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Agricultural Sciences (Esther Maleka Comprehensive)



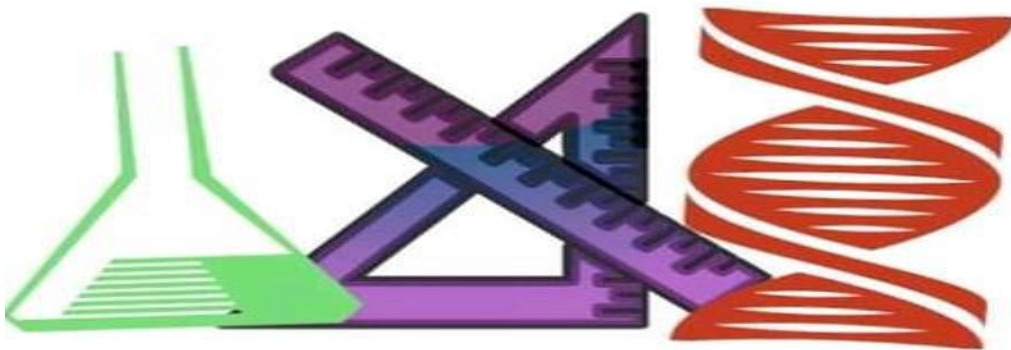
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AGRICULTURAL SCIENCES

GRADE 12

Annual Notes

BE Maths and Science Programme



JANUARY 1, 2020

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TOPIC 1

ANIMAL NUTRITION

Paper 1

Question 2

- ✚ This refers to the foods consumed by animals and how it is digested to help to keep the body of an animal healthy and warm
- ✚ Different animals has different digestive system that suit their feeding standard and requirements

1. Alimentary canal of farm animals

- ✚ Differences between Ruminants and non-ruminants

Structural differences

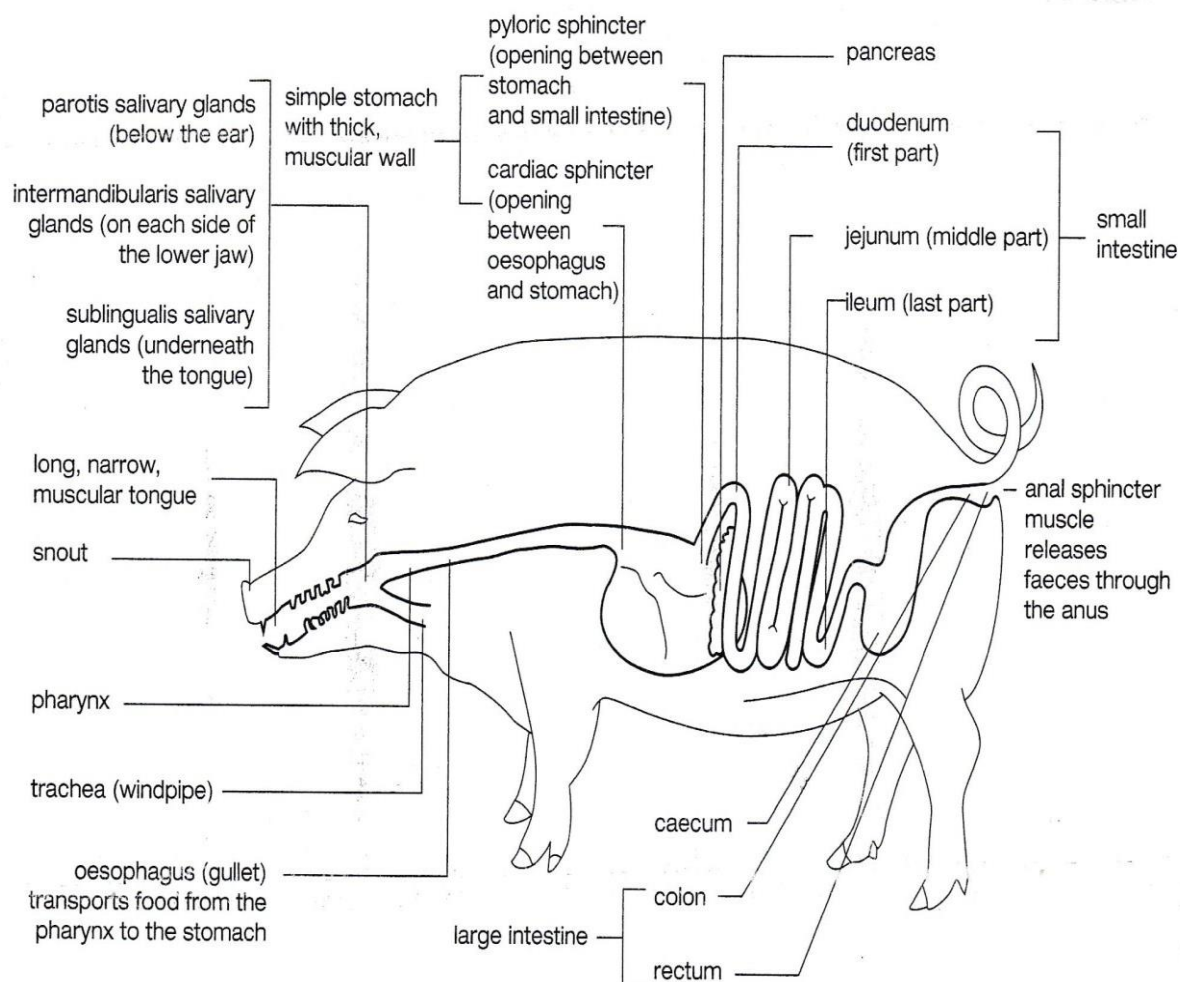
- Ruminant: **has a complex stomach**
: **has four stomach compartments**
- Non-ruminant: **has a simple stomach**
: **has less than four stomach compartment**

Differences in feed utilized

- Ruminant : **can feed on roughages** (because of the presence of micro-organism in the rumen that assist in digestion of roughage)
: **can utilize urea** (since micro-organism can change urea into microbial proteins)
- Non-ruminant: **cannot feed on roughage** (such animal doesn't have rumen hence no micro-organism that assist in digestion of roughage)
: **cannot utilize urea** (doesn't have micro-organism that change urea into microbial protein, hence excess urea will be changed into ammonia which is very dangerous for such animals)

ALIMENTARY CANAL OF NON RUMINANT

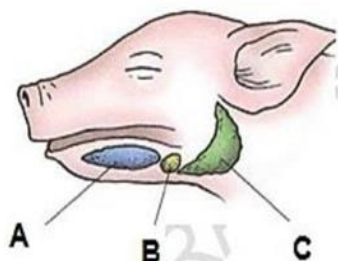
Alimentary canal of a pig



DIGESTIVE GLANDS AND DIGESTIVE JUICES

❖ In the mouth

Name digestive glands: **salivary gland** (3 pairs)



A = Sublingual

B = submandibular

C = parotid

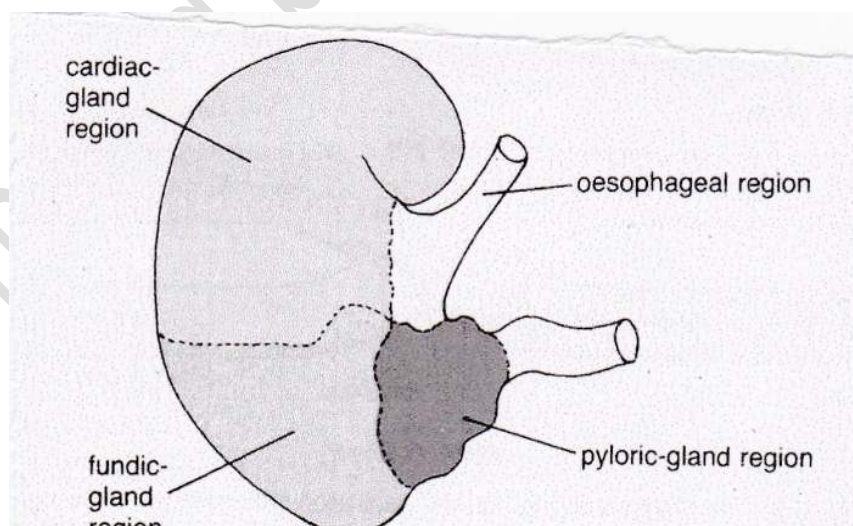
Name of digestive juice produced: **saliva**

❖ In the stomach

Name of digestive gland: **Gastric glands**

Name of digestive Juice produced: **Gastric juice and Hydrochloric acid (hcl)**

STOMACH REGIONS OF NON RUMINANTS



Simple stomach of non-ruminant has the following regions:

CADIAC REGION: secretes mucus to protect stomach linings against Hydrochloric Acid

PYLORIC REGION: controls the exits of foods

FUNDIC REGION: secretes Hydrochloric Acid, renin and pepsin

❖ In the small intestine

Name of digestive glands: **gland of liberkuhn**

Name of digestive juice produced: **succus entericus**

❖ In the accessory glands

1. Name gland: **liver** (largest gland in the body)

Digestive juice produced: **Bile** (alkaline juice without enzymes)

Functions of bile

- Neutralizes acid chime from the stomach
- Emulsifies fats
- Assist in absorption of fat

2. Name of gland: **Pancreas**

Digestive juice produced: **pancreatic juice**

DIGESTIVE ENZYMES AND Ph. CONTENT OF A PIG

❖ In the mouth

Name of enzyme: **Salivary amylase**

Function of the enzyme: **change starch into maltose**

Ph. content in the mouth of pig: **alkaline** (The alkaline ph. in the mouth create suitable environment for normal functioning of enzyme amylase)

❖ In the stomach

Name of enzyme: **Renin & pepsin**

Functions of enzyme: **Renin-** change caseinogen into casein
: Pepsin- change protein into peptons

Ph. content in the stomach of pig: **acidic**

❖ **In the small intestine**

Name of enzyme: **Sucrase**

: **Maltase**

: **Lipase**

: **Trypsin**

Function of enzymes: **Sucrase**- change sucrose into glucose and fructose

: **Maltase**- change maltose into glucose

: **Trypsin**- change peptides into amino acids

: **Lipase**- change lipids into fatty acid and glycerol

FUNCTIONING OF PARTS OF ALIMENTARY CANAL OF A PIG

- ❖ Functioning of the mouth: **intake of food**
- ❖ Functioning of the oesophagus: **transport food from mouth to the stomach**
- ❖ Functioning of stomach: **temporal storage of food**
- ❖ Functioning of small intestine: **responsible for absorption of nutrients**
- ❖ Functioning of large intestine: **absorption of water from undigested feed**
- ❖ Functioning of anus: **expel waste material away from the body**

PROCESSES TAKING PLACE IN THE ALIMENTARY CANAL OF A PIG

❖ **In the mouth**

Processes taking place: Ingestion (intake of feed)

: Digestion (breaking down of food into smaller pieces)

Types of digestion

Mechanical digestion- Is the physical breaking down food into smaller pieces

Chemical digestion- Is the breaking down of food into smaller pieces by enzymes

: Mastication- is the physical mixing of food with saliva

❖ **In the stomach**

Process taking place: **chemical digestion** (due to the presence of enzyme)

❖ **In the small intestine**

Process taking place: **absorption** (transport of nutrients into blood stream

: **assimilation** (process when nutrients are taken up by cells)

: **chemical digestion** (due to presence of enzymes)

❖ **In the large intestine**

Process taking place: **microbial fermentation** (has micro-organism in has a hind-gut (caecum)

❖ **In the Anus**

Process taking place: **egestion/ excretion** (expelling of waste)

ADAPTATION OF DIFFERENT PARTS OF THE ALIMENTARY CANAL OF A PIG

❖ **In the mouth**

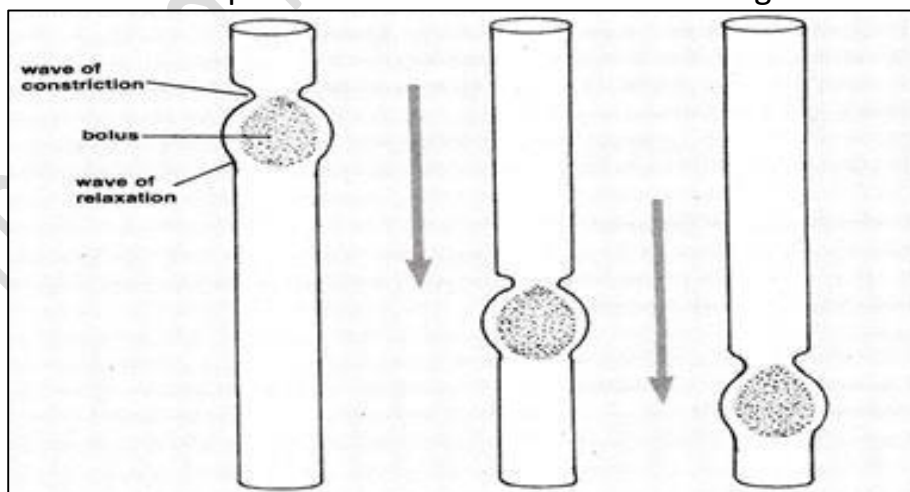
has three pairs of salivary gland:

1. **Parotid**- situated below the ear
2. **Sublingual**- situated below the tongue
3. **Submandibular**- situated in between the parotid and sublingual

❖ **In the oesophagus**

Has muscles that relax and contract to move food in the alimentary canal

Has a cardiac sphincter that controls food entering the stomach



❖ In the stomach

Has a pear shape

Has a pyloric sphincter that controls food leaving the stomach

❖ In the small intestine

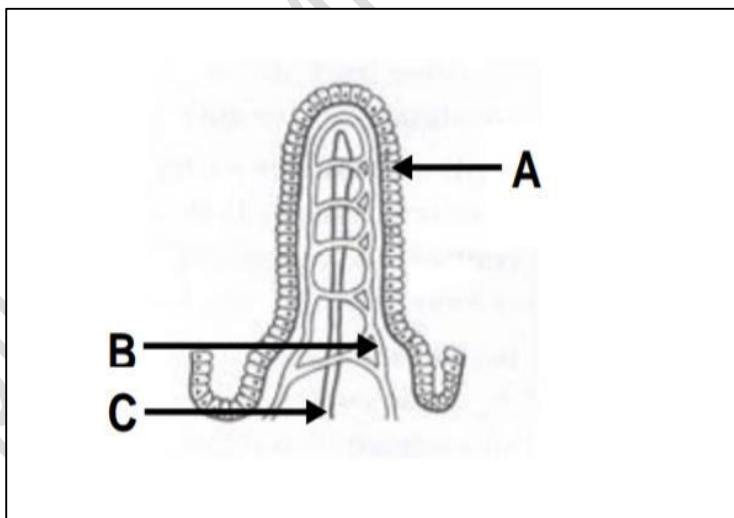
Divided into three parts:

- Duodenum – secretes digestive enzyme
- Jejunum- absorption of nutrients
 - Presence of villi
- Ileum- absorption of feeds

Structural adaptation of small intestine

- It is very long and has large surface area
- The inner surface is folded
- Folds are covered with thousands of small projection called VILLI

Structure of a villi



B- Blood capillarity- absorbs nutrients (glucose , amino acid, vitamin and minerals)

C- Lacteal- absorbs fats

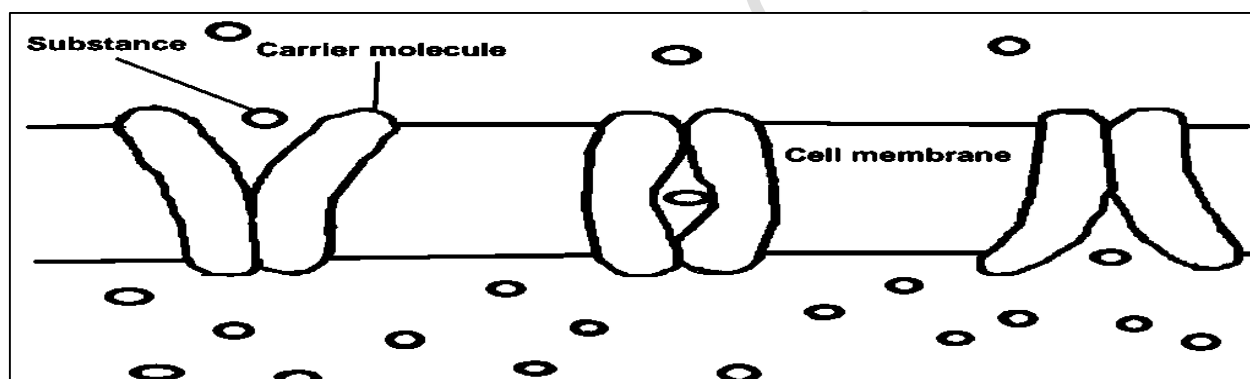
Absorption processes

Are divided into:

Active absorption- it requires energy to transport nutrients from low concentration to high concentration against concentration gradient e.g **osmosis**

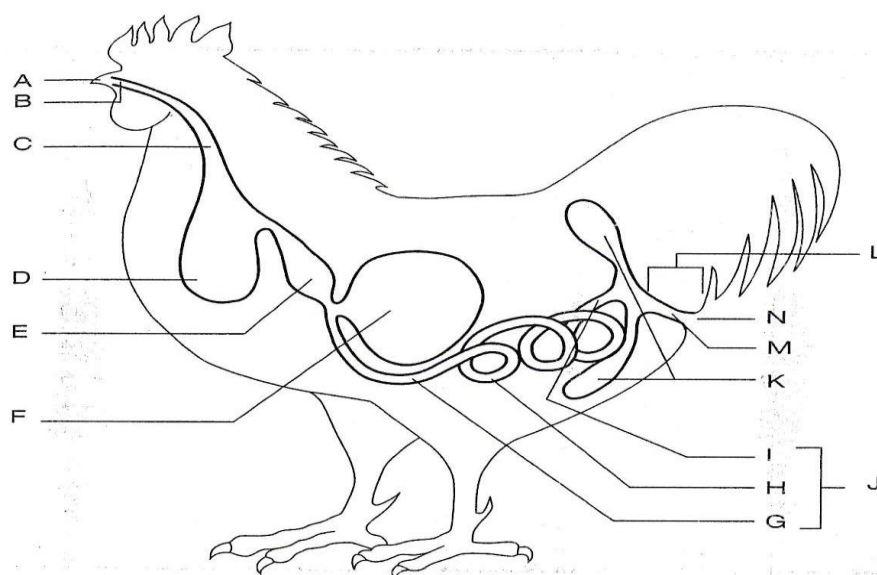
Passive absorption – it doesn't require energy to transport nutrients from high concentration to low concentration along concentration gradient e.g **diffusion**

Example of diagram showing active absorption process



FOWL AS A NON RUMINANT

Alimentary canal of fowl



- | | |
|--------------------|-------------------|
| A. Beak | E. PROVENTRICULUS |
| B. Mouth | F. VENTRICULUS |
| C. Oesophagus | G. DUODENUM |
| D. Crop | H. JEJUNUM |
| I. ILEUM | K. CAECA |
| J. SMALL INTESTINE | L. COLON |
| N. CLOACA | |

FUNCTIONING OF DIFFERENT PARTS OF ALIMENTARY CANAL OF A FOWL

BEAK – Collect food particles from the soil

CROP - Moistening, soaking, softening and storage

GIZZARD – Grinding of food

SMALL INTESTINE – Absorption of nutrients

LIVER – Secret bile

- **Store glucose**
- **Store fat soluble vitamin**
- **detoxifies harmful substances**

LARGE INTESTINE – absorption of water from undigested food

CLOACA - expel both urine and faeces

PROCESSES OCCURING IN DIFFERENT PARTS OF ALIMENTARY CANAL OF FOWL

BEAK – ingestion

OESOPHAGUS – Peristalsis

CROP – Moistening of food

PROVENTRICULUS – Chemical digestion

VENTRICULUS – Mechanical digestion /physical digestion

ADAPTATION OF DIFFERENT PARTS OF THE ALIMENTARY CANAL OF A FOWL

It has TWO stomach compartment:

- **VENTRICULUS** (muscular stomach)

Contain small stones that help in grinding of food (mechanical digestion)

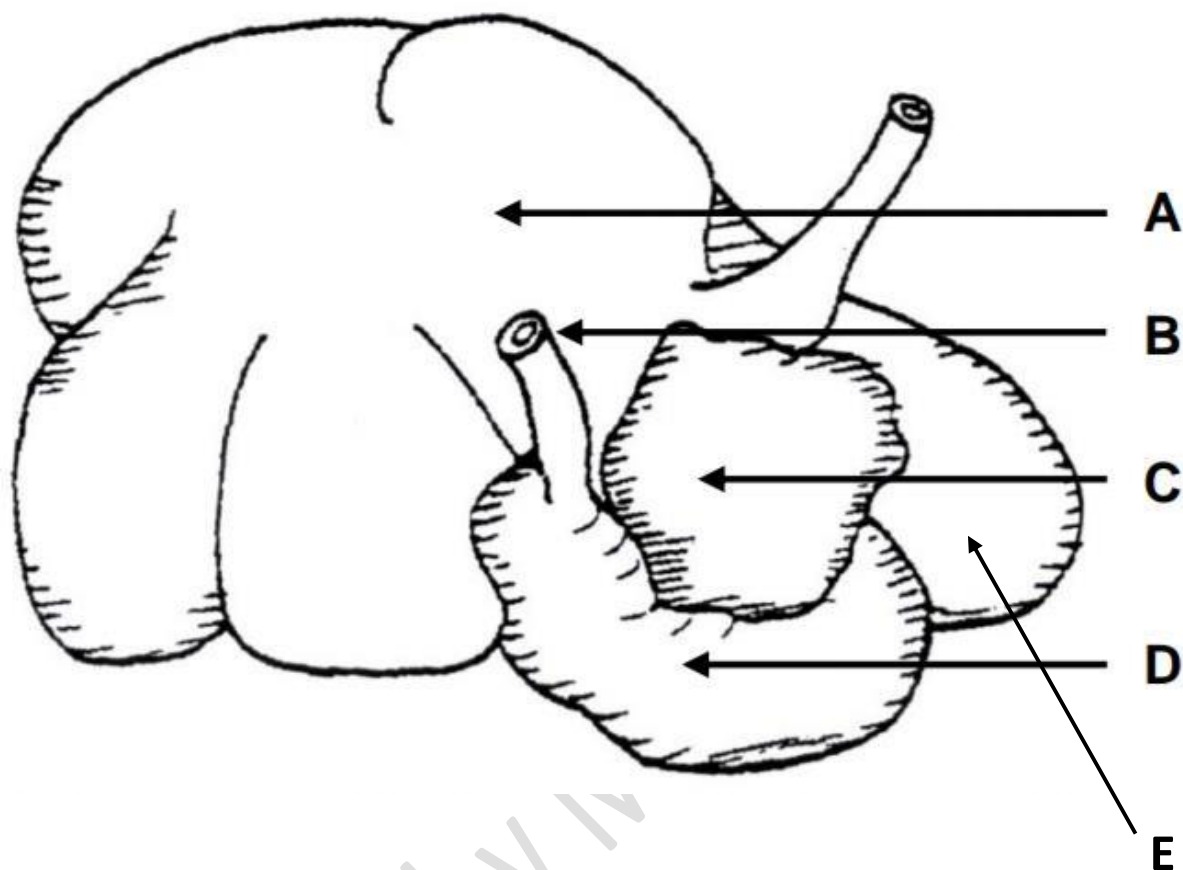
Contain a layer of muscle that help in grinding of food (mechanical digestion)

- **PROVENTRICULUS** (glandular stomach)

