finding out the animal's feed requirement based on body weight.
2. List all the available feeds, with their nutrient composition and their prices.
3. Calculate the amount of ingredients required in the ration to meet the animal's need.

Methods used in ration formulation

- (a) Trial and error method.
- (b) Pearson's square method.
- (c) Graphical method.
- (d) Linear programming (use of computers).

Example: Pearson's square method

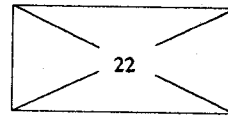
Mix a pig ration 22% protein using soya

bean meal 40% D.C.P. and maize meal containing 8% D.C.P.

Method: Pearson's Square

Soyabean 40% D.C.P
meal

14 Parts of
Soyabean meal



Maize 8% D.C.P
Meal

18/32 Parts of
Maize Meal

$$\text{Soya bean meal} = \frac{14 \times 100}{32} = 43.75\text{kg.}$$

$$\text{Maize meal} = \frac{18 \times 100}{32} = 56.25\text{kg.}$$

Digestion and Digestive Systems

Digestion is the process whereby food is broken down into small particles in the alimentary canal ready for absorption into the blood stream.

Digestion of food in livestock takes place in three stages:

- (i) Mechanical breakdown and chewing.
- (ii) Microbial breakdown by bacteria and protozoa in ruminants.
- (iii) Chemical breakdown by enzymes.

Digestive System of a Ruminant

Functions

- Rumen: Breakdown of food by micro-organisms and also stores food.
- Reticulum: - Separates large food particles from the small particles.
- Retains foreign materials e.g. stones, cof hard wood and sand.
- Omasum: - Breaks up food by grinding.
- Reduction of water content from the feedstuff.
- Abomasum: Enzymatic digestion takes place here.
- True stomach (Caecum): Contains some microbes which digest cellulose. It is also found in non-ruminants.

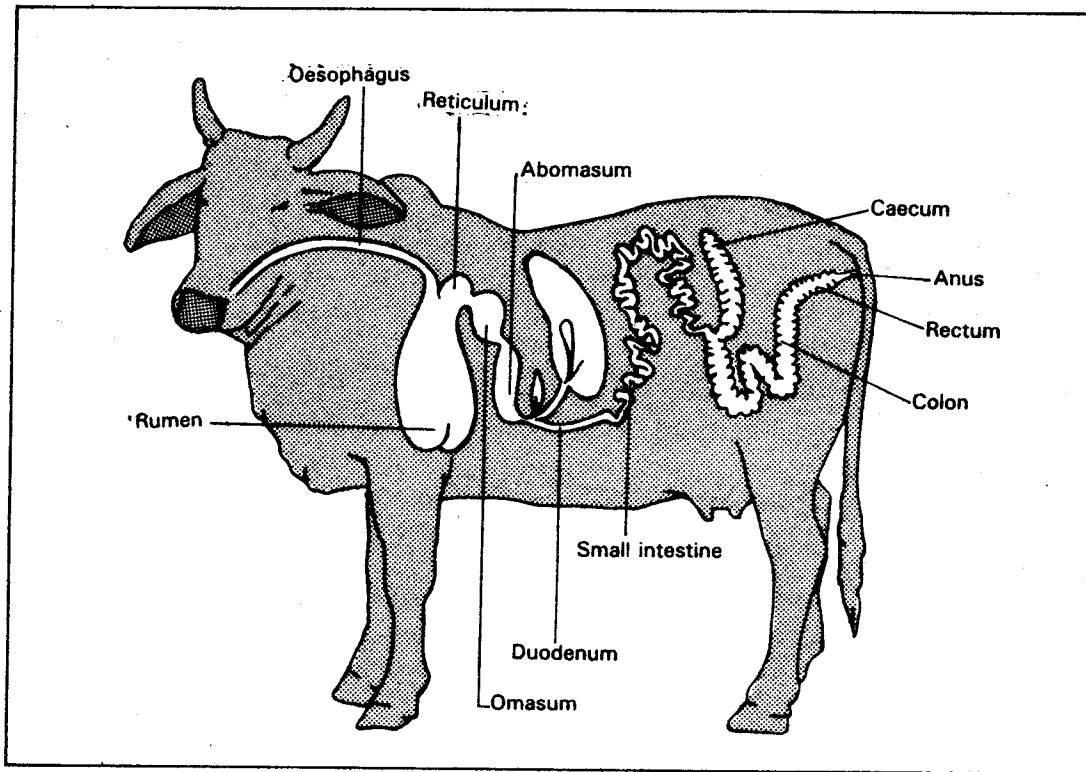


Fig. 13(a): Digestive system of a ruminant.