Has both enzyme RENIN and PEPSIN that help in CHEMICAL DIGESTION

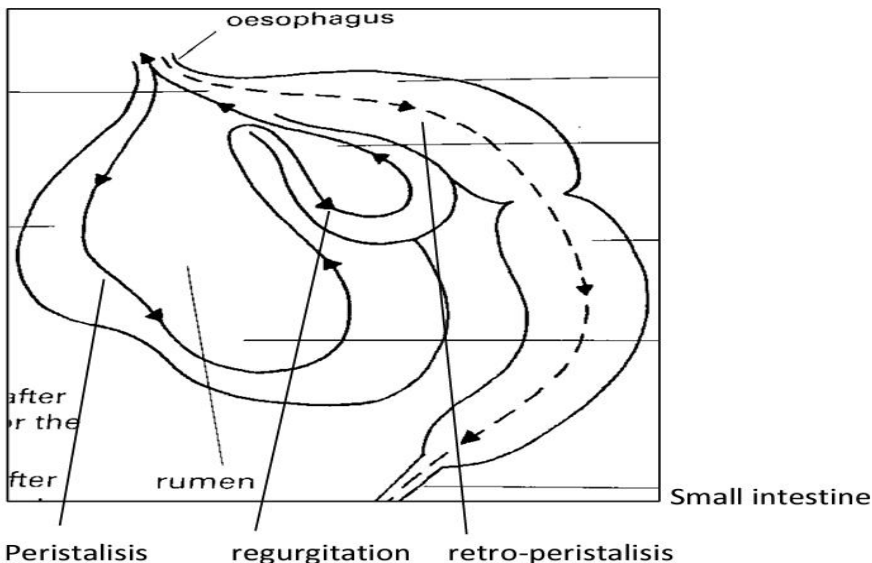
CLOACA – It is urogenital (excretion of faeces and urine)

ALIMENTARY CANAL OF RUMINANT



- A. RUMEN
- B. DUODENUM
- C. OMASUM
- D. ABOMASUM
- E. RETICULUM

PATHWAY OF FOOD IN THE ALIMENTARY CANAL OF RUMINANT



1. Food moves from the oesophagus from the mouth by **PERISTALSIS** into the rumen.
2. Food **REGURGITATE** from the reticulo-rumen back to the mouth for re-chewing
3. After re-chewing food is moved back through **RETRO-PERISTALSIS** into Omasum and abomasum

Functioning of different parts of alimentary canal of ruminants

- MOUTH – **food is taken in**
- OESOPHAGUS – **transport food to the stomach**
- STOMACH- **temporally storage of food**
 - Divided into four compartments:
 - RUMEN
 - RETICULUM
 - OMASUM
 - ABOMASUM
- SMALL INTESTINE – **absorption of nutrients**
- LARGE INTESTINE – **absorption of water from undigested feed**
- ANUS – **expel waste material away from the body**

PROCESSES TAKING PLACE IN DIFFERENT PARTS OF ALIMENTARY CANAL OF RUMINANTS

➤ MOUTH

Process taking place: **Ingestion** (intake of food)

: **Digestion** (breaking down of large food molecule into smaller pieces)

NB: ONLY MECHANICAL DIGESTION TAKE PLACE IN THE MOUTH OF RUMINANTS DUE TO THE ACIDIC PH AND ABSENCE OF ENZYME

➤ ESOPHAGUS

Process taking place: **Peristalsis** (alternative contraction and relaxation of muscles responsible for movement of food in the alimentary canal)

➤ STOMACH

Process in the Rumen: **Microbial digestion** (presence of micro-organism)

: **Heat production** (presence of papillae)

Process In the Reticulum: **Storage of foreign objects**

Process In the Omasum: **Water absorption** (folds increase surface area for water absorption)

: **Grinding of food** (folds assist in grinding of food)

Process In the Abomasum: **Chemical digestion** (presence of enzyme renin and pepsin)

ADAPTATION IN DIFFERENT PARTS OF ALIMENTARY CANAL OF RUMINANT

➤ IN THE MOUTH

Has three pairs of salivary glands

Has teeth that assist in **mechanical digestion**

Ph. Is acidic

Saliva has no enzyme salivary amylase

No chemical digestion

➤ **IN THE OESOPHAGUS**

Has a ring of muscle called CARDIAC SPHINCTER that controls food entering the stomach

It has muscles that contract and relax to move food into the stomach

➤ **IN THE STOMACH**

1. RUMEN

Is the largest stomach compartment of ruminant

Contain papillae that act as a heating rod (heat production)

Contain micro-organism (bacteria and protozoa)

POPULATION OF BACTERIA IN THE RUMEN

Cellulolytic bacteria: Digest cellulose

: Population increase with increase in cellulose intake

: Secrete enzyme **CELLULASE**

Amylolytic bacteria: Digest starch

: Population increase with increase in starch intake

: Secrete enzyme **MALTASE**

Proteolytic bacteria: Digest protein

: Population increases with increase in protein intake

Note: Rumen bacteria are very sensitive to feed changes, therefore frequent and sudden changes in diet may disturb rumen functions

FUNCTIONS OF RUMEN MICRO-ORGANISM

1. DIGESTION OF CELLULOSE / ROUGHAGE

Micro-organism digest cellulose to form Fatty acids, carbon dioxide and methane
Over accumulation of methane can cause animal to bloat

2. SYNTHESIS OF VITAMIN

Micro-organism can make vitamin B and K

It is not important to include vitamin B Complex and vitamin K in the feed of ruminant

3. SYNTHESIS OF PROTEIN

Micro-organism break large protein molecule into amino acids (smaller compound)

4. DIGEST STARCH

Micro-organism digest starch into maltose (simpler substance)

REQUIREMENTS FOR MICRO-ORGANISM / IDEAL CONDITION FOR RUMEN MICRO-ORGANISM

1. SUITABLE pH

pH 6.4

2. SUITABLE TEMPERATURE

Warm temperature between 39°C and 40°C

3. SUFFICIENT NITROGEN

Micro-organism need nitrogen from urea to form a protein

4. REGULAR INTAKE OF FOOD

5. OXYGEN-FREE ENVIRONMENT

2. RETICULUM

It is known as a honeycomb stomach or a hardware stomach

It is where foreign objects are stored

3. OMASUM

It is known as a leaf stomach

It has many folds that help in water absorption

It has many folds that help in grind of food

4. ABOMASUM

It is known as a TRUE STOMACH or milk stomach

It corresponds with the simple stomach of a pig and a Proventriculus of a fowl

Supplied with the following:

Digestive Glands: **gastric gland**

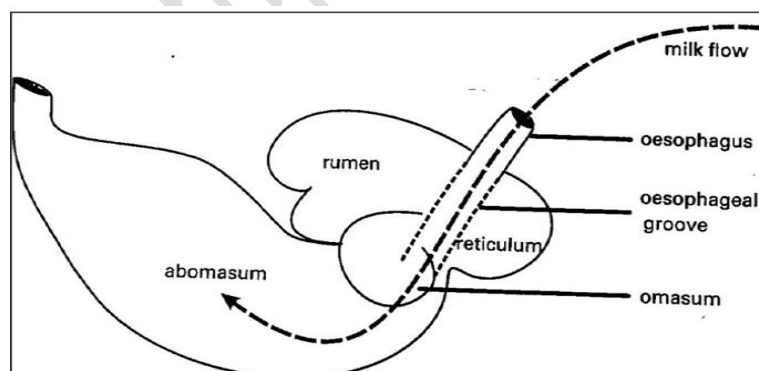
Digestive juice produced: **gastric juice and hydrochloric acid**

Digestive enzymes: **renin and pepsin**

Ph. medium: **acidic**

Process: **chemical digestion / enzymatic digestion**

Alimentary of young ruminant



DIFFERENCES BETWEEN YOUNG RUMINANT AND ADULT RUMINANT

YOUNG RUMINANT

Fore stomach is underdeveloped developed

Only the abomasum is functional

Oesophageal groove is present

MATURED RUMINANT

Fore stomach is fully

All the four stomach functions

Oesophageal groove is absent

2. Components of feeds

Animals require all the essential nutrients to balance their daily ration. These nutrients become indispensable for life. All the major nutrients includes; WATER, CARBOHYDRATES, PROTEIN, LIPIDS, MINERALS AND VITAMIN.

These nutrients are needed for many purpose which includes:

- ☐ Regular function of the animal's system
- ☐ Protection of body system
- ☐ For growth
- ☐ For production
- ☐ For reproduction
- ☐ To perform work

1. WATER

- ☐ Made up of 2 hydrogen atom and 1 oxygen atom (H₂O)
- ☐ Water is the cheapest nutrients.
- ☐ It is a basic unit for all fluid in the animal's body
- ☐ Animals can survive for long without food, but only few days without water

SOURCE OF WATER (WAYS IN WHICH ANIMAL OBTAINS WATER)

- ☐ Drinking water
- ☐ Water from the feed it eats
- ☐ Metabolic water (water produced by chemical reactions in the animal's body)

IMPORTANCE OF WATER IN ANIMALS

- ☐ Regulates body temperature (act as a cooling agent)
- ☐ Medium for chemical reaction
- ☐ Act as a transport medium
- ☐ Act as a lubricant

WATER USAGE AND FEED INTAKE IN RELATION TO TEMPERATURE AND OTHER FACTORS

- **ON A COLD DAY** (low temperatures)

Animal drink LESS and eat MORE feed

REASON: energy released from feed is used to keep the animal warm

- **ON HOT DAY** (high temperatures)

Animal drink MORE water and eat less feed

REASON: large amount of water help the animal to cool down

2. CARBOHYDRATES

It is created by PLANTS through photosynthesis

It is an ORGANIC COMPOUND

It includes:

SIMPLE CARBOHYDRATES: GLUCOSE

COMPLEX CARBOHYDRATE: STARCH

INSOLUBLE CARBOHYDRATES: CELLULOSE and LIGNIN

Made of element carbon, hydrogen and oxygen

Has **HIGH CRUDE FIBRE CONTENT**

FUNCTIONS OF CARBOHYDRATES

- ☐ Needed for fattening of farm animals
- ☐ Provide bulkiness of ration
- ☐ Important source of energy

BUILDING BLOCK OF CARBOHYDRATES

- ☐ Glucose

EXAMPLES OF CARBOHYDRATE RICH FEEDS

- ☐ Maize
- ☐ Wheat
- ☐ Sorghum
- ☐ Oat

3. PROTEIN

- ☐ It is the most expensive feed
- ☐ It is an **ORGANIC COMPOUND**
- ☐ It is divided into :
- ☐ **CRUDE PROTEIN**- all proteins found in feed
- ☐ **DIGESTIBLE PROTEIN**- amount of protein that was not excreted in faeces but to be used by the animal
- ☐ Made up of element carbon, hydrogen, oxygen, nitrogen and sulphur
- ☐ Has **low crude fibre content**

FUNCTION OF PROTEIN

- ☐ Needed for growth
- ☐ Needed for reproduction
- ☐ Needed for production (wool, meat, eggs and milk)
- ☐ Repair worn out tissues

BUILDING BLOCK OF PROTEIN

Amino acid

EXAMPLES OF PROTEIN RICH FEED

- ☐ Soya bean
- ☐ Fish
- ☐ Bone meal
- ☐ Sunflower oil cake
- ☐ Peanut oil cake
- ☐ Lucerne

PROTEIN SUPPLEMENT

Proteins can be supplemented by **SOURCE OF NPN**;

- ☐ **UREA**- cheap source
- ☐ **BUIRET**- expensive feed

4. FATS AND OIL (LIPIDS)

- ☐ It is an **ORGANIC COMPOUND**

Differences between **FATS** and **OIL**

- ☐ **FATS** – Originates from animals
 - Solid at room temperature
- ☐ **OIL** – originate from plants
 - liquid at room temperature

FUNCTIONS OF LIPIDS

- ☐ Protects important organs (such as heart, liver, and lungs)
- ☐ Act as a shock absorber
- ☐ Act as an insulation material

BUILDING BLOCK OF LIPIDS

- ☐ Fatty acids and glycerol

5. VITAMINS

EXAMPLES OF VITAMINS AND THE RESPECTIVE DEFICIENCY DISEASE DEFICIENCY

Example of fat soluble vitamin

- ☐ **Vitamin A**

Night blindness

Keratomalaise

Poor vision

- ☐ **Vitamin D** (needed for absorption of calcium and phosphorus)

Oestomalacia

Rickets

- ☐ **Vitamin E** (act as antioxidant)

Stiff lamb disease

- ☐ **Vitamin K**

Poor blood clotting

Example of water soluble vitamin

- ☐ **Vitamin B1**

Polyneuritis

- ☐ **Vitamin B2**

Curled-toe paralysis

- ☐ **Vitamin B12** (it contain element cobalt)

Poor hatching of chicken

Wasting disease

6. MINERALS

- ☐ These are inorganic substances that are required for normal body functioning
- ☐ They are divided into:
 - ☐ **MACRO MINERAL** – are minerals that are needed in large quantities
 - ☐ **MICRO MINERAL** - are minerals that are needed in small quantities
 - ☐ They can cause metabolic disease when they are insufficient

Mineral	Deficiency
☐ Calcium	Rickets and Osteomalacia
☐ Phosphorus	Pica (animal feed on non-feeding object)
☐ Iodine	Goitre (enlargement of thyroid gland)
☐ Iron	Anaemia (low haemoglobin in blood)
☐ Zinc	Parakeratosis (rough skin in pigs)
	Keratinization (hairlessness)
☐ Copper	Swayback
☐ Cobalt	Wasting disease

3. DIGESTIBILITY OF FEEDS

DIGESTIBILITY -Amount of feed that is not excreted in faeces but restored in the animal's body

DIGESTIBILITY COEFFICIENT- proportion of a nutrient taken absorbed by animal expressed in percentage

FACTORS DETERMINING DIGESTIBILITY OF FEED

☐ **TYPE OF ANIMAL**

Feed with high crude fibre are mostly digested by ruminants than by non-ruminants

☐ **AGE OF PLANT**

Hay made from younger plants are more digestible than hay made from older plants (older plants has lignin that is not easily digested)

☐ **INDIVIDUALITY**

Individual animals differ based on their ability to digest feed

☐ **COMPOSITION OF FEED**

High percentage of crude fibre in a feed results in lower digestibility

☐ **NUTRITIVE RATIO**

Feed with wide nutritive ratio are less digestible than feed with narrow nutritive ratio

WAYS TO IMPROVE / INCREASE DIGESTIBILITY OF FEEDS

☐ **GRINDING**

☐ **SOAKING**

☐ **ROASTING**

☐ **BOILING**

☐ **PELLETING**

☐ **ADD MOLASSES (to increase palatability and digestibility of a carbohydrate)**

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DIGESTIBILITY COEFFECIENT

Let's assume that 70kg of feed was taken in and only 30kg was excreted, one must assume that 40kg was digested and absorbed in the body of animal.

(70kg – 30kg = 40kg) This means that 40kg of the 70kg is absorbed by the animal

Example: calculate the digestibility coefficient of the following ration of a matured animal

Animal ingested **25kg** of grass with the moisture content of **75%**. 8kg of feed was excreted in faeces with a moisture content of 80%

$$\begin{aligned}\text{moiture intake: } & \frac{75}{100} \times 25\text{Kg} \\ & = 18,75\text{kg}\end{aligned}$$

$$\begin{aligned}\text{Therefore: } & 25\text{kg} - 18.75\text{kg} \\ & = 6.25\text{kg (dry matter intake)}\end{aligned}$$

$$\begin{aligned}\text{Moisture excreted: } & \frac{80}{100} \times 8\text{kg} \\ & = 6.4\text{kg} \\ \therefore & 8\text{kg} - 6.4\text{kg} \\ & = 1.6\text{kg (dry matter excreted)}\end{aligned}$$

$$\begin{aligned}\text{DIGESTIBILITY COEFFECIENT \%} &= \frac{\text{DM intake (kg)} - \text{DM excreted (kg)}}{\text{DM intake (kg)}} \times 100 \\ &= \frac{6.25\text{kg} - 1.6\text{kg}}{6.25\text{kg}} \times 100 \\ &= 74.4\%\end{aligned}$$

IMPLICATION OF THE CO-EFFICIENT ABOVE

74.4% of the feed is absorbed in the body of the animal, hence 25.6% is excreted in faeces

Note the interpretation of digestibility co-efficient

: Above 70% - **very high (good digestibility)**

: 60-70% - **high (moderate digestibility)**

: 40-59% - **low digestibility**

: Less than 40% - **very low digestibility**

4. QUALITY OF FEED

Different feeds has various physical chemical characteristics that determine its quality

BIOLOGICAL VALUE (BV) OF PROTEIN

Is the index used to measure the quality of protein in a feed

It is determined by;

- Amino acid composition
- Ratio of amino acid
- Amount of nitrogen supplied

Note: **FEED WITH HIGH AMINO ACID CONTENT IS A GOOD QUALITY FEED AND HAS HIGH BIOLOGICAL VALUE**

ESSENTIAL AMINO ACID AND NON ESSENTIAL AMINO ACID

☐ **ESSENTIAL AMINO ACID**- Amino acid cannot be synthesized and need to be taken in feed

☐ **NON-ESSENTIAL AMINO ACID** – Amino acid that can be synthesized by animal's body

TYPE OF FEED	BV %
☐ EGG PROTEIN	100
☐ MILK PROTEIN	95
☐ FISH MEAL	90
☐ WHEAT	75
☐ MAIZE	60

5. ENERGY VALUE OF FEED

Energy in animals is provided by feed taken in and expressed in kilojoules

TYPES OF ENERGY VALUE OF FEEDS

- ☐ **GROSS ENERGY (GE)** - is the potential energy (total energy value of feed)
- is the energy released when feed is completely burnt

(Combustion) to its final product

- ☐ **DIGESTIBLE ENERGY (DE)** – is gross energy minus energy lost in manure (faeces)

- ☐ **METABOLIC ENERGY (ME)** – is gross energy minus energy lost in manure, urine and gases (methane (CH₄) and carbon dioxide (CO₂))

- ☐ **NET ENERGY**- is the gross energy minus energy lost in manure, urine gases and body heat

REASON FOR CALCULATING ENERGY VALUE OF FEED

- ☐ To determine animals diet
 - ☐ To determine feeding standards
 - ☐ To determine ration formulation
-

6. NUTRITIVE RATIO

Is the measure of protein content in a feed

EXAMPLE OF NUTRITIVE RATIO

A feed has **75% TDN** (TOTAL DIGESTIBLE NUTRIENTS) AND **25% DP** (DIGESTIBLE PROTEIN). Calculate the nutritive ratio of this feed.

NR=1: TDN – DP

DP

$$= 1: \frac{75\% - 25\%}{25\%}$$

25%

$$= 1: \frac{50}{25}$$

25

$$= 1:2 \text{ (narrow)}$$

Meaning for every 1 part of digestible protein there's 2 parts of other nutrients

ANALYSIS OF NUTRITIVE RATIO

• **RATIO ABOVE 1:6**

- ☐ It's a WIDE RATIO
- ☐ Has LESS PROTEIN and MORE CARBOHYDRATES
- ☐ NOT SUITABLE for growth and production but SUITABLE for fattening and maintenance

• **RATIO BELOW 1:6**

- ☐ It's a NARROW RATIO
- ☐ Has MORE PROTEIN and LESS CARBOHYDRATES
- ☐ MOST SUITABLE for growth and production but NOT SUITABLE for fattening and maintenance

7. TYPES OF FEEDS

CONCENTRATE – feed with small volume per unit mass (not bulky)

ROUGHAGE – feed with large volume per unit mass (bulky)

DIFFERENCES BETWEEN ROUGHAGE AND CONCENTRATE

ROUGHAGE (HAY)

%TDN: Low (not easily digestible)

%Crude fibre: high

%crude protein: low

Cost: cheap

Animal utilised: ruminants only
ruminants and non-ruminants

Bulkiness: it is bulk

CONCENTRATE (MEAL)

%TDN: High (easily digestible)

%Crude fibre: low

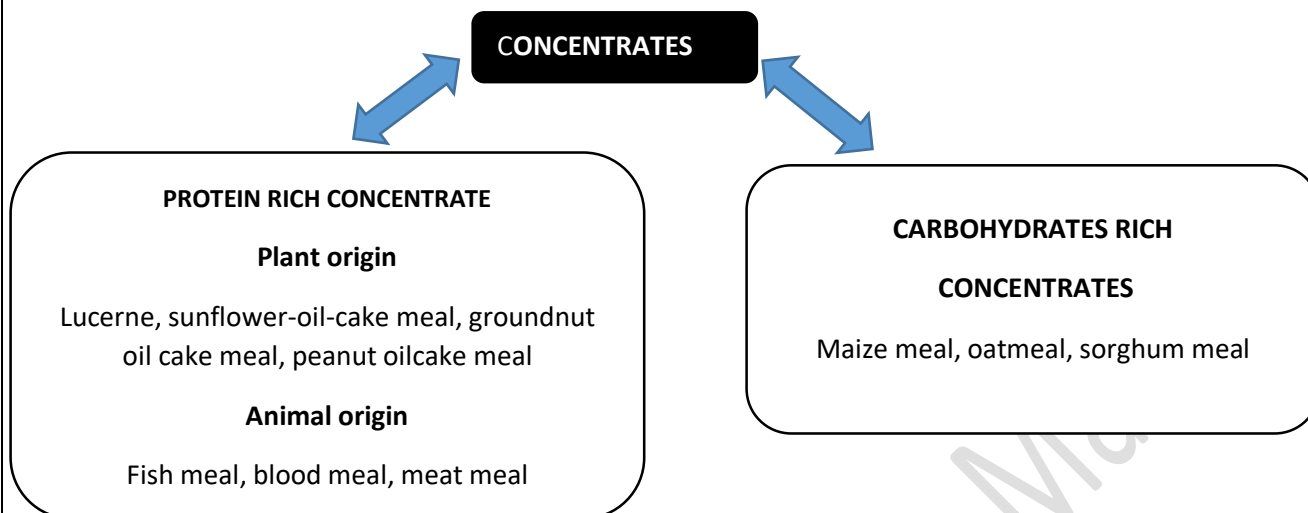
%crude protein: high

Cost: expensive

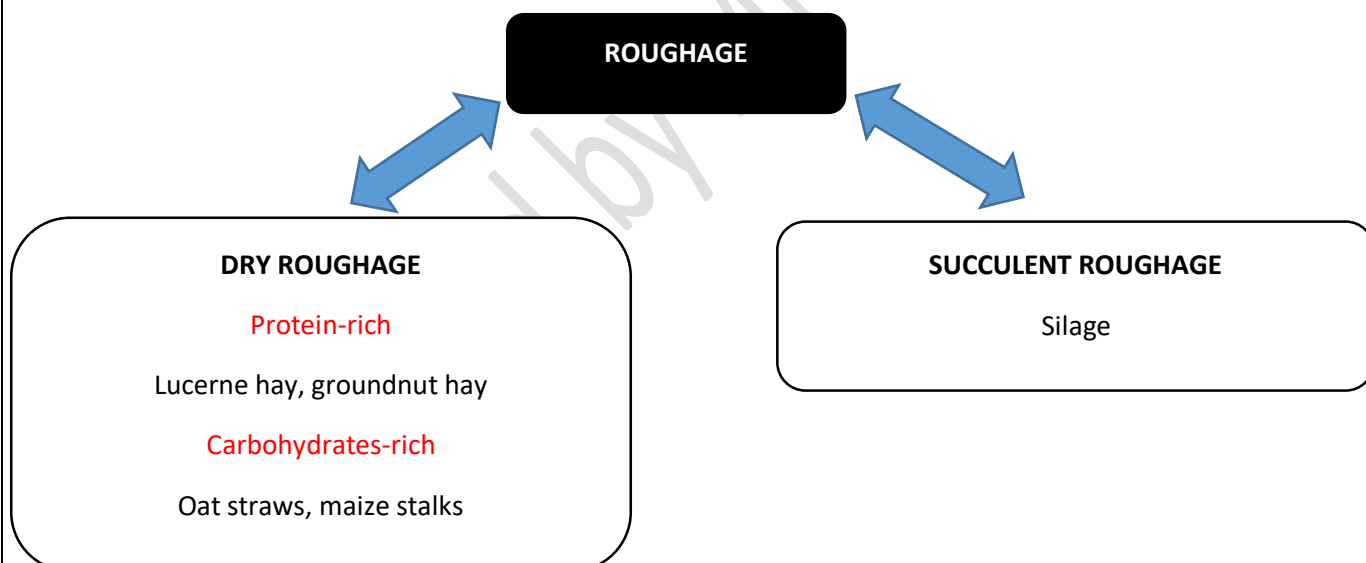
Animal utilized: both

Bulkiness: less bulk

TYPES AND EXAMPLES OF CONCENTRATES



TYPES AND EXAMPLES OF ROUGHAGE



8. SUPPLEMENTING RATION

This is additional feed given to animal to stimulate growth and production

WAYS TO SUPPLEMENT MINERALS

▪ MINERAL LICKS

- ☐ block containing mineral salts that are placed near drinking water

It is used to supplement: Urea

: Sodium

: Potassium

▪ INJECTION

- ☐ Iron injection in piglets to prevent anaemia

▪ CAFETIRIA STYLE/ FREE CHOICE/AD LIB

- ☐ Minerals are supplied to the feeding station that is usually controlled by a computer system