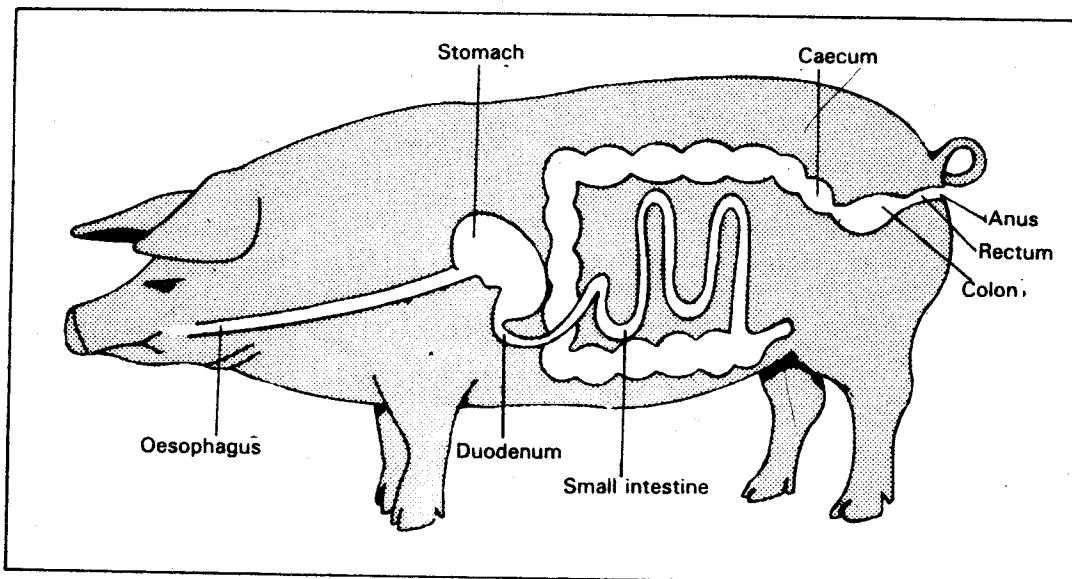


Fig. 13(b): Digestive system of a non-ruminant.

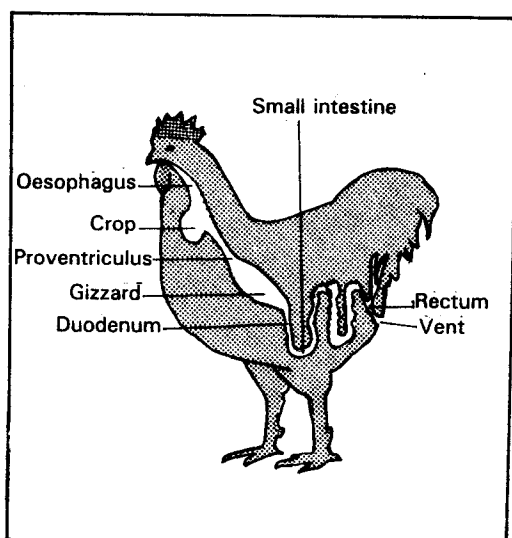


Fig. 13(c): Digestive system of poultry.

Functions of the Parts of Poultry

Crop: - Storage of food.
- Softening of food by secretions from small glands in the walls.

Proventriculus: Enzymes start the break-down of food

Gizzard: Crushes and grades the coarse food (Has small grit and gravel).