- ☐ Animal can feed on nutrients as much as the like

▪ ADD SOIL SOD

- ☐ To supplement iron to pigs kept in a pen with a concrete floor

▪ DOSING BY MOUTH

- ☐ Taking mineral into the mouth of animal

▪ SUPPLEMENTING RATIONS

- ☐ Adding mineral with feed

▪ ADD MINERAL IN DRINKING WATER

- ☐ Mineral salts are dissolved in drinking water

WAYS TO SUPPLEMENT VITAMIN

- Mix vitamin with feed
- Free choice/ cafeteria style
- Mix vitamin A with water
- Injection
- Dosing

PROTEIN SUPPLEMENT

Protein can be supplemented by adding NON-PROTEIN NITROGEN (NPN) SOURCES;

☐ UREA

Cheap source of NPN

Can be utilized by ruminants to make protein

It is poisonous when taken in large quantities

Can dissolve in water when there is rain and become poisonous to animals drinking this water

☐ BIURET

Expensive source of NPN

It is less soluble and safer to use

It cannot dissolve in water

9. GROWTH STIMULANTS

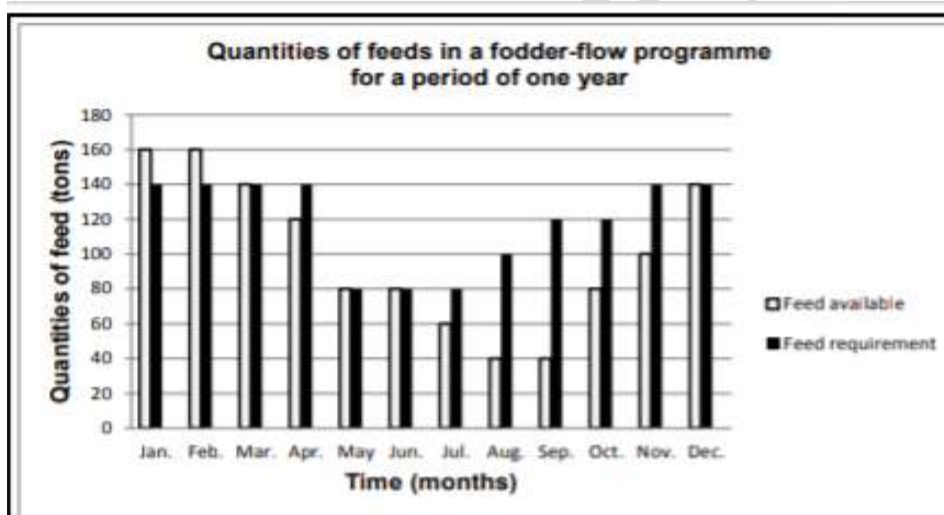
This are substances that are used to influence growth rate

TYPE OF GROWTH STIMULANTS

- ☐ **TRANQUILISER/ SEDATIVE** – Keep animal calm and eat more feed
- ☐ **ANTIBIOTICS** – Prevent disease that can affect growth rate in animals
- ☐ **THYROID REGULATOR** – It stimulates animal's metabolism and growth rate
- ☐ **HORMONES** – growth hormone in pellets are planted under the skin of animal to stimulate growth

10. PLANNING FODDER FLOW PROGRAMME

It is a strategic plan used by farmer to ensure that enough feed is available over a given period of time



FACTORS TO CONSIDER WHEN PLANNING A FODDER FLOW

- ☐ Resources available (e.g. pasture or supplement)
- ☐ Animal requirements
- ☐ Cost of feed
- ☐ Season

COST EFFECTIVE WAYS OF USING THE AVAILABLE FEED

- ☐ Storage
- ☐ Making hay
- ☐ Cutting
- ☐ Reduce number of animal

TYPES OF RATION

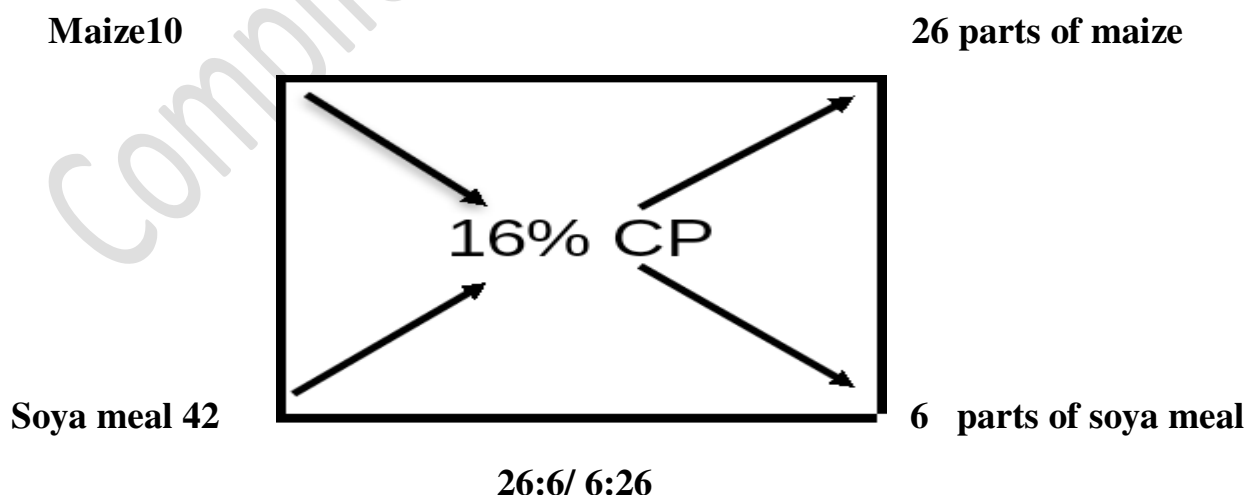
- ☐ **MAINTANANCE RATION** – amount of feed given to animal doing no work producing no product
- ☐ **PRODUCTION RATION** – it's over and above maintenance given to animal doing work and producing products

11. THE PEARSON SQUARE METHOD

Is a tool for balancing nutritional value of a feed mixture

EXAMPLE OF PEARSON SQUARE

A balanced ration of maize with 10%DP and soya meal with 42%DP was prepared for dairy cattle to meet the nutritional requirement of 16%DP



CALCULATING PERCENTAGES OF FEED MIXTURES ON A PEARSON SQUARE

$$26 + 6 = 32 \text{ (make this your denominator)}$$

$$\% \text{ of maize} = \frac{26}{32} \times 100$$

$$=81.25\%$$

$$\% \text{ of soya meal} = \frac{6}{32} \times 100$$

$$=18.75\%$$

YOU'RE NOW READY TO GRAB THE FIRST 50 MARKS OF YOUR PAPER 1

NOTES

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TOPIC 2**QUESTION 3****PAPER 1**

ANIMAL PRODUCTION

- ❖ To increase production of animal farmers should plan on which production system to be used according to the aim and economic standard of an individual farmer

1. ANIMAL PRODUCTION SYSTEMS

Animal production system are divided into:

Intensive production system

- ☐ This It is a production system that is characterized by high inputs of capital, labour and usage of technology
- ☐ Animals are kept on high densities and are fed with special formulated feed
- ☐ Animals are controlled and closely supervised
- ☐ Has more environmental effects as animal produce lot of waste

Extensive production system

- ☐ This is a production system that uses few inputs of capital, less labour and less use of technology
- ☐ There is less human interference since animal are kept on a natural pasture
- ☐ It has less environmental effects as it use vegetation sustainably

DIFFERENCES BETWEEN INTENSIVE AND EXTENSIVE PRODUCTION SYSTEM

	INTENSIVE PRODUCTION	EXTENSIVE PRODUCTION
GOAL	Making profit	Minimizing risk
PRODUCTION OUT-PUT	High production out-put	Low production out-put
CAPITAL INVESTMENT	High capital investment	Low capital investment
LABOUR	More labourers	Less labourers
AREA OF LAND	Occupies small area	Occupies large area
MANAGEMENT	Animal are carefully managed	Animals are less managed
ENVIRONMENTAL EFFECTS	More environmental effects	Less environmental effects
FEEDING	Animal kept in feedlot, broiler unit, layer units, furrowing pen and are fed with special formulated feeds	Animals kept in the veld to graze on natural pasture

FACTORS DETERMINING PRODUCTION UNDER INTENSIVE AND EXTENSIVE PRODUCTION

UNDER INTENSIVE PRODUCTION SYSTEM

- ☐ **Feeding** – farmer need to produce or buy feed for the animal (specifically feed suitable for growth and production)
- ☐ **Environment** – shelter should be provided to control environmental conditions (installation of heaters and fans)
- ☐ **Breeding** – the farmer select animal with desired characteristics (such as those that are adapted to produce high quality products, resistant to disease and pests) to be used for breeding purpose

UNDER EXTENSIVE PRODUCTION SYSTEM

- ❑ **Feeding** – farmer optimise the use of natural pasture for nutrition
 - ❑ **Environment** – they don't have artificial shelter, they rely on trees or other natural structures for protection against environmental conditions
 - ❑ **Breeding** - nature select animals with desired characteristics that are adapted to the environment to survive
-

2. FARMING SYSTEMS

Farming system are divided into:

❑ Small-scale (subsistence) farming system

- . Farmer grows crops and keeps livestock to feed their families rather than to sell
- .It is practiced intensively in rural areas of South Africa
- .Less use of technology
- .They have small plot “small-scale”

❑ Large-scale (commercial) farming system

- .Farmer grows crops and keeps livestock to sell at the market to make profit.
 - .Modern technology is used
 - .Contribute to environmental pollution
 - .They have large plots “large-scale”
-

3. ANIMAL SHELTER, HOUSING AND PROTECTION

REASON FOR PROVIDING SHELTER TO ANIMALS

Shelter provide protection of animals against:

- ☐ Extreme heat
- ☐ Extreme cold
- ☐ Wetting by rain
- ☐ Theft
- ☐ Predation

DIFFERENT STRUCTURES USED FOR SHELTER

Feedlot- restricted area where large animals are kept for maximum production of meat

Battery system- restricted area where chickens are kept for maximum production of eggs

- ❖ Chickens that produced eggs are called layers

Broiler unit – restricted area where chickens are kept for maximum production of meat

- ❖ Chickens that produce meat are called broilers

Backyard system-

Free range system-

Deep litter-

BASIC LAYOUT OF HOUSE FOR ANIMALS (chickens)

Built on slight slope

- ❖ For water run off

Dry bedding (use straws, sawdust or wood shaving)

- ❖ Protect animals against cold
- ❖ Cemented floor
- ❖ Easy to clean (prevent parasite infestation)
- ❖ Avoid mud when wet

Long building side face east

- ❖ Warm in winter and cool in summer

4. BEHAVIOUR AND HANDLING OF FARM ANIMALS

ANIMAL BEHAVIOUR

- ☐ This is the way in which animals interact and reacts with human, other animals and the environment

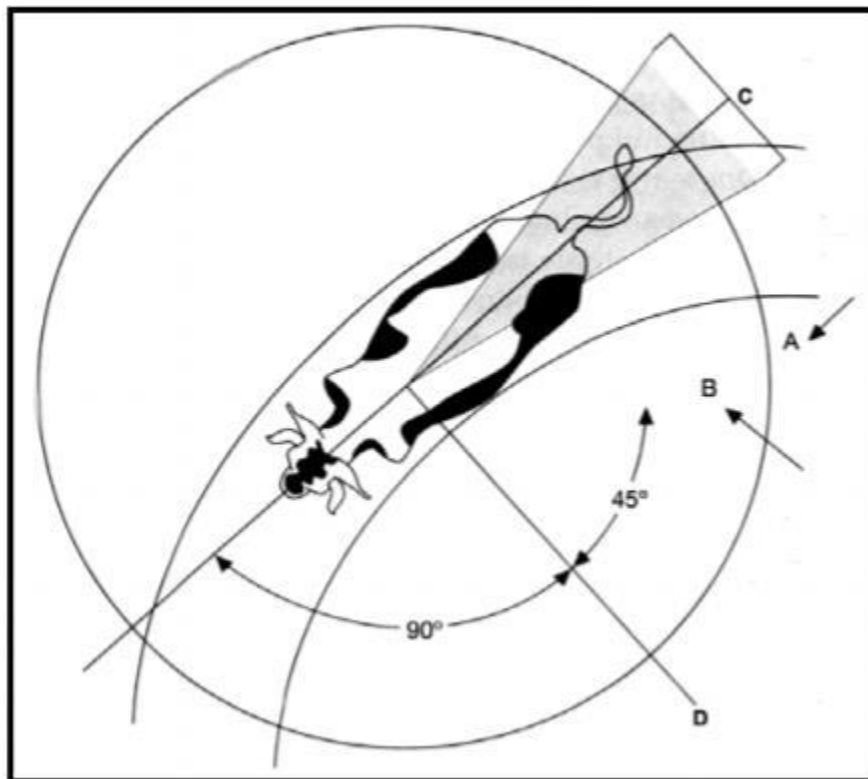
FACTOR DETERMINING BEHAVIOURS OF ANIMALS

Tameness

- ☐ Type of breed
- ☐ Age
- ☐ Physiological state
- ☐ Health status
- ☐ Flight zone

THE FLIGHT ZONE

Is the distance that the animal likes to keep between themselves and threat of danger



A= HANDLERS POSITION

- ❖ Handler should be outside the edge of flight zone.
- ❖ In this position the handler is not a threat to the animal
- ❖ Handler initiate movement

B= FLIGHT ZONE

- ❖ The distance the animal keep between themselves and threat to danger

C= BLIND SPOT

- ❖ Area in which animal will kick when approached

D= BALANCE POINT

COMMON BEHAVIOURS OF DIFFERENT FARM ANIMALS

COMMON NORMAL BEHAVIOUR OF CATTLE (large animal)

- ☐ **GRAZZING:** they divide a day into periods of GRAZZING, REGURGITATION AND REST
- ☐ **SIGHT:** position of eye give them a wide angle view (without turning their heads)
- ☐ **HEARING:** They have strong sense of hearing (can be stressed when exposed to too much noise)
- ☐ **SOCIAL INSTINCTS:** they have herd instinct (can be agitated and stressed when isolated)

: They may refuse to cross a shadow

ABNORMAL BEHAVIOUR OF LARGE CATTLE UNDER DISTRESS

- o PAWING
- o RAPID TAIL MOVEMENT
- o RAISED BACK FUR
- o SNORTING

SMALL ANIMALS (SHEEP and GOATS)

COMMON NORMAL BEHAVIOUR OF SMALL ANIMALS:

SHEEP AND GOATS

- ☐ They have a flock instinct
- ☐ They urinate and defecate when disturbed
- ☐ They have strong eyesight
- ☐ They have very strong fear response

PIGS

- ❑ It is the cleanest and most ordered farm animal
- ❑ They reserve a place for urination and defecation and a dry place for sleeping (they don't defecate where they sleep)

ABNORMAL BEHAVIOR OF PIG UNDER DISTRESS

- o TAIL BITING
 - o EAR BITING
 - o CANNIBALISM (kill and eat other pigs in the pen)
 - o BELLY NIBBLING
-

ANIMAL HANDLING

It is when you touch, hold or move animal one place to another

REASON FOR HANDLING FARM ANIMALS

When administering medication to animals

- When dehorning, castration and docking
- When milking
- When transporting animals
- When taking data such body weight, and pregnancy testing
- When inseminating animals
- When slaughtering

TOOL, TECHNIQUES AND EQUIPMENTS USED FOR HANDLING OF FARM ANIMALS

WHEN HANDLING A CATTLE:

- ☐ HALTER

USE OF HALTER

- ❖ restrain animal by its head usually when milking

- ☐ CRUSH

USE OF CRUSH

- ❖ restrain large animals

DESIGN FEATURES OF A CRUSH

- ❖ High and strong solid sides
- ❖ Wide and straight to provide clear path
- ❖ No sharp pointing objects

- ☐ LOADING RAMP

USES OF RAMP

- ❖ To load and unload animals

DESIGN FEATURE OF A LOADING RAMP

- ❖ Should not be slippery
- ❖ Should not be too steep

- ☐ SPOTLIGHT

- ☐ STRONG ROPE

- ☐ ELECTRIC FENCE

- ☐ WHIP

- ☐ GUIDING DOGS

- ☐ RED FLAG-

USE OF RED FLAG

- ☐ used when animals are crossing busy roads

☐ WHISTLE

WHNE HANDLING A PIG

- ❖ PLYWOOD BOARD
- ❖ PLASTIC SHAKERS
- ❖ BOX
- ❖ CRUSH

GUIDELINE WHEN HANDLING FARM ANIMALS

- ☐ Use correct handling equipment
- ☐ Use correct handling facility
- ☐ Handler should be skilled
- ☐ Walk calmly and quiet
- ☐ Beware of flight zone
- ☐ Avoid chasing and grabbing
- ☐ Never approach animal from the back (blind spot)
- ☐ Do not mix animal in one crush

GUIDELINE WHEN TRANSPORTING AND MOVING ANIMALS

- ☐ Keep animal together for few days before transporting
- ☐ Dehorn animal before transporting
- ☐ Do not mix animal
- ☐ Permit should be completed
- ☐ Animals should be transported when roads are not too busy
- ☐ Truck floor must not be slippery
- ☐ Truck must be ventilated
- ☐ Do not load animal too long before departure

INCORRECT HANDLING METHODS OF FARM ANIMALS

- ☐ Throwing objects to animals
- ☐ Handling chicken with feathers (should be handled with feet or wings)
- ☐ Handling sheep with wool (should be handled with hind legs)
- ☐ Kicking and beating animal

You are now ready to tackle your question 3 of your paper one. But only one topic pending (animal disease and animal pests) to complete your entire question 3 of paper 1

Notes

Compiled by Mr E.C.

TOPIC 3

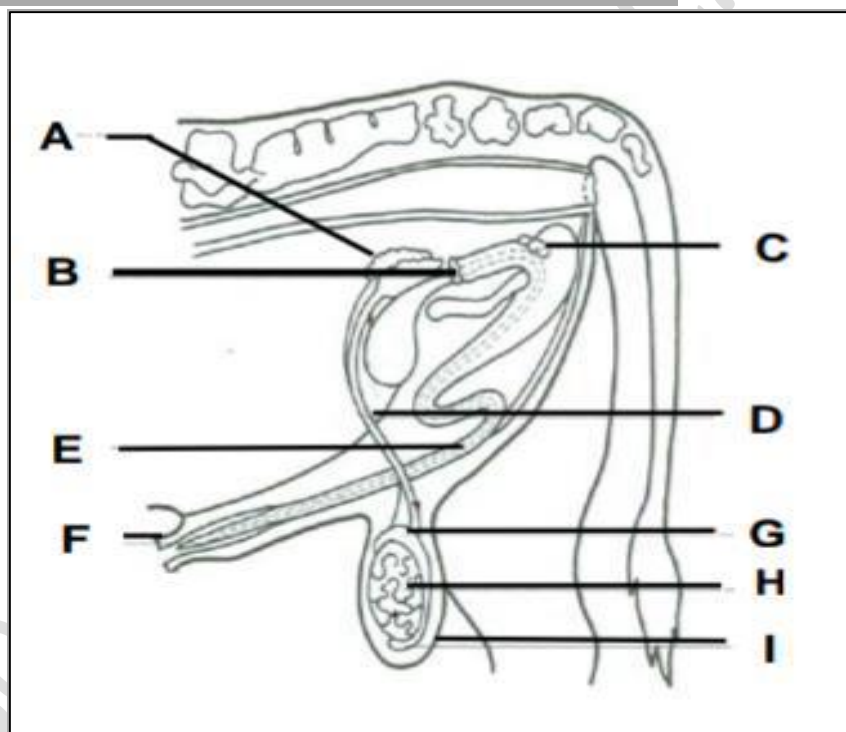
Question 4

Paper 1

ANIMAL REPRODUCTION

- For farm animal to thrive, they must be able to reproduce
- Proper functioning of male and female reproductive system is the key to successful production of offspring

1. MALE REPRODUCTIVE SYSTEM



A= seminal vesicle. B= Prostate gland. C = Cowper's gland. D= Sperm duct. E=Urethra. F= Penis. G= Epididymis. H= Testis. I= Scrotum.

FUNCTIONING OF MALE REPRODUCTIVE SYSTEM

□ SCROTUM

- Holds and protect the testis
- Regulates temperature for normal sperm production

□ TESTES

- Produce sperm (male gamete)
- Produce testosterone (male hormone)

➤ TESTOSTERONE

Stimulate production of sperm

Development of male characteristics

□ EPIDIDYMIS

- Stores , matures and transport sperm

□ SPERM DUCT

- Transport sperm to the urethra

□ URETHRA

- Transport both urine and semen to the outside

□ PENIS

- Deposit semen to the female's body during mating

□ MALE ACCESSORY GLAND

➤ SEMINAL VESICLE

Is the largest sex gland

Secretes sticky fluid that provide energy for sperm

➤ PROSTATE GLAND

Forms a ring around the urethra

Secrete a milky, alkaline fluid that regulates ph.