Differences between Ruminants and Non-Ruminants

<i>Ruminants</i>	<i>Non-Ruminants:</i>
1. Polygastric (4 stomach compartments).	1. Mono gastric (simple stomach).
2. Digestion and absorption takes place in the rumen.	2. Digestion and absorption takes place in the small intestines.
3. Can ruminate.	3. Cannot ruminate.
4. Can digest fibrous feeds.	4. Cannot digest large quantities of fibrous feeds.
5. Do not have ptyalin in the saliva.	5. Have ptyalin in the the saliva.

Similarities

- (i) Both have a single stomach when young.
- (ii) In both, final digestion of proteins and carbohydrates takes place in the small intestines.
- (iii) Water is absorbed in large intestines in both.

Livestock Improvement

Reproduction and Reproductive Systems

Reproduction involves the fusion of male and female gametes to form a zygote.

Types of Reproduction

- (a) Asexual reproduction.
- (b) Sexual reproduction.

Male Reproductive Organs

1. The testis: Produce spermatozoa.
2. Epididymis: Storage of spermatozoa.
3. Sperm ducts: Conveys sperm from the testis to the urethra.
4. Accessory glands: Are seminal vesicles, Cowper's gland and prostate gland.

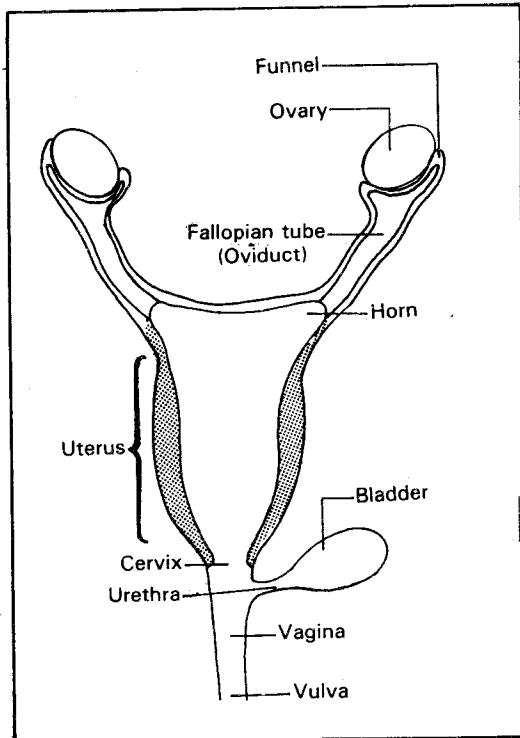


Fig. 13(e): Female reproductive organ.

Neutralise the acidic effect in urine and secrete semen fluids.

5. Urethra:

Conveys urine and semen.

6. Penis:

It is a copulatory organ, also used for urination.

Female Reproductive Organs

1. Ovaries: Produce eggs and hormones. The latter regulates sexual cycle.
2. Fallopian tubes: Fertilisation takes place here. Also a passage for the egg from the ovary to the uterus.
3. The uterus: Embryo develops here.
4. The cervix: Closes the uterus.
5. The vagina: Receives semen and discharges urine.

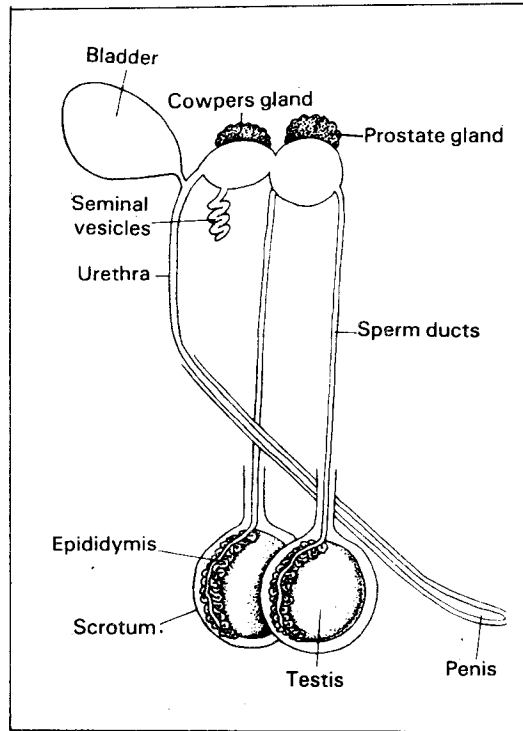


Fig. 13(d): Male reproductive organ.