➤ COWPER'S GLAND

Secrete fluid that lubricate and clean the urethra

ADAPTATION OF MALE REPRODUCTIVE SYSTEM

ADAPTATION OF THE TESTES: contain specialized cells;

- **SERTOLI CELLS**- supply sperm with nutrients
- **LAYDIG CELLS**- produce hormone testosterone
- **EPITHELIAL CELLS**- produce sperm

PROCESS OCCURING IN MALE REPRODUCTIVE SYSTEM

□ SCROTUM

Process: **Temperature regulation**

□ TESTES

Process: **Meiosis** (cell division)

: **Spermatogenesis** (sperm formation)

□ EPIDIDYMIS

Process: **Sperm maturation**

□ SPERM DUCT

Process: **Ejaculation**

□ PENIS

Process: **Copulation**

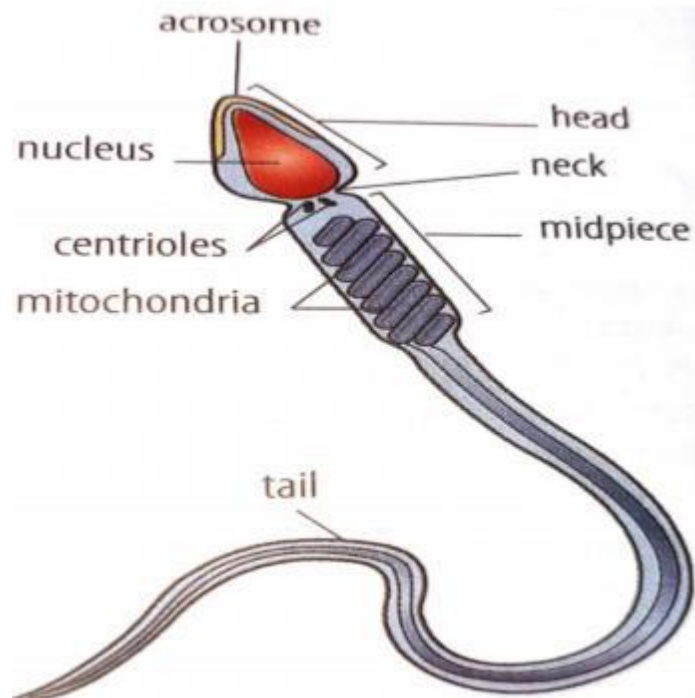
SPERMATOGENESIS

Is the process that involve the formation sperm

PROCESS OF SPERMATOGENESIS

1. **SPERMATOGONIUM** (the undifferentiated male germinal epithelial cell) found in the wall of the seminiferous tubule divides by **MITOSIS** to form a primary spermatocytes that are diploid (2n)
2. **PRIMARY SPERMATOCYTE** divides by **MEIOSIS 1** to form secondary spermatocytes
3. **SECONDARY SPERMATOCYTE** divides by **MEIOSIS 2** to form haploid spermatid
4. **SPERMATID** undergo differentiation (change) and develop into a **MATURE SPERM**

STRUCTURE AND FUNCTIONING OF SPERM CELL



- ❑ **ACROSOME**- contain enzyme that digest the outer membrane the egg during fertilization
- ❑ **NUCLEOUS**- contain genetic material
- ❑ **CENTRIOLES**- help with cell division
- ❑ **MITOCHONDRIA** –supply energy
- ❑ **TAIL** – enable sperm to move (propels the sperm forward)

DIFFERENCES BETWEEN SPERM CELL AND SEMEN

- ❑ **SPERM CELL**- is a male gamete
- ❑ **SEMEN**- is a fluid containing sperm

ABNORMALITIES IN THE MALE REPRODUCTIVE SYSTEM

- These abnormalities may cause the inability of a bull to serve and fertilize a cow.
- Abnormalities can be either permanent or temporal

STERILITY AND INFERTILITY

STERILITY

- Is a permanent inability to reproduce
- Is a total loss of fertility

Caused by congenital defect (defects that are present from birth)

FACTORS CAUSING STERILITY

- ☐ **HYPOPLASIA** – underdevelopment of one or both testes
- ☐ **CRYPTORCHIDISM** – failure of one or both testes to descend from abdominal cavity
- ☐ **HERMAPHRODISM** – animal having both male and female reproductive system
- ☐ **AZOSPERMIA** – absence of sperm in semen
- ☐ **AGE** – older animals permanently lose their libido

INFERTILITY

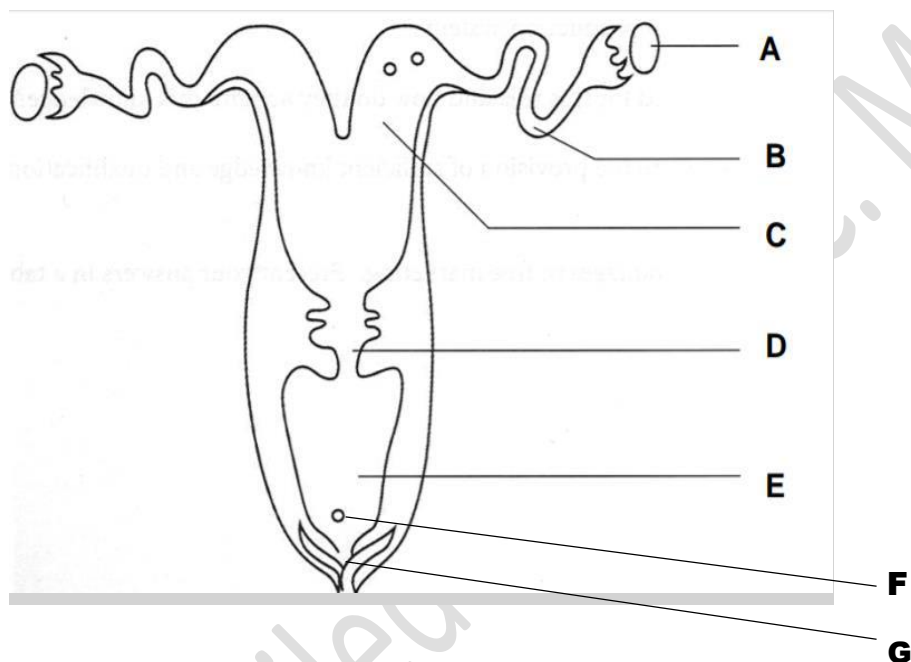
- Temporal inability to reproduce
- Fertility is not totally lost
- It can be corrected and reclaim the animal's ability to reproduce

FACTORS CAUSING INFERTILITY

- ☐ **Obesity**
- ☐ **IMPORTANCE** – inability to copulate
- ☐ **Injuries**

- ☐ Experience
- ☐ Lack of libido
- ☐ Climate
- ☐ Malnutrition

2. FEMALE REPRODUCTIVE SYSTEM



A= Ovary. B= Oviduct. C= Uterus. D= Cervix. E= Vagina. F= Clitoris. G= Vulva

FUCNTIONING OF FEMALE REPRODUCTIVE SYSTEM

☐ **OVARIES**

Function: Produce female gamete (**ovum**)

: Produce female hormone (**Oestrogen & Progesterone**)

➤ **OESTROGEN**

Function: Stimulate oestrus

: Stimulate the thickening of endometrium

: Development of female characteristics

➤ PROGESTERONE

Function: Maintain pregnancy

: Prepare the wall of uterus for implantation

□ INFUNDIBULUM

Function: Catch the egg during ovulation

□ OVIDUCT

Function: Transport fertilized egg to the uterus

□ UTERUS

Function: Implantation of fertilized egg

□ CERVIX

Function: **Secretes mucous that prevent bacterial infection**

: **Secretes fluid that neutralize the acidity of the vagina**

□ VAGINA

Function: Receives semen during copulation

: Serves as a birth canal

PROCESS OCCURRING IN THE FEMALE REPRODUCTIVE SYSTEM

□ OVARIES

Process: Oogenesis (formation of egg)

: Meiosis (cell division)

□ OVIDUCT

Process: Fertilization (site of fertilization)

☐ UTERUS

Process: Implantation

☐ VAGINA

Process: Copulation

ABNORMALITIES IN THE FEMALE REPRODUCTIVE SYSTEM

STERILITY AND INFERTILITY

STERILITY

Permanent inability to conceive

It is caused by congenital defect and genetic defects

FACTORS CAUSING STERILITY IN COWS

- ☐ **HYPOPLASIA** – underdevelopment of one or both ovaries
- ☐ **FREEMARTINISM**
- ☐ **HERMAPHRODISM** –having both male and female reproductive organs
- ☐ **DOUBLE CERVIX**
- ☐ **ABNORMAL HYMEN**

INFERTILITY

- ☐ Temporal inability to conceive
- ☐ It can be corrected and reclaim the reproduction of animal

FACTORS CAUSING INFERTILITY IN COWS

- ☐ **MALNUTRITION**
- ☐ **ANOESTRUS** – animal showing no signs of oestrus
- ☐ **NYMPHOMANIA** – cow is permanently on oestrus
- ☐ **REPEAT BREEDING SYNDROM** – failure of animal to conceive after several attempts of mating

- ❑ **DISEASE**- such as infection of the uterus (Metritis)
- ❑ **EXPERIENCE**

3. OESTRUS AND OESTRUS CYCLE

Is the hormonal controlled cycle of activities taking place in the female reproductive system over 21 days

Can be disturbed by PREGNANCY, DISEASE & CLIMATE

FEMALE HORMONES THAT CONTROL THEN OESTRUS CYCLE

❑ GONADOTROPIC RELEASING HORMONE

- Secreted by hypothalamus in the brain

Function: Stimulate release of FSH & LH

❑ FSH

- Secreted by hypophysis in the brain

Function: Stimulates development of follicle of the ovaries

❑ OESTROGEN

- Produced by the follicle of the ovary

Function: Stimulates oestrus

: Stimulate development of female characteristics

: stimulate development of endometrium

❑ LH

- Secreted by the hypophysis in the brain

Function: stimulate ovulation (cause developed follicle to burst and egg is released)

: stimulate formation of corpus luteum

□ PROGESTERONE

- Secreted by the corpus luteum of the ovary

Function: maintain pregnancy

STAGES OF OESTRUS CYCLE IN COWS

1. PRO-OESTRUS

- Last 2-3 days
- First stage in the cycle
- FSH level start increasing
- Follicle start growing and developing
- Oestrogen level start increasing

2. OESTRUS

Is the stage in the oestrus cycle where female is receptive to male and allow mating

- Last 12- 18 hours (18 hours is the average length)
- Shortest stage in the cycle
- Oestrogen level reach peak (high)
- Animal start showing signs of oestrus

SIGNS OF OESTRUS (HEAT) IN COWS

- Red swollen vulva
- Restlessness
- Mount other cows and allow them to mount her
- Mucous discharge appear on the vulva

ALTERNATIVE METHODS OF DETECTING AN ANIMAL ON OESTRUS (HEAT)

- ☐ **CHIN-BALL MARKER-** is a device strapped on the chin of animal expected to mount a cow on heat. The ink of the marker will leave a streak on the back of the cow that was mounted or attempted to be mounted
- ☐ **TAIL –CHALKING-** the chalk is rubbed on the back within the tail of the cow to be detected.
- ☐ **PEDOMETER-** is a device that is strapped around the lower leg of a cow to detect movement
- ☐ **HEATMOUNT DETECTOR-** is a device glued at the back of the cow suspected to be on heat. Pressure from the chest of mounting animal will turn the originally white detector to be red

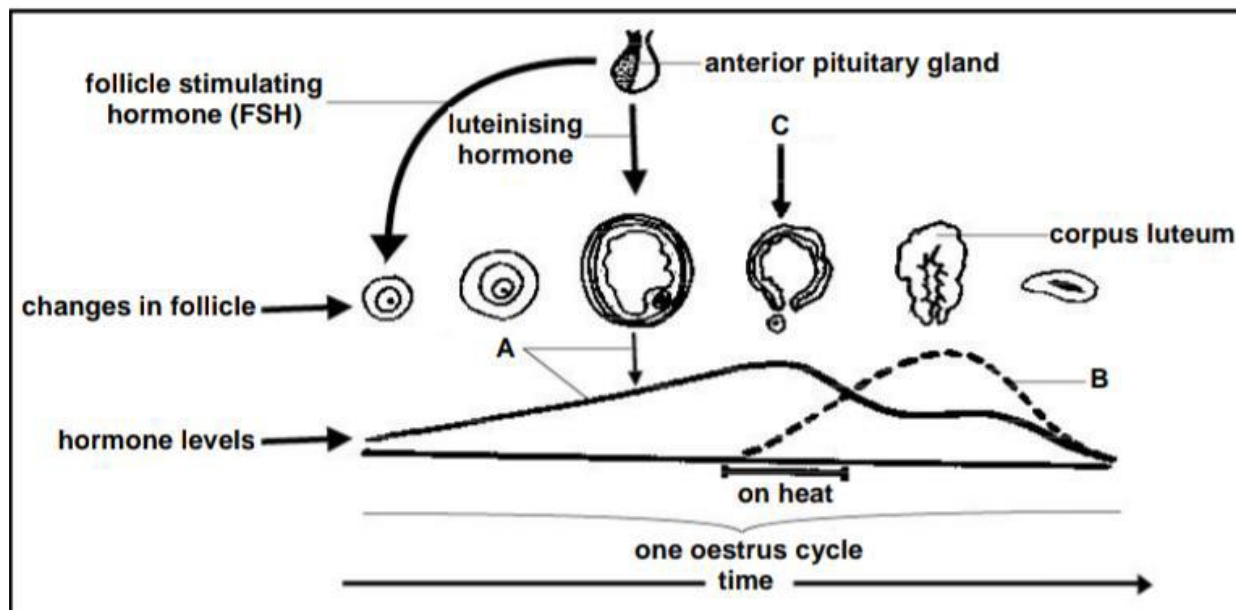
3. MET-OESTRUS

- ☐ Last 3-4 days
- ☐ LH level increases
- ☐ Ovulation take place (bursting of the follicle and the release of egg)
- ☐ Corpus luteum start developing
- ☐ Progesterone level starts increasing

4. DI-OESTRUS

- ☐ Last 12-16 days
- ☐ Longest stage in the cycle
 - **IF FERTILISATION TOOK PLACE** (animal is pregnant)
 - ☐ Corpus luteum is fully developed
 - ☐ Progesterone level reach peak
 - **IF FERTILISATION DID NOT TAKE PLACE** (animal is not pregnant)
 - ☐ Corpus luteum regress (degenerates)
 - ☐ Progesterone level decrease

GRAPH SHOWING OESTRUS CYCLE



Graph represents: A- OESTROGEN

: B- PROGESTERON

SYNCHRONISATION OF OESTRUS

Is the process involving making group of animals to come to oestrus approximately at the same time

HORMONES USED DURING SYNCHRONISATION

- ☐ MGA- it is mixed with feed
- ☐ PROGESTERONE INJECTION
- ☐ PROSTAGLANDIN INJECTION
- ☐ OESTROGEN INJECTION
- ☐ GONADOTROPHIC HORMONE INJECTION

5. MATING

Mating is divided into: **natural mating** and **artificial mating**

NATURAL MATING

Stages of natural mating

- ☐ Courtship
- ☐ Mounting
- ☐ Copulation
- ☐ Ejaculation
- ☐ Dismounting

Factors regulating mating behavior

- ☐ Experience
- ☐ Environment
- ☐ Genetics

ARTIFICIAL MATING

Divided into:

- Artificial insemination
- Embryo transfer
- Cloning

ARTIFICIAL INSEMINATION (AI)

Is a technique where semen is collected from a male animal and deposited into the uterus of a female animal for fertilization?

REQUIREMENTS FOR ARTIFICIAL INSEMINATION

- ☐ Animal must be on oestrus
- ☐ Inseminator must be skilled
- ☐ Equipment must be clean

➤ **COLLECTION OF SEMEN**

Method of collection includes

☐ **ARTIFICIAL VAGINA**

☐ **ELECTRO-EJACULATOR**- involve application of a series of short, low voltage pulse of currents into the rectum and results in ejaculatory response

➤ **SEMEN DILUTION** (treatment)

Semen is diluted using:

- ☐ **SKIMMED MILK** – control Ph.
- ☐ **EGG YOLK**- protect semen from change in temperature
- ☐ **GLYCEROL**- prevent semen from freezing
- ☐ **ANTIBIOTICS**- prevent bacterial infection

➤ **SEMEN EVALUATION**

☐ **MACRO SCOPIC EVALUATION** (with naked eyes)

Characteristics of semen seen with naked eye;

- ☐ Colour

RED- represents fresh blood

BROWN- represents infection

GREY- represents old blood

- ☐ Density
- ☐ Ph. (6, 9)
- ☐ Volume

☐ **MICROSCOPIC EVALUATION** (with a microscope)

Characteristics of semen seen under a microscope;

- ☐ Sperm mobility (movement)
- ☐ Sperm abnormalities

- ☐ Percentage of living sperm cell

CHARACTERISTICS OF GOOD QUALITY SEMEN

- ☐ Its opaque
- ☐ Milky and sticky
- ☐ Smell like fresh milk
- ☐ Have more than 80% living sperm cell (sperm count)
- ☐ Have less than 20% dead or having abnormalities (sperm count)

CHARACTERISTICS OF POOR QUALITY SEMEN

- ☐ Reddish indicates presence of blood
- ☐ Brown indicates infection
- ☐ Abnormal sperm count (less than 80% living and more than 20% dead sperm cell)
- ☐ Abnormal sperm movement
- ☐ Abnormal sperm structure (morphology)

SEMEN STORAGE AND THAWING

Semen is stored in straws

- FOR LONG PERIOD : -196°C on a liquid nitrogen

Thawing of semen:

- Place straws in 37°C water for 30-40 sec

TIMING OF INSEMINATION

- ☐ If the animal shows signs of oestrus in the morning it should be inseminated in the afternoon. If it shows signs of oestrus in the afternoon should be inseminated next morning
- ☐ Should be inseminated 12 hours after the visible signs of oestrus

ADVANTAGES OF AI

- ☐ Less spread of infection
- ☐ Semen from one bull can inseminate many cows
- ☐ Semen can still be used after the death of the male animal
- ☐ Semen from bulls from overseas can be used

DISADVANTAGES OF AI

- ☐ It is expensive
- ☐ Disease can spread rapidly
- ☐ Cow maybe injured if the inseminator is not skilled
- ☐ Time consuming

EMBRYO TRANSFER

Is the transfer of fertilized egg (embryo) from the **DONOR** to the **RECIPIENT**

The **DONOR** has superior characteristics

The **RECIPIENT** has genetically inferior characteristics

STEPS OF EMBRYO TRANSFER

1. Synchronization of donor and recipient
2. Superovulation of donor
3. AI of donor
4. Embryo flushing from the donor
5. ET to the recipient

ADVANTAGES OF EMBRYO TRANSFER

- ☐ Large number of offspring can be produced within a short space of time
- ☐ Prevent extinction of endangered species
- ☐ Genetics are conserved

DISADVANTAGES OF EMBRYO TRANSFER

- ☐ It is expensive
- ☐ Skills is required
- ☐ Higher chances that recipient abort the calf

CLONNING

Is the breeding of animal to produce offspring that is genetically identical to the original organism

STEPS OF THE CLONNING PROCESS

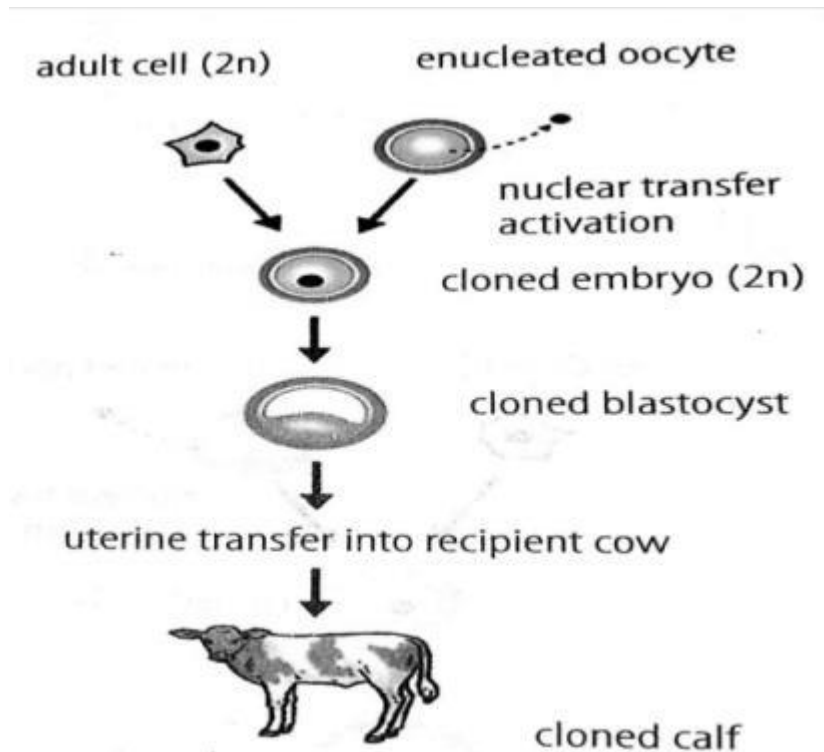
- ☐ Nucleus from Somatic cell ($2n$) is collected from the animal to be cloned (donor)
- ☐ Egg cell (n) is collected from the animal to be cloned
- ☐ Nucleus is removed from the egg cell (enucleation)
- ☐ Nucleus from the somatic cell ($2n$) is fused with the enucleated egg cell
- ☐ Electrical shock stimulates cell division
- ☐ Egg cell divides to form an embryo
- ☐ Embryo is placed in the uterus of a surrogate
- ☐ And a clone is born

TYPES OF CLONNING

REPRODUCTIVE CLONNING

Result in the formation of a whole organism

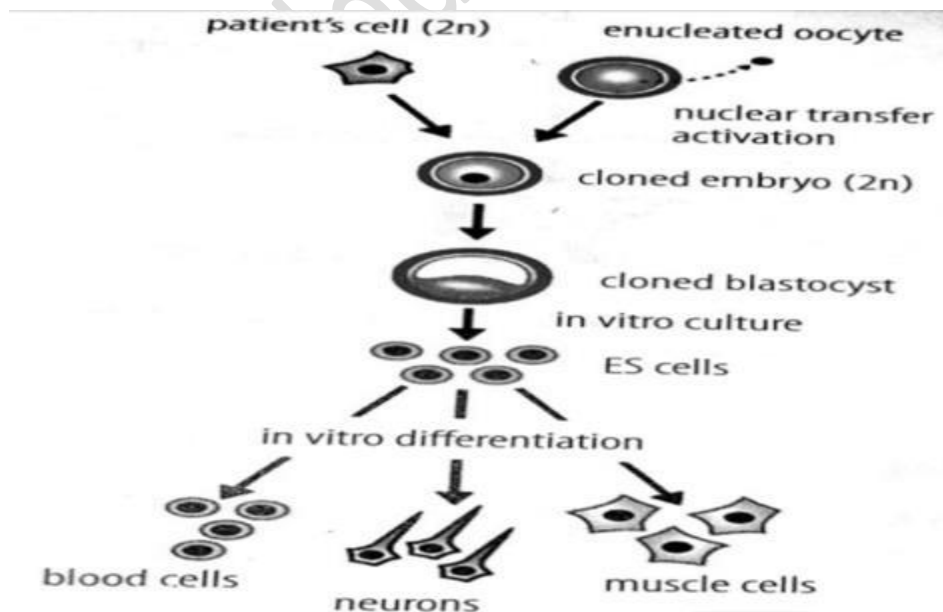
The cloned embryo is placed in the uterus of a female animal



□ THERAPEUTIC CLONNING

Used in production of organs, cells and tissues

It aim on finding cure for disease (intention is not to create an offspring) through the use of stem cells



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AIMS OF CLONNING

- ☐ To produce large number of genetically identical animal
- ☐ Produce offspring from superior animals
- ☐ To achieve high quality meat and dairy production
- ☐ To find cures for disease

6. FERTILISATION

Is the fusion of sperm (male gamete) and egg cell (female gamete) to form a zygote

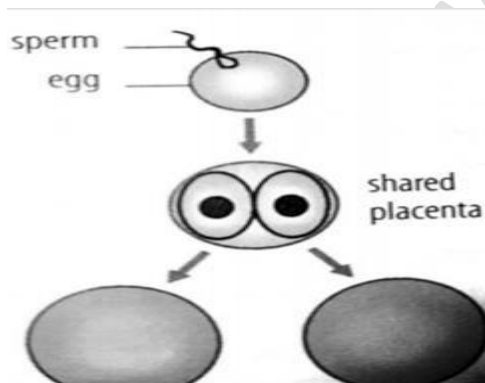
☐ MONOZYGOUS TWINS

Identical twins

They of same sex

Develop from fertilization of single egg

They share same placenta



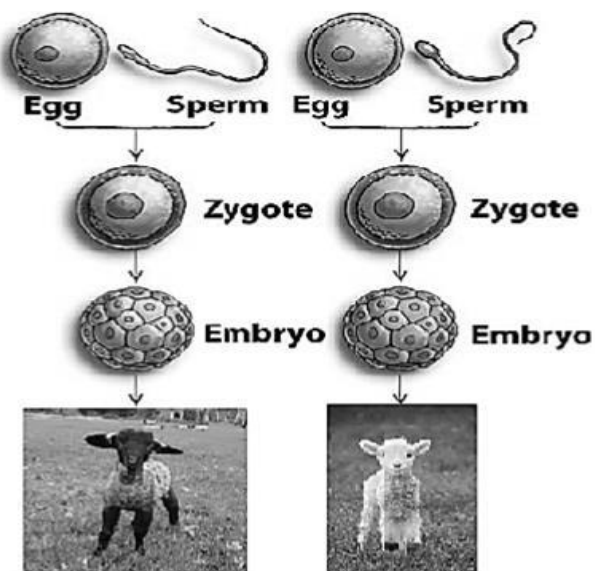
☐ DIZYGOUUS TWINS

Non-identical twins

They are of opposite or same sex

Develop from fertilization of two separate eggs

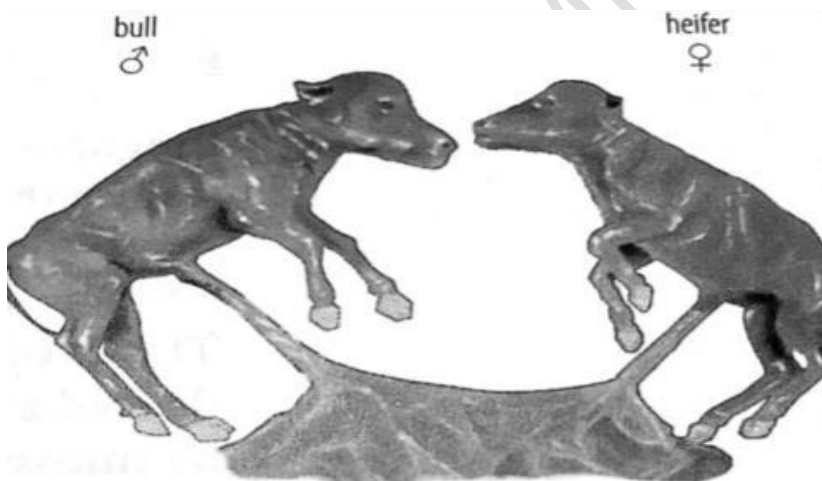
They share different placenta



□ FREEMARTINISM

Infertile or sterile female calf that develop in the uterus with the normal male calf

Male hormone of the developing bull calf affects the female calf.