Reproduction in Poultry

The cock has no penis. During mating the cloaca of the hen and the vent of the cock fit into each other and then poured into the cloaca of the hen then to the oviducts

1. Funnel: Site of fertilisation and chalaza formation takes 15 minutes.
2. Magnum: Albumen added here (takes 3 hours).
3. Isthmus: Shape of egg determined. Soft shell membrane added. (takes $1\frac{1}{4}$ hours).
4. Uterus: This secretes the shell on the egg, shell pigment and water. (takes (18-22hrs).
5. The vagina: This secretes mucous to reduce friction. (takes 1-10 minutes).
6. Cloaca: Delivers the eggs.

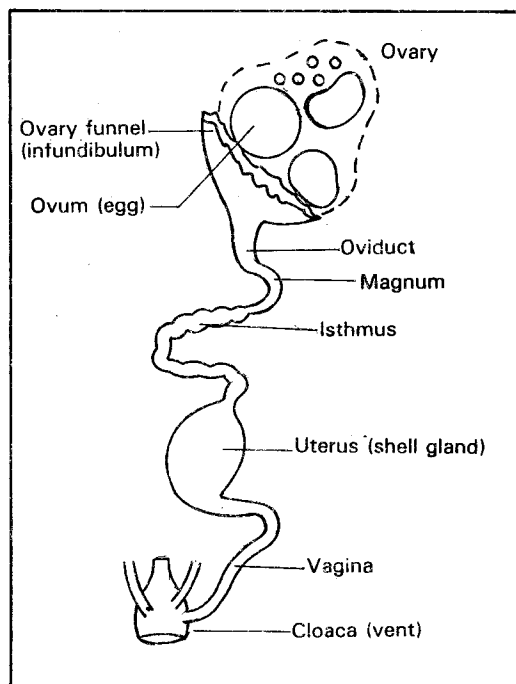


Fig. 13(f): Reproductive system of a hen.

Selection of Breeding Stock

Factors to consider when selecting a good breeding stock.

1. Age.
2. Level of production.
3. Physical deformity.
4. Health status of the animal.
5. Physical appearance.
6. Temperament/behaviour.

Breeding and Breeding Methods

Aims of Breeding

- (i) To improve the production e.g. production of milk.
- (ii) Develop stock which can resist diseases.
- (iii) Develop animals which are adaptable to the local conditions.
- (iv) Develop early maturing stock.

Breeding Methods

- (i) Cross-breeding: Mating of two animals of different breeds e.g. Friesian bull x Jersey cow.
- (ii) Inbreeding: Mating closely related animals e.g. father and daughter. The objective is to retain the good qualities of the family.
- (iii) Upgrading: A form of cross-breeding involving a local animal crossed by an exotic bull for a long period of time.
- (iv) Line breeding: Mating of distantly related animals that had a common ancestor.
- (v) Out crossing: Mating of different families of the same breed.

Mating Methods

- (a) Natural mating: Cow and the bull stay together freely hence they mate together.
- (b) Artificial insemination: It involves the collection of semen from a good bull then introduced into the cow's reproductive channel.

WORK TO DO

1. State the importance of keeping the following livestock.
 - (a) Camels
 - (b) Rabbits
 - (c) Poultry
2. State the general characteristics of light breeds of birds. Give examples of the light breeds.
3.
 - (a) Name the common breeds of pigs kept in Kenya.
 - (b) State problems associated with pig industry in Kenya.
4. Give one example of each of the following.
 - (a) Wool sheep
 - (b) Mutton sheep
 - (c) Dual purpose.

5. Give four characteristics of Zebu cattle of East Africa.
6. Give the main differences between *Bos taurus* and *Bos indicus*.
7. Draw a well labelled diagram to show the reproductive systems in a cow.
8. State the similarities between ruminants and non-ruminants.
9. State characteristics of a good breeding stock.
10. Write short notes on the following:
 - (a) Inbreeding
 - (b) Hybrid vigour in cattle.
 - (c) Artificial insemination.
 - (d) Process of egg formation.