7. PREGNANCY/ GESTATION

Is the period between fertilization and birth (it starts when the egg is fertilized until the animal give birth

DURATION: 280 days

STAGES OF PREGNANCY

□ OVUM PERIOD

First stage of pregnancy

During this stage the following occur:

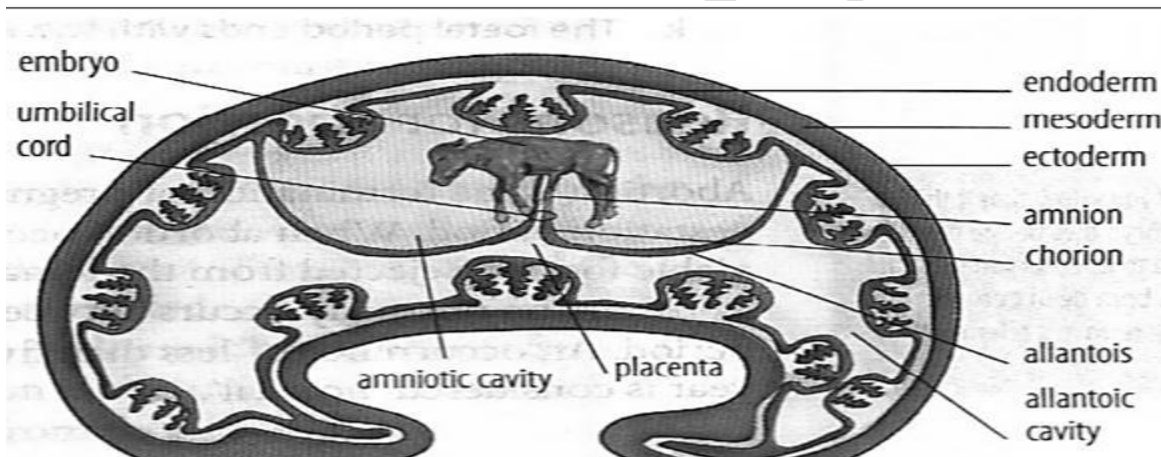
The fertilized egg (zygote) travels along the oviduct to the uterus

Last from fertilization until implantation

Zygote divides by mitosis (this is called **CLEAVAGE**) to form a blastocyst

Blastocyst attach to the wall of uterus (this is called **IMPLANTATION**)

□ EMBRYONIC PERIOD



Second stage of pregnancy

During this stage the following occur:

Blastocyst divides to form an embryo

Cells differentiate to form tissues, organs and system (e.g. urinary system and digestive system etc.)

Extra-embryonic membrane that covers the embryo develop as follows;

➤ CHORION

Is the outer membrane

Attached to the uterus

➤ AMNION

Is the inner membrane

It encloses amniotic fluid

Embryo is connected to the amnion by umbilical cord

➤ ALLANTOIS

It grows out of the urinary system

It collects urine from the unborn calf

□ **PLACENTA** attach the embryo to the wall of uterus

It brings blood of the mother and the embryo in close contact but there is no mixing

It allows exchange of nutrients, gases, and elimination of waste material

In the early embryonic development cells migrate to the interior of the embryo, forming the three primordial germ layers:

Ectoderm

Is the outer layer

It gives rise to the nervous system and the epidermal skin cells

Mesoderm

Is the middle layer

It gives rise to the skeletal muscles, bone cartilage, joints and urogenital organ

Endoderm

Is the inner layer

It gives rise to the digestive system and other internal organs

□ FOETAL PERIOD

Is the third stage of pregnancy

During stage the following occur;

The organs of the embryo grow and develop

Embryo develops into a foetus

Foetus increases in volume and mass

Foetus grows and shows characteristics of normal mammal

8. ABORTION

Is the termination of pregnancy before normal parturition

CAUSES OF ABORTION

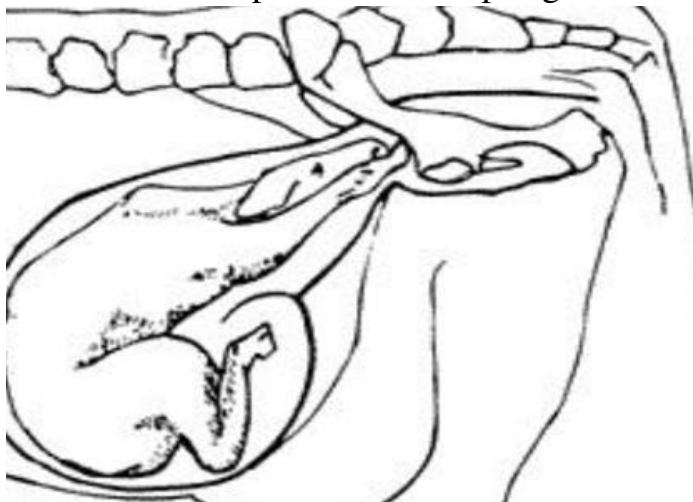
- ☐ Hormonal disturbance
- ☐ Stress and injuries
- ☐ Poison
- ☐ Allergies
- ☐ Multiple birth (twinning)

OTHER FACTORS THAT MAY CAUSE FOETUS TO DIE:

- ☐ **MUMMIFICATION**- foetus dies after the skin and skeleton have already been formed i.e. amniotic fluid and placenta dries out
 - ☐ **RESORPTION**- termination of pregnancy without signs of loss of foetus loss i.e. foetus is attached to the uterus
 - ☐ **MACERATION** – is the decaying of soft tissue leaving behind only bones (may lead to bacterial infection)
 - ☐ **HYDRO-FOETUS**- excessive amniotic fluid collects in the chorion and under the skin and between muscles of the foetus
-

9. PARTURITION (BIRTH)

Is the normal separation of offspring from the body of the mother



SIGNS OF PARTURITION (signs of a cow about to give birth)

Isolates herself

- ☐ Urinates and defecates often
- ☐ Loss of appetite
- ☐ Drop in milk production
- ☐ Vulva enlarges and become soft

STAGES OF PARTURITION

➤ **PREPARATORY STAGE**

- ☐ First stage of parturition
- ☐ Foetus moves to the normal birth position
- ☐ Vagina and cervix enlarges
- ☐ Membrane covering the foetus breaks and amniotic fluid flows

➤ **EJECTION STAGE**

- ☐ Second stage of parturition
- ☐ Head and front legs of the foetus appear on the vulva

- ☐ Female lies on the ground and foetus move out the body of the female
- ☐ Second stage of parturition
- ☐ Head and front legs of the foetus appear on the vulva
- ☐ Female lies on the ground and foetus move out the body of the female

➤ **EXPULSION OF PLACENTA**

- ☐ Is the third stage of parturition
- ☐ After 30 min of birth the placenta or the after birth is expelled

Note: With after birth we mean the **umbilical cord** and **foetal membranes**.

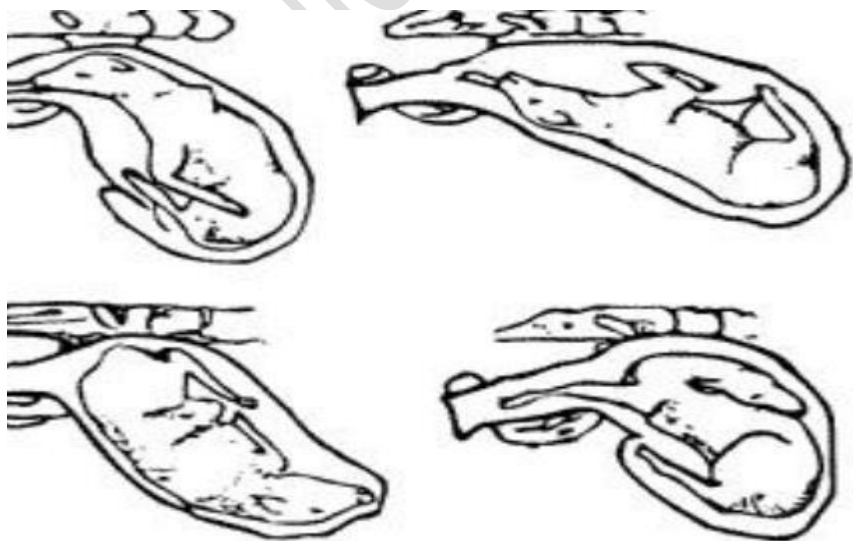
: There are some case in which the **placenta or after birth is retained** in the body of the female

FACTORS CAUSING RETENTION OF PLACENTA

- ☐ Vitamin A deficiency
- ☐ Mineral deficiency
- ☐ Premature birth
- ☐ Abortion
- ☐ Disease

10.DYSTOCIA

Is the difficulty of giving birth



Under normal circumstance the young animal is born head and forelegs first, with the **head lying on the forelegs**

CAUSES OF DYSTOCIA

- ☐ **Deviation of the head** – head is displayed sideways, upwards or downwards
- ☐ **Retention of both forelegs**- forelegs are trapped inside only head appears on the vulva
- ☐ **Hydrocephalus** –when there is accumulation of fluid in the brain which cause the skull to be large three to four times the normal size
- ☐ **Twins** -
- ☐ **Posterior presentation**-all the four legs enters the pelvic ring simultaneously
- ☐ **Clone** – cloned animals are usually abnormally large
- ☐ **Large foetus**
- ☐ **Congenital defect**-newly born calf might have crooked legs and wry neck

INDEGENOUS TREATMENT OF DYSTOCIA

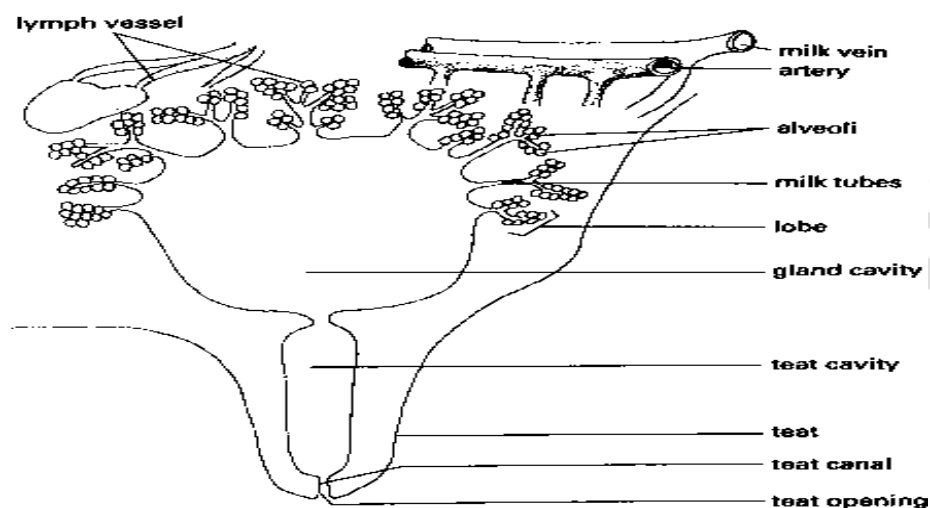
- ☐ Use animal fats
- ☐ Use soap

11.LACTATION

Is a milk production process

Duration: 305days after that the milk dries up

STRUCTURE OF THE UDDER



FUNCTIONING OF THE UDDER

□ ALVEOLI

- It is where milk is produced or synthesized

□ MILK ARTERIES

- It pump deoxygenated blood from the udder to the heart and the lungs

□ MILK VEIN

- Supply the udder with oxygenated blood

□ LYMPH VESSEL

- Transport waste products away from the udder

HOMORNES INVOLVED IN MILKING REFLEX

□ PROLACTIN

- Stimulates production of milk

☐ OXYTOCIN

- Stimulates release of milk

☐ ADRENALIN

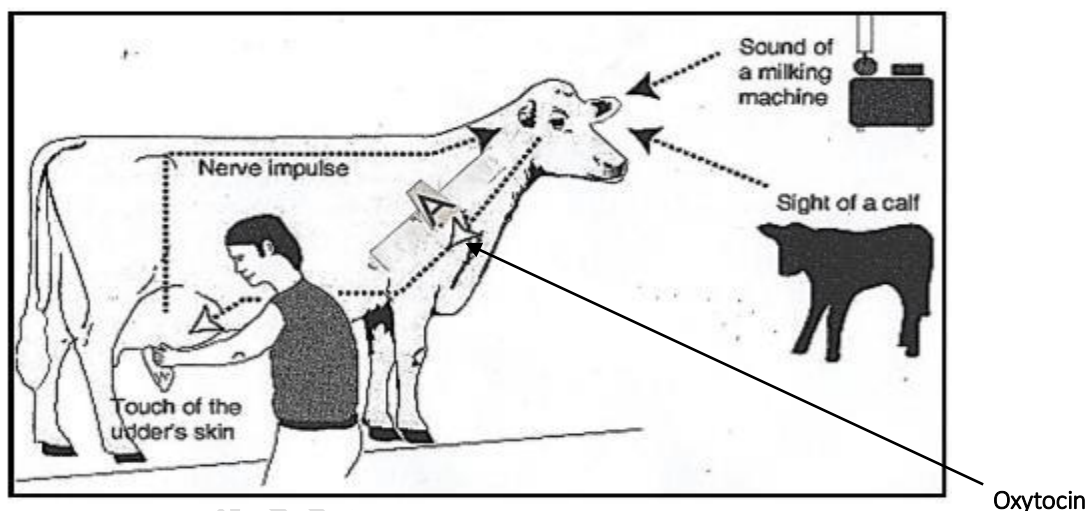
- Stops milk production

MILKING STIMULI

The udder has nerves that respond to stimuli

Example of milk stimuli:

- ☐ SIGHT OF A CALF
- ☐ SOUND OF MILKING MACHINE
- ☐ TOUCHING THE UDDER
- ☐ SUCKLING CALF



ALL THIS STIMULI STIMULATE THE BRAIN TO RELEASE HORMONE OXYTOCIN.

COLOSTRUM

Is the first milk produced after calving (usually after 3 day)

It is yellower than normal milk

CHARACTERISITIC OF COLOSTRUM

□ Contain extra nutrients

- Protein
- Fats
- Lactose

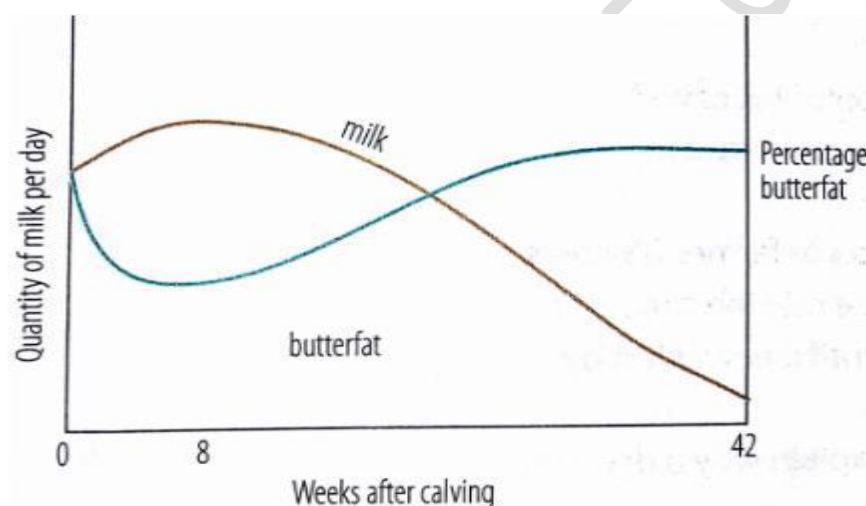
□ Contain extra minerals

- Calcium
- Phosphorus

□ Contain antibodies

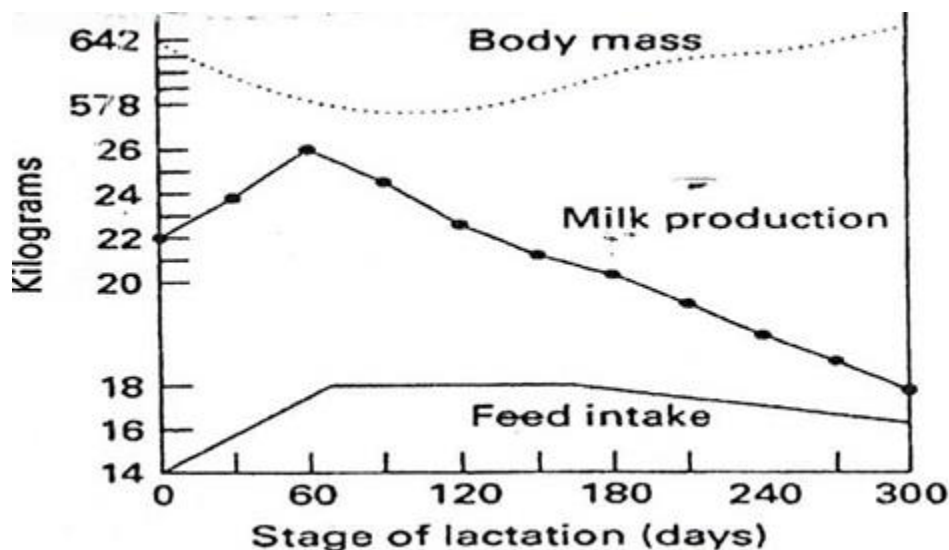
- Increase resistance to disease

LACTATION CURVES SHOWING BUTTER FAT AND MILK PRODUCTION



- When milk production increase butterfat content decreases.
- And again when milk production start decreasing butterfat content increase.
- After 3 days the cow will start producing normal milk (no more colostrum)
- Milk production reach peak about 8 weeks and continue until it dries out

LACTATION CURVE SHOWING MILK PRODUCTION IN RELATION TO FEED INTAKE AND BODY MASS



- When milk production **INCREASE** the animal eats a **LOT** but body mass **DECREASES**.
- When milk production **DECREASE** animal eat **LESS** and body mass **INCREASES**

DRYING-OFF PERIOD

Is the natural end of lactation

REASON FOR DRYING OFF OF COWS

- ☐ It allow the udder tissue to repair and rejuvenate
- ☐ To prevent new infections from occurring (since the udder is exposed to new infections at the beginning and end of dry period)

Notes

TOPIC 5

PAPER 1

QUESTION 3

ANIMAL DISEASE AND PROTECTION

- ✓ The main important task for the farmer is to maintain the health of their animals
- ✓ Healthy animal mean increased profit and successful farm business
- ✓ It is usually very cheap to control and protect animals from disease than treatment

1. ANIMAL HEALTH

SIGNS OF GOOD HEALTH AND POOR HEALTH IN ANIMALS

Signs of good health	Signs of poor health
1. Urine and faeces appear normal	1. Urine may be discoloured and faeces too soft or too hard
2. Normal milk production	2. Low milk production
3. Animal walk normal	3. Animal walk slow
4. Normal breathing	4. Forced breathing
5. Normal body temperature	5. High body temperature
6. Normal pulse rate	6. Abnormal pulse rate
7. Animal eat well	7. Animal lose appetite

TESTING ANIMAL HEALTH

It is very important to take careful precaution when testing animals, this precautions includes:

- ☐ Animal to be tested should be separated from other animals
- ☐ Large animals should be restrained before being tested
- ☐ Animals are restrained in different ways depending on TYPE and SIZE animal to be tested

ANIMAL RESTRAINING METHODS

□ HEAD GATES

- Trap the head of large animals
 - **Example of animal restrained:** bulls

□ HALTER

- used to lead animal and tie it on a post
 - **Example of animal restrained:** cattle and horse

□ NOSE LEAD

- Hold large animals by nose
 - **Example of animal restrained:** bulls

□ CRUSH

- use to handle large ruminants

ANIMAL TESTING METHODS

□ TESTING ANIMAL'S BODY TEMPERATURE

- **Instrument used :** rectal thermometer
- **Site of insertion :** rectum
- **Normal body temperature :** 37°C - 40°C
- **Precautions :** Tie thermometer with a string so that it does not get lost in the body of animal
- **Precautions :** Coat thermometer with a sterile jelly to lubricate it

□ TESTING PULSE RATE

- ❖ **What is pulse rate?:** equal number of heart beats in a minute
 - **Instrument used :** stethoscope

□ TESTING RESPIRATORY RATE

- ❖ **What is respiratory rate?:** equal number of breaths in a minute
 - **Determining respiratory rate:** watch the rib cage movement and count the number of breaths in one minute
 - **Instrument used :** stethoscope

TREATMENT OF SICK ANIMAL

If an animal become sick, it must be given medication so that it can return to good health

METHOD OF ADMINISTERING MEDICINE

□ ORAL ADMINISTRATION

Medication is taken directly into the mouth of animal

It includes:

- **Pills-** use a **balling gun** (device to place pill in animal's throat)
- **Powder-** mix powder with water or feed
- **Liquids-** use a drenching gun or a syringe to give medicine in a form of liquid to animals

□ TOPICAL ADMINISTRATION

Medication is applied directly to the wound or skin

It includes :

- Creams
- Sprays
- Dips

□ INJECTION

Administering medicine using a syringe and a needle

It includes:

- **Intravenous-** into the vein (effect is very fast)
- **Intramuscular** – into the muscle
- **Subcutaneous** – under the skin
- **Intradermal** – between the layers of skin
- **Intramammary injection-** into the udder

□ VAGINAL ADMINISTRATION

Drug for retained placenta or vaginal infection is inserted into the vagina

SUSTAINABLE USE OF MEDICINE

- ☐ Check expiry date
- ☐ Storage
- ☐ Dosage
- ☐ Method of administration
- ☐ Medicine registration

2.ANIMAL DISEASE

Most animal disease are caused by small organism called **PATHOGEN** (Bacteria, virus, fungi and protozoa)

Different pathogen cause different animal diseases

VIRUS

This pathogen causes viral disease

- ☐ Most viral disease are **highly contagious** and **zoonotic**
- ☐ Most viral disease are epidemic
- ☐ Most viral disease are non-curable

Note:

CONTAGEOUS DISEASE- disease that spread through contact

ZOONOTIC DISEASE- disease that can spread from animals to human and vice versa

EPIDERMIC DISEASE- disease that affect large number of animals

NOTIFIABLE DISEASE- disease that need to be reported after seeing symptoms

EXAMPLES OF VIRAL DISEASE

□ FOOT AND MOUTH DISEASE (FMD)

Animal affected: ALL FARM ANIMAL

Symptoms: SORES IN THE MOUTH, TONGUE
AND TOES (HOOVES)
HIGH FEVER

Mode of transmission: INGESTING CONTAMINATED FEED
:CONTACT WITH SECRETIONS AND
: EXCRETIONS FROM INFECTED
ANIMAL

Treatment: VACCINATION
: QUARANTINE INFECTED ANIMALS
: SLAUGHTER AND BURN INFECTED ANIMALS

□ RABBIES

Animal affected: ALL FARM ANIMALS

Symptoms: HIGH FEVER
: AGGRESSION
: EXCESSIVE SALIVATION
: EXCITEMENT
: PARALYSIS OF HINDQUARTERS

Mode of transmission: BITE FROM AN INFECTED ANIMAL

Treatment : VACCINATION
:INFECTED ANIMALS SHOULD BE DESTROYED
AND MEAT BURNT

□ RIFTY VALLEY FEVER(RVF)

Animal affected: ALL FARM ANIMALS

Symptoms: HIGH FEVER

: ARBOTION

Mode of transmission: BITE FROM AN INSECT (MOSQUITO)

: HANDLING AFFECTED ANIMAL

MEAT OR BLOOD

Treatment: VACCINATION

: SLAUGHTER AND BURN INFECTED ANIMALS

□ NEW CASTLE DISEASE (NCD)

Animal affected: POULTRY

Symptoms: TWISTED NECKS

: GREEN DIARRHOEA

: RAPID BREATHING

Mode of transmission: CHICKEN EATING CONTAMINATED

FEED

: DRINKING CONTAMINATED WATER

Treatment: VACCINATION

: QUARANTINE

□ ALL THE ANIMAL'S FLU

SWINE FLU – affects pigs

AVIAN FLU – affects poultry

Treatment : vaccination and good farm management

BACTERIA

This pathogen causes bacterial disease

Many bacteria are **harmless** (not deadly)

Bacterial disease can be cured with **ANTIBIOTICS**

Most bacterial disease are contagious

EXAMPLES OF BACTERIAL DISEASE

☐ MASTITIS

Animal affected: DAIRY CATTLE

Symptoms: SORES IN THE UDDER
: DROP IN MILK PRODUCTION

Treatment: ANTIBIOTICS INSERTED IN THE UDDER

☐ ANTHRAX

Animal infected: ALL FARM ANIMAL

Symptoms: SWELLING OF THE NECK AND BODY
: HIGH FEVER

Treatment: ANTIBIOTICS

☐ TB

Animal affected: ALL FARM ANIMALS AND HUMAN (it is
zoonotic)

Symptoms: CHRONIC COUGHS
: INCREASED RATE OF BREATHING

Treatment: ANTIBIOTICS

PROTOZOA

They cause protozoan disease

- ☐ Many protozoan disease are deadly
- ☐ Many protozoan disease are non-curable
- ☐ VECTOR carrying protozoan disease is a TICK
- ☐ Protozoan disease are common in grassy areas

EXAMPLES OF PROTOZAN DISEASE

□ RED WATER

Animal affected: CATTLE , SHEEP AND GOAT

Type of tick causing: BLUE-TICK

Symptoms: HIGH FEVER , RED OR BROWN URINE , ANAEMIA

Treatment: VACCINATION

: ERADICATE VECTOR

□ HEART WATER

Animal affected: ALL RUMINANTS (cattle , sheep and goats)

Type of tick causing: BONT-TICK

Symptoms: HIGH FEVER , DIARRHOEA

Treatment: vaccination

□ ANAPLASMOSIS / GALL SICKNESS

Animal affected: CATTLE SHEEP GOAT

Type of tick causing: BONT TICK AND BLUE TICK

Symptoms: HIGH FEVER , ANAEMIA

Treatment: vaccination

□ COCCIDIOSIS

Animal affected: most farm animals and human (it is zoonotic)

Type of tick: bont legged tick

Symptoms: high fever , watery faeces , rapid dehydration

Treatment: vaccination and isolation

FUNGI

They cause fungal disease

Most fungal disease are **CHRONIC**

- ☐ Most fungi consist of fine tubes called HYPHAE
- ☐ Many fungal disease are not deadly

EXAMPLE OF FUNGAL DISEASE

☐ RINGWORM

Animal affected: all farm animals including human (it is zoonotic)

Symptoms: a round wound with a scabby surface

Treatment: apply ointment (topical application)

☐ LYMPHY WOOL

Animal affected: sheep

Symptoms: sores in the skin

:secrete pus and form a scab (A Scab is tissue covering that form when your skin is damaged)

Treatment: Dipping after shearing

: Topical application

PREVENTION OF ANIMAL DISEASE

- ☐ Vaccination
- ☐ Quarantine affected animals
- ☐ Ban imports
- ☐ Restrict movements of animals (movement permits)
- ☐ Breed animals that are resistant to disease
- ☐ Public awareness

ECONOMIC IMPLICATION OF ANIMAL DISEASE

- ☐ Job loss
- ☐ High cost of treatment
- ☐ Decreased production
- ☐ Food insecurity
- ☐ Decrease in international trades
- ☐ Decreased GDP of a country

INDEGENOUS METHOD OF CONTROLLING ANIMAL DISEASE

- ☐ Rotational grazing
- ☐ Burning infected pasture
- ☐ Use herbal remedies

3. ANIMAL PEST AND PARASITE

Parasites are organism that spend most of its life in the body of another organism

- ☐ They suck blood and transmit disease.
- ☐ They cause great economic loss
- ☐ Parasites are categorised according to their life cycle

TWO TYPES PARASITE

- Internal parasite
- External parasite

INTERNAL PARASITE / ENDOPARASITE

- ☐ They live and survive inside the body of animal called **HOST**
- ☐ They rob the HOST's nutrients and transmit disease
- ☐ The effects cannot be seen as they leave no scar

Examples of internal parasites

Liver fluke

Tape worm

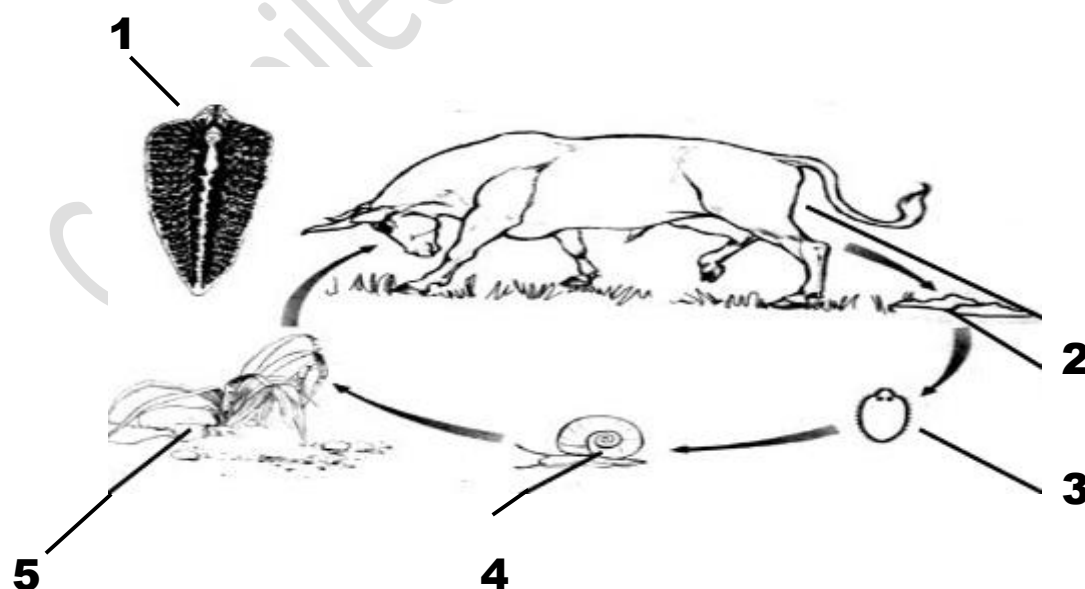
Round worm

LIVERFLUKE

A worm with a flattened body

- **PART OF BODY AFFECTED:** Liver
- **METHOD OF INFESATION:** Through grazing infected pasture
- **NUMBER OF HOST ON THE CYCLE:** horse/cattle (first host)
: Snail (intermediate host)

LIFE CYCLE OF LIVERFLUKE



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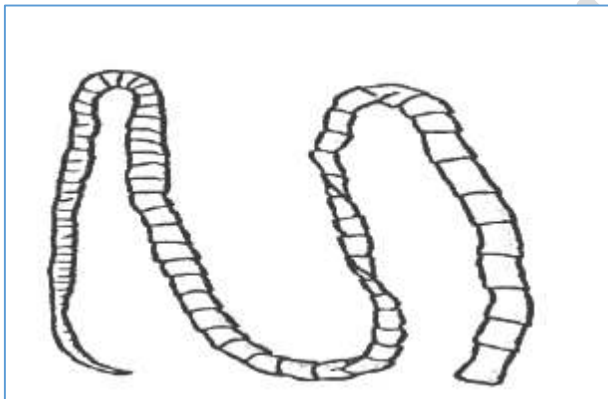
1. **ADULT FLUKE** in the liver of primary host (horse) laid eggs in the liver
2. **EGGS** are released in faeces
3. Eggs hatch into a **LARVAE** (maracidium) in the grass
4. Larvae swim to enter **INTERMEDIATE HOST** (snail)
5. Larvae leave the snail and form a **CYSTS** on the grass (resting stage)
6. Cysts on the grass is eaten by the animal and grow into a **FLUKE** (and affect the liver)

WAYS TO CONTROL LIVERFLUKE

- Destroy all the intermediate hosts
- Burning the veld
- Rotational grazing

TAPEWORM

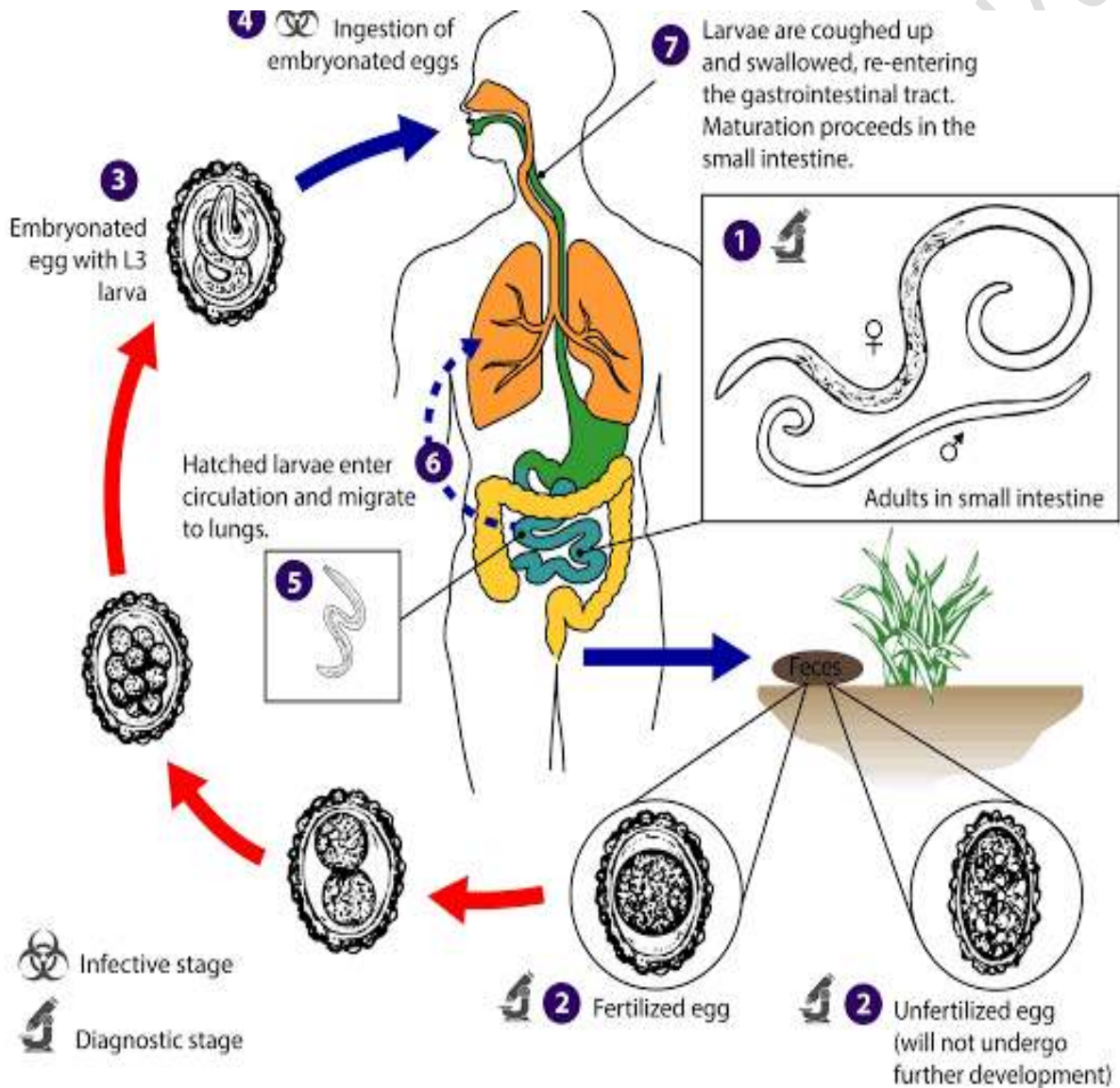
A long narrow and flat organism with many segments



- **PART OF THE BODY AFFECTED:** Intestine
- **NUMBER OF HOST:** pig and human (TWO)
- **METHOD OF INFESATION:** ingesting raw meat that is infected
- **ANIMAL AFFECTED:** pigs, sheep and goat

- **PART OF BODY AFFECTED:** lungs
- **NUMBER OF HOST:** one
- **METHOD OF INFESTATION:** grazing on a infected pasture
- **ANIMAL INFECTED:** cattle, sheep and goat

LIFE CYCLE OF ROUND WORM



1. Adult worm lay **EGGS** in the small intestine of a cow
2. Eggs are released in **FAECES** of the cow
3. Eggs are eaten by cow when grazing on the grass
4. Egg hatch into a **LARVAE** in the intestine of a cow and moves into the **LUNGS**
5. Larva is coughed up and swallowed
6. Larvae matures and move to the **small intestine**

PREVENTION AND CONTROL OF ALL EXTERNAL PARASITES

- ☐ Rotational grazing
- ☐ Fencing off infected areas
- ☐ Destroying intermediate hosts
- ☐ Dosing animals with chemicals
- ☐ Breed animals that are resistant to parasites

ECONOMIC EFFECT OF INTERNAL PARASITES

- ☐ High treatment cost
- ☐ Low production
- ☐ Decrease GDP of a country

EXTERNAL PARASITE / ECTOPARASITE

- ☐ They live on the outside the body of animal called a **HOST**
- ☐ They rob host nutrients and transmit disease like **ANAEMIA**
- ☐ Their effects can be seen as they leave scars

EXAMPLES OF EXTERNAL PARASITES

TICKS

BLOWFLY

MITES

O768538168

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LICE

NASAL WORM

MOSQUITO

TICKS

Ticks causes protozoan disease



- **REGION WHERE THEY OCCUR:** warmer / humid region of the country
- **EFFECTS OF TICKS:** They bite, suck blood, transmit disease, cause death to animals and low production (loss of wool , meat and milk)

TYPES OF TICKS

Ticks are divided into THREE according to number of host in their life cycle
To control the effect of ticks as parasites farmers need to know about the life cycle and habits of ticks

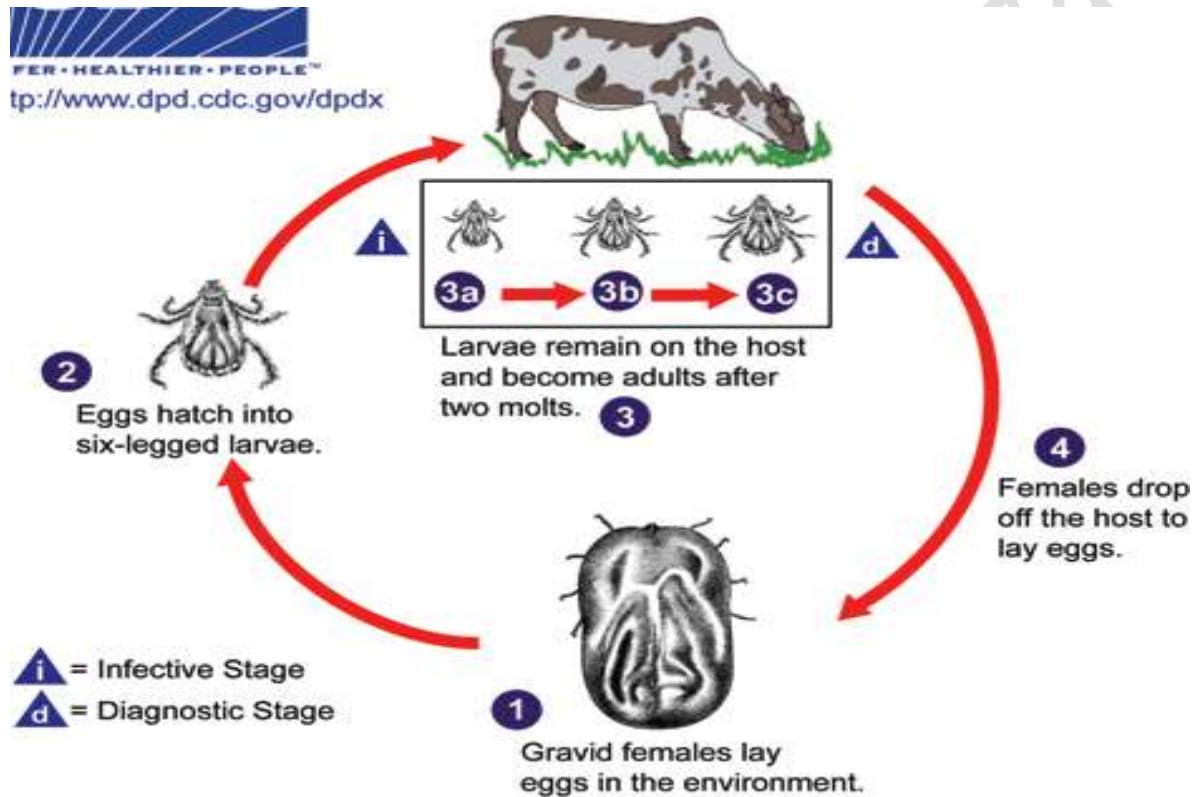
GENERAL LIFE CYCLE OF TICKS:

ADULT TICK → EGGS → LARVA → NYMPH

(i) **BLUE-TICK**

- has a **single host** in its life cycle
- **Disease caused** : red water and Anaplasmosis

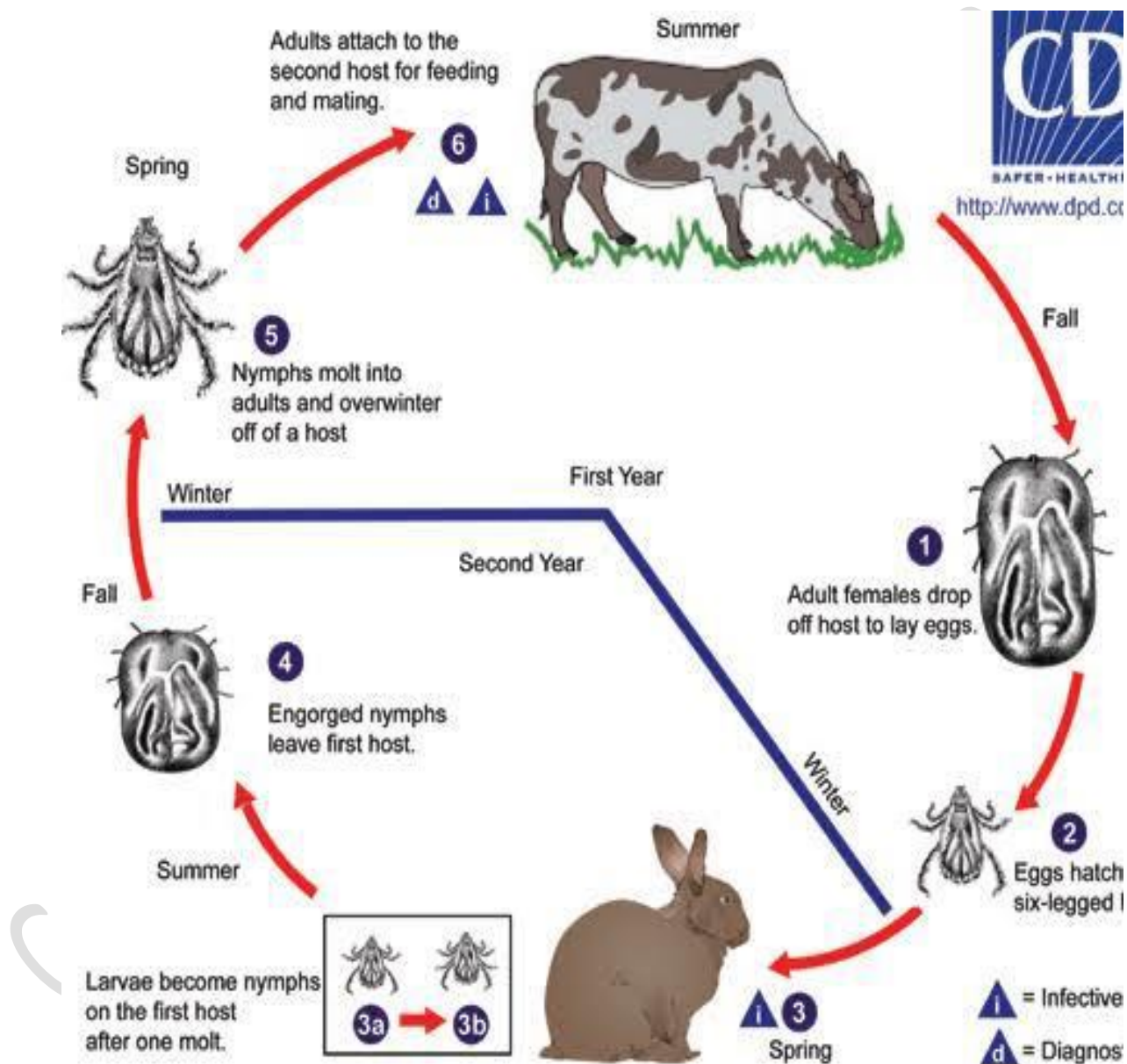
LIFE CYCLE OF BLUE-TICK TICK



(ii) BONT-LEGGED TICK

- Has **two hosts** in its life cycle
- **Disease caused:** Red water

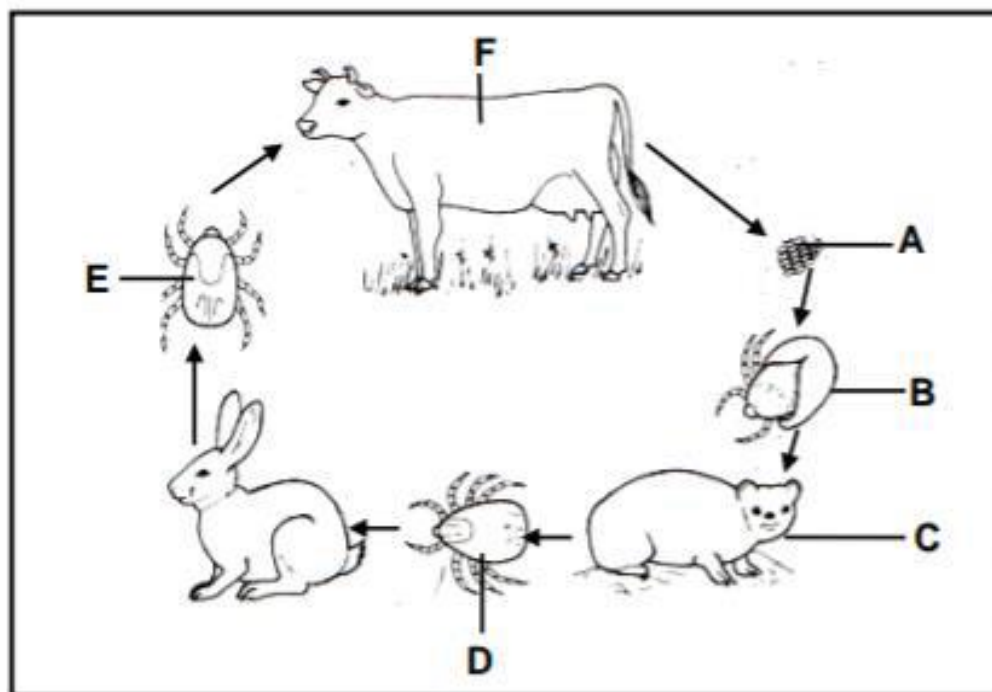
LIFE CYCLE OF BONT-LEGGED TICK



(iii) BONT-TICK

- Has three host in its life cycle
- **Disease caused:** Heart water and Congo fever

LIFE CYCLE OF BONT-TICK



- A. **ADULT TICK** lay eggs on the ground
- B. Eggs hatch into a **LARVAE** (after 6 weeks)
- C. Larvae feed on the **FIRST HOST**
- D. Larvae develop into a **NYMPH** (nymph feed on the 2nd host)
- E. Nymph develop to an **ADULT** (adult feed on the 3rd host)

MITE

MITES CAN SPREAD FROM ANIMAL TO ANIMAL.
THEY LIVE PERMEMANTLY IN THE BODY OF HOST



EFFECTS OF MITES: Cause skin irritation

: Loss of hair ,wool and hide

: Transmit disease called **SCAB** and **MANGE**

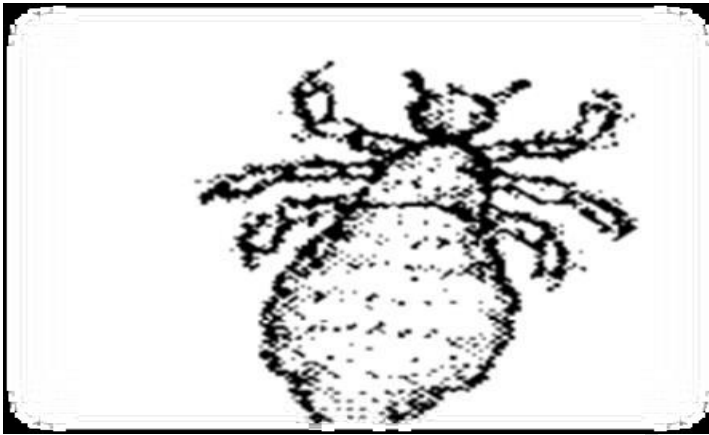
Mange- is a skin condition that appear as red blister and itchy

APPEARANCE: Has four pairs of legs and a sucking mouth

LICE

They are big enough to be seen with naked eyes

They can be transmitted from one animal to another



EFFECTS OF LICE: Cause skin irritation

: Decrease production

: Suck blood and transmit disease

APPEARANCE: Have three pairs of legs with big bums and hips

TYPES OF LICE

- ☐ **SUCKING LICE** – have pointed heads and piercing style of sucking
- ☐ **BITTING LICE** – have rounded heads and chewing mouth parts

BLOWFLY



ANIMAL AFFECTED: sheep

EFFECTS OF BLOWFLY: sheep spend less time grazing and more time tail wagging

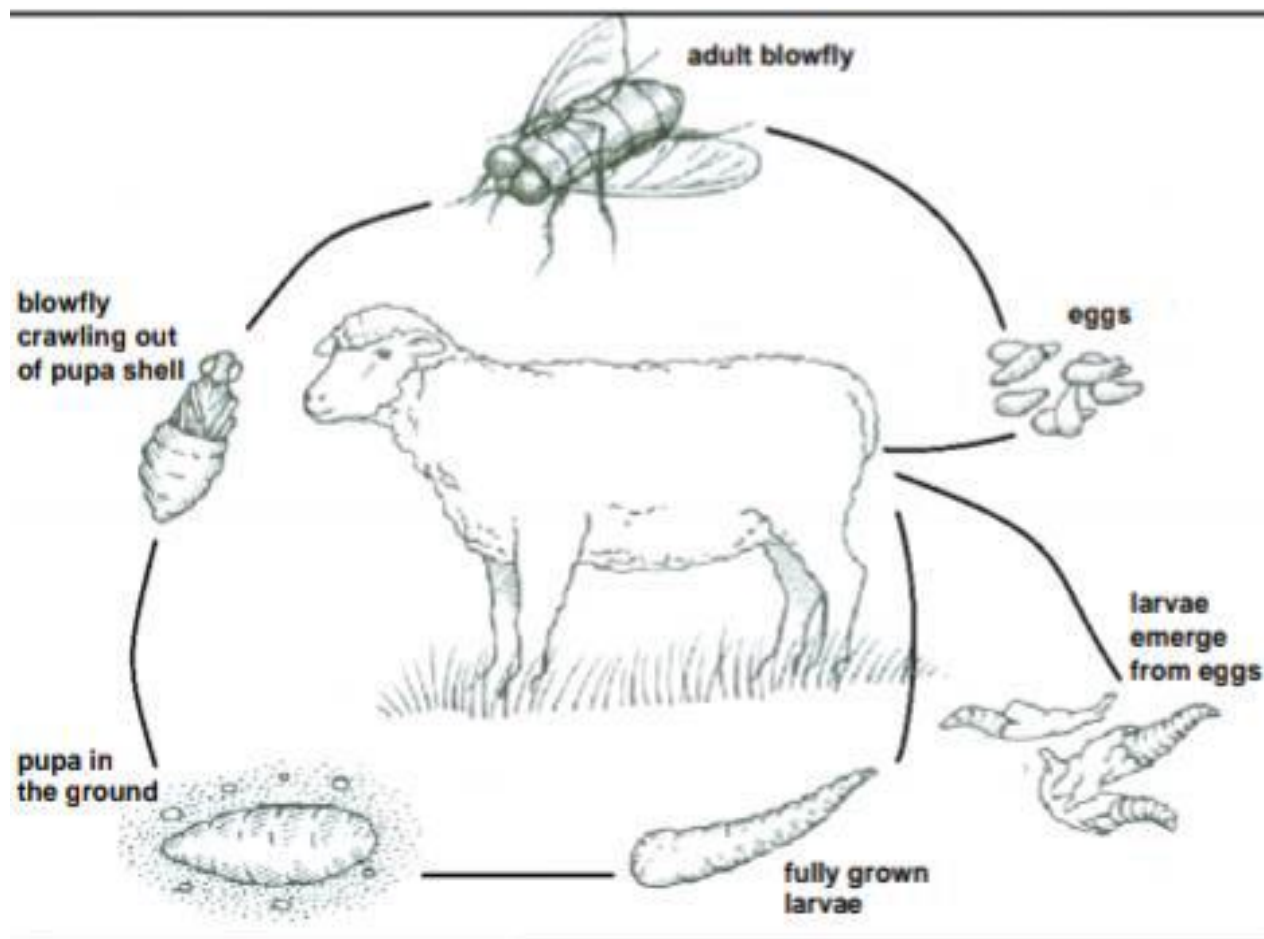
ENVIRONMENTAL CONDITIONS THAT FAVOURS GROWTH AND DEVELOPMENT OF BLOWFLY

- : Wet conditions
- : Availability of grass
- : Soil below tail
- : Open wounds

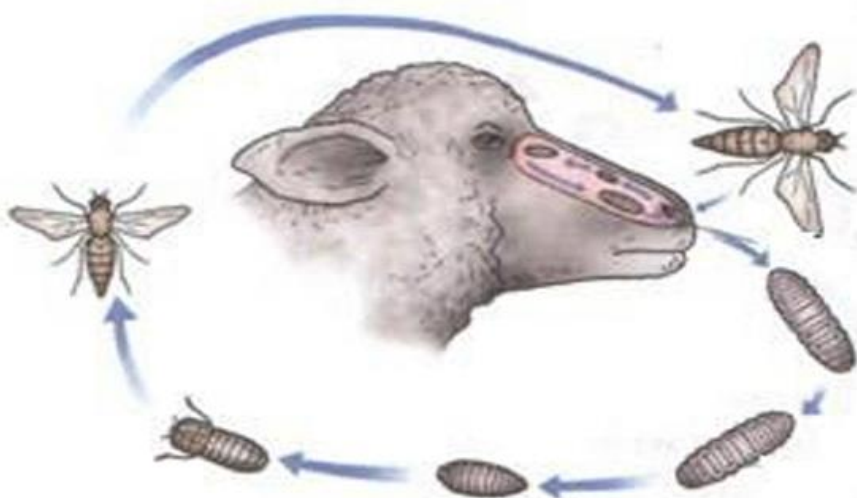
WAYS TO CONTROL BLOWFLY INFESTATION

- ☐ **Tail docking** – removal of tail
- ☐ **Crouching** – removal of wool in the tail area and legs
- ☐ **Wool shearing**- removal of wool
- ☐ **Dipping**
- ☐ **Treatment of wounds**

LIFE CYCLE OF BLOWFLY



NASAL WORM



ANIMAL AFFECTED: sheep

EFFECTS OF NASAL WORM: It blocks the nasal cavity

: Cause discomforts to animal

: Sheep will shake its head trying to get rid of the worm

PREVENTION AND CONTROL OF ALL EXTERNAL PARASITES

- ☐ Dipping with chemicals
- ☐ Rotational grazing
- ☐ Fence off infected areas
- ☐ Burning of the veld
- ☐ Breed animals that are resistant to parasites

BIOLOGICAL CONTROL OF EXTERNAL PARASITES

- ☐ Use parasite natural enemy
- ☐ Use macro-fungi
- ☐ Breed animal that are resistant to parasites

NOTE: **MICRO-FUNGI** eat the parasite's eggs or larvae on the ground.

4.PLANT POISONING

- Wide range of plants can be poisonous to livestock.
- Farmers should be aware of plants that poses threat to their livestock and take measures to prevent animals from grazing poisonous plants
- Plant poison is not very common , it occur when the pasture is overgrazed and only poisonous plants remains
- There are **THREE** main important poisonous plants ;
- **MAIZE FUNGUS**
- **THORNE APPLE**
- **POISON BULB**

ANIMALS SUSCPTIBLE TO POISONOUS PLANTS

- ☐ Young animals
- ☐ Pregnant animals
- ☐ Very old animals
- ☐ Exotic breeds

EXAMPLES OF POISONOUS PLANTS

➤ MAIZE FUNGUS

Is a mould often associated with grains (maize cob,peanuts and sorghum)

It occur from eating maize that is stored in damp conditions

SYMPTOMS OF MAIZE FUNGUS

- Lack of appetite
- Stomach pain
- Sweating
- Vomiting

TREATMENT OF MAIZE FUNGUS

- Keep affected animal calm to reduce further infection
- Increase supply of proteins and vitamins

PREVENTION / CONTROL OF MAIZE FUNGUS

- Remove infected feed from animals
- Remove source of poisoning
- Avoid over grazing
- Practice rotational grazing

➤ POISON BULB

This type of poison is mainly caused by bulbs such as a **ONE-LEAF CAPE TULIP**

About a kilogram of leaf is enough to cause death overnight

PREVENTION OF POISON BULB

- Remove infected feed from animals
- Remove source of poison
- Avoid over grazing
- Practice rotational grazing

➤ THORN APPLE

Is a bushy plant with flowers covered with sharp spines nearly all summer
Thorn apple does not pose much threat since most animals cannot graze it due to: **BAD SMELL.BAD TASTE** and **THORNS**

SYMPTOMS OF THORN APPLE

- Loss of appetite
- Extreme mouth dryness
- Slow growth
- Pupil dilation

TREATMENT OF THORN APPLE

- Use activated charcoal

PREVENTION / CONTROL OF THORN APPLE

- Remove infected feed from animals
- Remove source of poisoning
- Avoid over grazing
- Practice rotational grazing

5.METALIC SALT POISONING

Poison due to heavy metals produced by industries can be a serious problem. Many metals may enter into production animal's production system through pollution.

These toxic metals will then accumulate in vital organs such as the liver and the heart.

EXAMPLES OF METALIC POISONING

(i) SALT POISONING

CAUSES OF SALT POISONING

- ☐ Intake of less water and more salts
- ☐ Lack of water (this will stop urine production and more salts builds up in blood until it become poisonous and deadly)

SYMPTOMS OF SALT POISONING

- ☐ Excessive saliva excretion
- ☐ Dehydration
- ☐ Diarrhoea

- ☐ Increased thirst
- ☐ Increased urination and defecation
- ☐ Vomiting

TREATMENT OF SALT POISONING

- ☐ Provide clean water in small amount at short interval
- ☐ Give young animals saline solution / hypertonic dextrose
- ☐ Remove source of poisoning

(ii) UREA POISONING

- ☐ Urea is protein source for ruminants
- ☐ Urea poisoning occur when it is not properly mixed with feed
- ☐ It is possible for hungry or thirsty animal to consume too much urea in poorly mixed feed
- ☐ Nitrogen from urea is converted to **AMMONIA** and when this ammonia is excess it become poisonous

SYMPTOMS OF UREA POISONING

Bloating

Rapid death

Nervous excitement

Incoordination

TREATMENT OF UREA POISONING

Administer vinegar

PREVENTION OF UREA POISONING

Limit access to licks containing urea

Gradual increase in urea supplement to animals

5.BASIC GENETICS

QUESTION 4

PAPER 2

Father of genetics “Gregor Mendel”

Genetics is the study of how characteristics are transferred from parents to offspring

1. GENETIC TERMINOLOGY

- ☐ **GENETICS**- study of heredity
- ☐ **HEREDITY** – passing of characteristics from parents to offspring
- ☐ **CHROMOSOME** – structure that holds genes
- ☐ **GENE**- small portion of DNA that code for characteristics
- ☐ **QUANTITATIVE CHARACTERISTICS** - characteristics that give rise to whole range of phenotypes. It is influenced by many genes (polygenic inheritance)

Environment has an influence in determining this characteristics

They determine **continuous variation**

➤ e.g. **PRODUCTION** (of eggs or milk) **Colour coat**

- ☐ **QUALITATIVE CHARACTERISTICS**- characteristics that have fixed form of phenotypes. It is influenced by one pair of genes.

Environment has no influence in determining the characteristics.

They determine **discontinuous variation**

➤ e.g. **Gender, Horns shape and chicken head comb**

- ☐ **ALLELE**- different forms of genes (expressed using alphabet)
 - e.g **T= Tall and t=Short**
- ☐ **DOMINANT**- allele that mask characteristics of recessive allele
 - e.g **TT= Tall and Tt= Tall**

- ☐ **RECESSIVE**- allele that is masked by the presence of a dominant allele.

It only appear in phenotype if the organism is homozygous

➤ e.g **tt= short**

- ☐ **HOMOZYGOUS / PURE BRED**- combination of similar allele

➤ e.g **tt and TT**

- **HETEROZYGOUS / HYBRID**- combination of different allele
 - e.g **Tt**
- **GENOTYPE**- genetic make-up of an organism
- **PHENOTYPE**- physical appearance of an organism

MENDEL'S LAWS

Genetics laws can be summarised as follows:

(i) **LAW OF DOMINANCE**

On the set of characteristic one gene is dominant and the other is recessive. The phenotype of the organism will display the characteristics of the dominant gene

(ii) **LAW OF SEGREGATION**

When gametes are formed during meiosis allele separates so that offspring can get one gamete from each parent

(iii) **LAW OF INDEPENDENT ASSORTMENT**

In a DIHYBRID crosses, during gamete formation allele segregate independently of each other.

GENETIC CROSSES

Mendel's genetic crosses are divided into:

(i) **MONOHYBRID CROSSING** “mono” means one

Is a genetic cross that **involve one** contrasting characteristic

Example of monohybrid crossing

A **homozygous** (purebred) **Black bull** (F) is crossed with a **homozygous** (purebred) **white cow** (f) in a genetic experiment. Determine the genotype and the phenotype of the offspring in the F1

Phenotype: black bull x white cow

Genotype: **FF** **ff**

Meiosis:

fertilisation:

Genotype: **Ff** **Ff** **Ff** **Ff**

Phenotype: all black / 100% black

Note: Only one characteristic (colour coat) was crossed

TO DETERMINE THE F₂ GENERATION SHOULD BE ALLOWED TO MATE. FOR AN EXAMPLE FROM THE ABOVE CROSSING WE CAN CROSS; (Ff** with **Ff** to get our F₂ generation)**

Dihybrid crossing “di” means two

Is a crossing that involve two contrasting characteristic

Example of dihybrid crossing

A **homozygous** pea plant with **purple flower** (A) and **tall plant size** (B) is crossed with a **homozygous** pea plant with **white flowers** (a) and **short plant size** (b)

Phenotype: **purple and tall plant x white and short plant**

Genotype: **AABB X aabb**

Meiosis: **A, A, B, B X a, a, b, b**

Fertilization:

	AB	Ab	aB	ab
AB	AABB	AABb	AaBB	AaBb
Ab	AABb	AAbb	AaBb	Aabb
aB	AaBB	AaBb	aaBB	aaBb
ab	AaBb	Aabb	aaBb	aabb

Phenotype: 9 purple & tall : 3 purple and short: 3 white and tall: 1 white and short

Note: Two characteristics (colour and height) was crossed

PATTERN OF INHERITANCE

☐ COMPLETE DOMINANCE

It apply mainly on a heterozygous combination where only the effect of dominant allele is shown in the phenotype of offspring

EXAMPLE OF COMPLETE DOMINANCE

A homozygous red flower (F) is crossed with a homozygous white flower (f) determine the phenotype and genotype of the F1 generation

P₁

Phenotype: red flower

white flower

Genotype:



Meiosis:

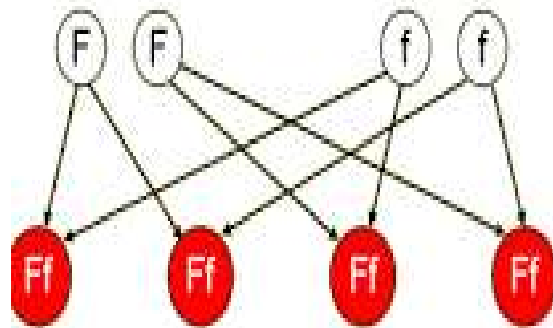
Gametes

fertilisation

f₁

Genotype

Phenotype: all 100% red



□ CO-DOMINANCE

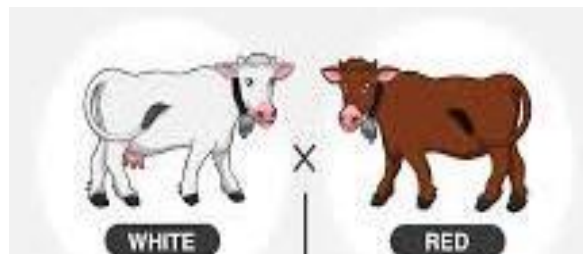
Both alleles in a gene pair are equally dominant

Both allele are equally shown in phenotype of offspring

Offspring become **roan**

Example of co-dominance

A **homozygous white cow** (W) is crossed with a **homozygous red bull** (R) to produce **red and white calves**



WW

RR



RW

□ INCOMPLETE DOMINANCE

Alleles are not always dominant or recessive as in a complete dominance

It results in the formation of offspring with a phenotype that is in between that of the parents.

Offspring are different from parents.

Example of incomplete dominance

A **homozygous red flower (R)** is crossed with a **homozygous white flower (W)** and produced an offspring with a phenotype that is **in between that of parents**

Phenotype: red flower x white flower

Genotype: RR X WW

MEIOSIS (R) (R) X (W) (W)

Fertilization

F1

Genotype: RW RW RW RW

Phenotype: all pink

□ ATAVISM

Is the reappearance of ancestral characteristics after it has been absent for many generation (Teeth in chicken or extra toes in horse). It is also known as “throwback”

□ PREPOTENCY

Is the ability of one parent to pass a complete set of gene to its offspring?

Dominant genes from the male are passed to offspring

□ EPISTASIS

Action of one gene is controlled or modified by another gene

□ POLYGENIC INHERITANCE

Mechanism of inheritance in which genetic characteristics is controlled by many genes.

Each gene add to value of a certain phenotype

Each gene may have an additive allele or non-additive allele

An additive allele adds a set of amount to the phenotype while a non-additive allele does not add anything to the phenotype

Example of polygenic inheritance

The milk production in dairy cow is controlled by two pairs of genes. The genotype **aabbcc** gives a milk yield of **200 litres**. **Each additive dominant gene adds 20 litres**. Calculate milk yield of a dairy cow with **AAbbcc**

bbcc = 200 litres

AA = 20+20= 40

∴ 200+40 = 240 litre

VARIATION

Is the difference amongst organism of same species

- All individual of same species differ slightly from each other with characteristics such as; **HEIGHT** , **WEIGHT** and **COAT COLOUR**

IMPORTANCE OF VARIATION

- ☐ It is a foundation of selection
- ☐ Improve breeding cultivars (crop varieties)
- ☐ Improve breeding of breeds (livestock)

TYPES OF VARIATION

(i) Continuous variation

Is a variation in which there is a complete range of form

It is determined by **quantitative characteristics** (determined by many genes)

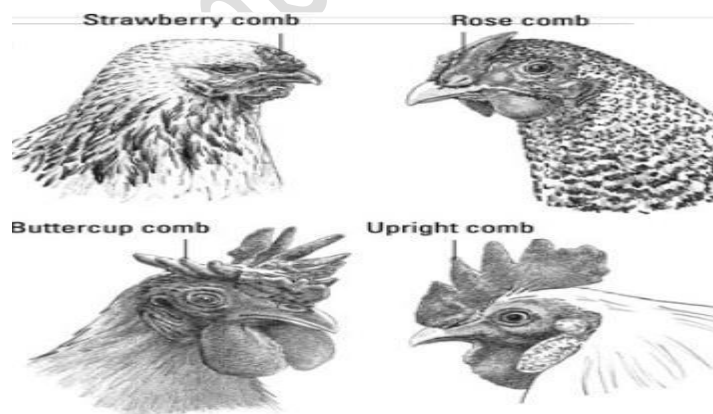
e.g. Height, Milk production, weight gain, yield of field crops

(ii) Discontinuous variation

Is a variation in which characteristics has fixed form with no intermediate form in between

It is determined by **qualitative characteristic**

e.g. There are four types of chicken head comb (there are no other type comb and chicken cannot have a mixed comb-type) and Gender



CAUSES OF VARIATION

Variation is caused by two factors “ **internal factors** and **external factors**”

(i) **INTERNAL FACTOR** (genetic factors)

Meiosis

Fertilisation

Mutation

(ii) **EXTERNAL FACTOR** (environmental factor)

Climate

- Animals kept in colder region have thicker hair than those in warmer region

Topography

- Goats kept on steeper slope have longer and strong legs than goats kept on flat slope

Nutrition

- Animals are shorter than other animals with same gene for tallness due to nutrient deficiency

Disease

- Animals that are constantly exposed to disease develop immunity from the disease while some does not develop immunity

Light intensity

- Animals on higher altitude have darker pigment than those on lower altitude

MUTATION

Is the sudden change in the structure of gene

- Mutation can be **harmful** or **beneficial**
- An organism affected by mutation is a **MUTANT**

TYPES OF MUTATION

- (i) **GENE MUTATION** – sudden change in nucleotide sequence of the DNA

☐ TYPES OF GENE MUTATION:

- **Deletion**- one or more nitrogen bases are removed from the gene sequence
- **Insertion** – one or more nitrogen base is added into the gene sequence
- **Substitution** – one nitrogen base is replaced with another nitrogen base
- **Inversion**- the order of one or more nitrogen bases is reversed

AGENTS OF MUTATION (mutagens)

- ☐ **Physical mutagens**
- ☐ e.g. X-rays , gamma rays , ultra violet radiation
- ☐ **Chemical mutagens**
- ☐ e.g. nitrous acid , hydrogen peroxide, alkaloids
- ☐ **Biological mutagens**
- ☐ e.g. Bacteria , virus

IMPORTANCE OF MUTATION

- ☐ Increase variation
- ☑ Give individual improved characteristics

CAUSES OF MUTATION

- ☐ Climate
- ☐ Deletion
- ☐ Substitution
- ☐ Inversion
- ☐ Insertion

SELECTION

Is the process of choosing individuals with desired characteristics for breeding purpose

IMPORTANCE OF SELECTION

It help to improve the characteristics livestock and crops over few generation

FACTORS TO CONSIDER WHEN SELECTING BREEDING LIVESTOCK

- ☐ Health
- ☐ Adaptability
- ☐ Productivity
- ☐ Level of performance
- ☐ Behaviour

PRINCIPLES OF SELECTION

☐ HERITABILITY

- Is the degree in which a characteristic is determined by genetic factor than environmental factors.

INTERPRETING HERITABILITY

Characteristic with heritability above 50% (0.5) i.e. $50/100=0.5$

- IT IS DETERMINED BY GENETIC FACTORS
- THERE IS HIGH CHANCES THAT CHARACTERISTICS WILL BE PASSED ON TO OFFSPRING DURING BREEDING

Characteristic with heritability less than 50% (0.5) i.e $60/100= 0.6$

- IS DETERMINED BY ENVIRONMENTAL FACTORS
- THERE IS LESS CHANCE THAT CHARACTERISTICS ARE PASSED ON TO OFFSPRING DURING BREEDING

☐ **BIOMETRIC**

- Is the use of statistics to analyze biological data
- Measure unique characteristics using a computer technology

IMPORTANCE OF BIOMETRIC

It improve accuracy of selecting individual for breeding programme

METHOD OF SELECTION

☐ **Mass selection**

Selection from group of animal according to individuals performance

It is quick and simple but not very accurate (because it is based on phenotype not genotype)

☐ **Pedigree selection**

Selection based on the quality of ancestor

☐ **Family selection**

Selection based on the quality of relatives such as **FULL-SIBLINGS** or **HALF-SIBLINGS**

☐ **Progeny selection**

Animal are selected based on the quality of their offspring

EBV (ESTIMATED BREEDING VALUE)

Is the estimate on how much better or less than average the offspring of an individual will be for a characteristic

- It can either be **positive** or **negative**

☐ **Positive value**

Indicate that offspring will be better than average

☐ **Negative value**

Indicate that offspring less than average

Calculating estimated breeding value (EBV)

Example: a horse farmer wants to calculate EBV for weight of a breed she bought at an agricultural show. The farmer's farm records gave the following information:

Weaning weight of horse = **350 kg**

Average weaning weight of all the horse in the farm = **310 kg**

Heritability %: **60**

Formula:

$$\text{EBV} = (\text{WEANING WEIGHT} - \text{AVERAGE WEANING WEIGHT}) \times \text{HERITABILITY } \%$$

Calculation:

$$\text{EBV} = (\text{WW} - \text{AWW}) \times 60/100$$

$$= (350 - 310) \times 60/100$$

$$= 40 \times 0.6$$

$$= +24$$

$$\therefore 310 + 24 = 334 \text{ KG}$$

Note: EBV is positive, meaning offspring will be better than average

IMPORTANCE OF EBV

- It indicates the heritability of a particular characteristic to estimate the success of a breeding programme
 - Can be used to monitor progress of breeding programme
-

BREEDING

Is the production of offspring by sexual reproduction

ANIMAL BREEDING SYSTEMS

Breeding systems are categorized into:

RELATED BREEDING and NON RELATED BREEDING SYSTEM

(i) RELATED BREEDING SYSTEM

Breeding of individuals that are related

Breeding results in the formation of **HOMOZYGOUS** offspring

➤ Related breeding is divided into:

1. Inbreeding

Breeding of two individuals that are closely related to each other

Example of inbreeding

- Mating of parents with their offspring (**backcrossing**)
- Mating of siblings with each other (brother and sister)

2. Line breeding

Breeding of two individuals that are less closely-related to each other

Example of line breeding

- Mating of grandparents with offspring
- Mating of **half sibling** with another **half sibling**

ADVANTAGE OF INBREEDING AND LINE BREEDING

- ☐ Offspring are genetically uniform
- ☐ There is greater **prepotency**
- ☐ Harmful recessive gene is eliminated
- ☐ Stimulates **homozygosity** of offspring

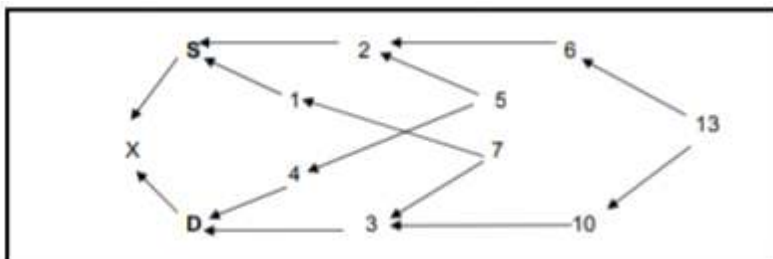
DISADVANTAGES OF INBREEDING AND LINE BREEDING

- ☐ Loss of variation
- ☐ Offspring may be deformed
- ☐ Lead to inbreeding depression
- ☐ **Inbreeding depression**

Gradual decrease in performance from generation to generation

- ☐ Poorly adapted to the environment

Diagram showing inbreeding



(ii) NON RELATED BREEDING SYSTEM

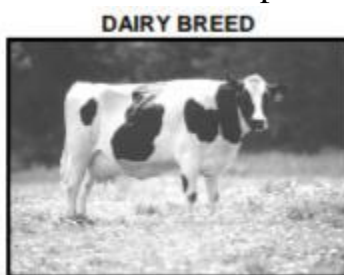
Breeding of individual that are not related to each other

Breeding results in **HETEROZYGOUS** offspring

Non related breeding system is divided into:

1. CROSS BREEDING

Mating of two animals that are not related closely related to each other
i.e. Mating of two different breeds of same species



ADVANTAGES OF CROSS BREEDING

- ☐ Better adaptation
- ☐ Increased variation
- ☐ Improved vigour or heterosis

Hybrid vigour or heterosis- increased performance of offspring generation after generation

- ☐ Development of new breeds
- ☐ Faster growth

DISADVANTAGES OF CROSS BREEDING

- ☐ It is labour intensive
- ☐ Offspring are not uniform
- ☐ Introduction of harmful recessive gene

2. SPECIES CROSSING

Mating of two animals of different species results in the offspring being sterile



ADVANTAGES OF SPECIES CROSSING (MULE)

- ☐ Endurance
- ☐ They don't get tired easily
- ☐ They don't have digestive programme
- ☐ Mules are hardworking

DISADVANTAGES OF SPECIES CROSSING (MULE)

- ☐ They cannot reproduce (they are sterile)

3. UPGRADING

Is the repeated mating of inferior cow with a superior male animal generation after generation

e.g. Crossing a **COMMERCIAL MIXED-BREED COW** with a **HOSLTEN STUD BULL** generation after generation

DISADVANTAGES OF UPGRADING

- ☐ It is time consuming
- ☐ Offspring cannot be 100% pure-bred
- ☐ It is expensive / pure-breed bulls should be bought outside

- ☐ Commercial value of first few generation is low

4. OUT CROSSING

Is the mating of two breeds that are not related

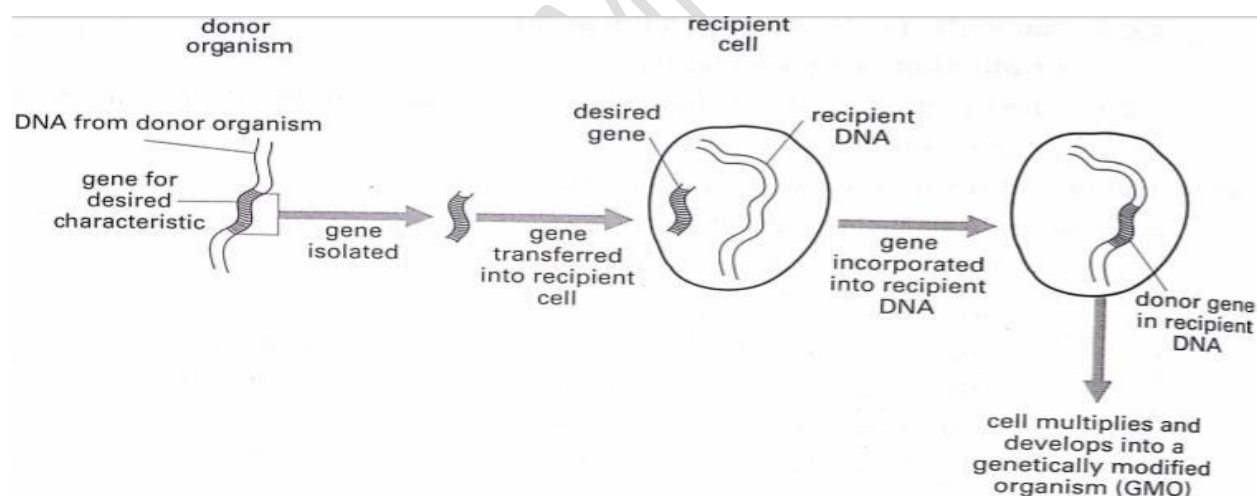
ADVANTAGES OF OUTCROSSING

- ☐ Increase genetic diversity
- ☐ Animals are more adapted
- ☐ Improved growth and fertility

GENETIC ENGINEERING/ MODIFICATION

Is the technique of changing the characteristic of an organism by inserting gene from another organism into its DNA

Genetic modification process:



AIMS OF GENETIC MODIFICATION

- ☐ Improve crop yield / production in animals
- ☐ Increase resistance to pest and disease
- ☐ Improve food quality
- ☐ Production of medicine

CHARACTERISTICS OF GENETIC MODIFIED ORGANISM (GMO)

- ☐ Crops that are resistant to insect
- ☐ Crops that are resistant to herbicide
- ☐ Animals and crops that are tolerant to harsh condition e.g. drought and cold
- ☐ Animals with improved growth and productivity

COMPARISON BETWEEN GENETIC MODIFICATION AND TRADITIONAL METHOD

TRADITIONAL METHOD

It is slow

It is not very precise

It is limited to breeds of same species

It is less convenient

Less productivity

GENETIC MODIFICATION

It is fast

It is very precise

It is not limited to breeds of same species

It is more convenient

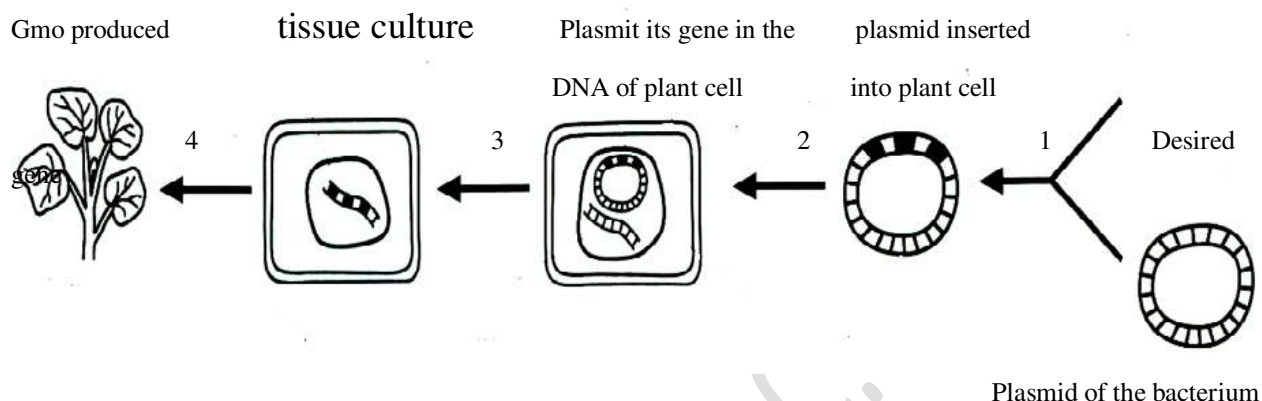
High productivity

GENETIC MODIFICATION TECHNIQUES

□ AGROBACTERIUM TUMEFECIENS

A bacterium called tumefeciens transfer a piece of its DNA into the plant cell

This bacterium is used as a **vector** to transfer desired genes into the plant cell



1. **Desired gene** inserted to the plasmid
2. **Plasmid inserted into** plant cell
3. Plasmid **insert its gene** into the DNA of plant cell
4. Tissue culture
5. Genetic modified plant is produced

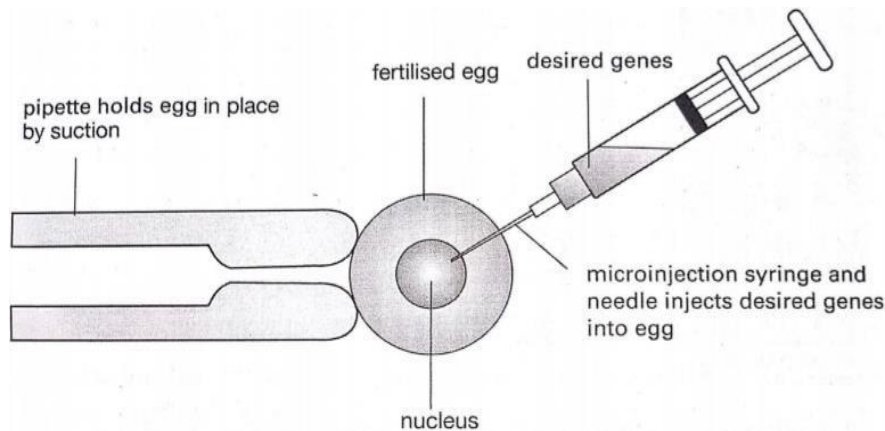
□ GENE GUN (BIOLISTIC)

Is a tool used to fire tiny particles of plant tissue into a cell

□ MICRO-INJECTION

Is the injection of desired genes directly into the nucleus of cell of a plant

It is mainly used in the modification of animals, but more difficult in plants because plants has cell walls



☐ ELECTROPORATION

Cells are placed in a solution containing desired gene. An electric current is passed through the solution and opens the pores in the cell membrane allowing desired genes to enter the cell.

☐ LIPFECTION

It involves using fats as carriers of desired genes through the cell membrane into the nucleus

☐ GENE SILENCING

Making a gene to be inactive or non-functional

POTENTIAL BENEFIT OF GENETIC MODIFICATION

Economic benefit

- ☐ GM crops may be more productive (produce higher yield) and growing world population will be fed at low cost
- ☐ Reduce effect of food insecurity
- ☐ Improve shelf life

Health benefit

- ☐ GM allow the production of medicine and vaccines
- ☐ Environmental benefit
- ☐ Farmer use less pesticides
- ☐ Production of animals that are more resistant to harsh environmental condition

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POTENTIAL RISK OF GENETIC MODIFICATION

☐ Economic risk

Seeds from GM crops cannot be replanted , which means farmers have to buy seeds every year

High seed cost

☐ Health risk

It can cause allergies

Can cause cancer

It can lower immune system

Can cause unknown disease

☐ Environmental risk

Reduce biodiversity

Insect resistant plant can kill beneficial insects

Production of super weed

Excess use of herbicides may damage the soil

Social risk

Developing countries will depend on developed countries for seeds

Some people think it is unethical using GMO

Notes

AGRICULTURAL PRODUCTION FACTORS

PAPER 2
QUESTION 3

There are four production factors in agriculture. Namely **LAND, LABOUR, CAPITAL** and **MANAGEMENT**

1. LAND/SOIL

This production factor is involved in the production of goods and services

It includes all the natural resources available to the farmer

ECONOMIC FUNCTIONS OF LAND/SOIL

- ☐ It supply raw materials
- ☐ It supply food (grass for livestock and vegetables for humans)
- ☐ It provide space (for building farm shed, planting crops or area for grazing)
- ☐ It supply minerals (minerals that can be used to make fertilizers such as potash that is used in manufacturing of potassium)

ECONOMIC CHARACTERISTICS OF LAND/SOIL

- ☐ It's value **appreciate** over time (it gains value)
- ☐ **Availability** of land for agriculture is limited (arable land previously used for agriculture can be used for urban development)
- ☐ It varies in production potential (sound investment)
- ☐ It can not produce on its own
- ☐ It is **immovable** (it has fixed location or found in a specific environment)
- ☐ It is **indestructible** (even though the structure can degrade if misused)
- ☐ It can be sold or bought
- ☐ It can be used as a **collateral** (form of security required by the bank before granting a loan)

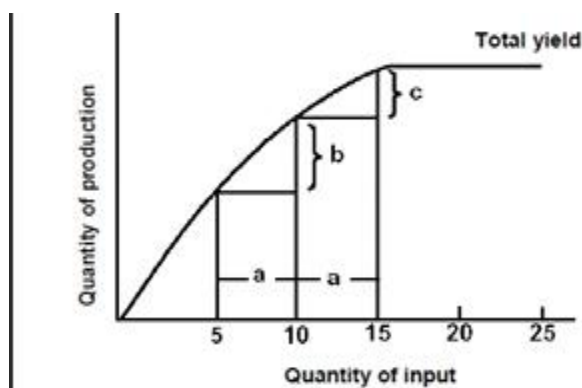
- ☐ It is **subjected to the law of diminishing return**
- ☐ It is **durable**

WAYS TO INCREASE PRODUCTIVITY OF LAND/ SOIL

- ☐ Add **fertilizers**
- ☐ Improve **water management** (irrigation system must be installed in areas where water is available)
- ☐ Practice **good farming methods** (such as crop rotation, double cropping and intercropping)
- ☐ Consolidation of **uneconomic farming units** (combining small farms to make one big farm)

THE LAW OF DIMINISHING RETURN

Graph illustrating the law of diminishing return



This law states that;

Increased amount of input does not give proportional increase to output this will to a point where the total yield decline

2. LABOUR

Is the combination physical and mental endeavor (skill) performed in expectation of remuneration (salary)

- It is one of the major cost items in agricultural industry and has a significant impact in the success of a farming operation.

WAYS TO REDUCE LABOUR COST

- ☐ Introduce mechanisation
- ☐ Increasing production
- ☐ Reducing labour force (retrenchment)
- ☐ Sending workers to training

TYPES OF LABOUR

PERMANENT LABOUR

- ☐ They work ordinary hours (**48 hours a week**)
- ☐ They live permanently with their families on the farm
- ☐ They have job security
- ☐ They have signed a contract with the employer
- ☐ They have benefits
- ☐ They are usually skilled

e.g. **foreman, tractor driver and mechanic**

CASUAL LABOUR

- ☐ They are employed for non-repetitive duties such as building or erecting a fence
- ☐ They work less than 24 hours a month
- ☐ They do not have contacts with the employer

SEASONAL LABOUR

- ☐ They are employed during peak period often for specific duties such as **harvesting , lambing and wool shearing**

RANKING OF SKILLS IN A WORK FORCE

SKILLED LABOUR

- Type of labour who is formally trained and qualified to the job

e.g. Engineer, veterinarian and manager

SEMI-SKILLED

- Type of labour with level of training (experience) but lack formal training

e.g. driver

UNSKILLED LABOUR

- Type of labour who does not have any formal skill or level of training

e.g General workers

PROBLEMS RELATED TO LABOOUR

□ LACK OF SKILLS

- It is caused by: **Lack of training**
- Effects of lack of skill: **Low production**
- : Limit use of technology**

□ SHORTAGE OF LABOUR

- It is caused by: **Less attractive working conditions**
- : Low wages**
- : Industrial competition**
- Effects of labour shortage: **Low production**
- : Production delays**

□ EXPLOITATION OF FARM WORKERS

- It includes: Farmer owners having racist attitudes to farm workers
- : Violation of farm worker's rights**

❑ HIV and AIDS

➤ Effects of HIV and AIDS: **Regular absenteeism make planning difficult**

: Decline in production

: Loss of skills and experience

: Production delays due to labour shortage

ILLEGAL PRACTICES ENCOUNTERED ON FARMS

❑ FARM EVICTION

People are illegally and forcibly removed from farms where they have living

❑ CHILD LABOUR

It is illegal to employ a child under 15 years of age, and child must be given task that are suited for a person of that age

❑ FAILURE OF EMPLOYER TO ADHERE TO LEGISLATION

It is considered illegal for an employer not to adhere to legislation such as the Basic Conditions Of Employment Act

INCREASING LABOUR PRODUCTIVITY

LABOUR PRODUCTIVITY

Is the measure of out-put per input of labour force

WAYS TO INCREASE LABOUR PRODUCTIVITY

❑ IMPROVING ECONOMIC CONDITION

➤ It can be improved by:

Provide incentives for workers

Increase wages

Pay bonus

Provide medical insurance

Supply farm products on reduced priced

Enter into partnership deals with workers (selling shares to workers)

❑ IMPROVING EDUCATIONAL CONDITIONS

- It can be improved by:

Send workers to training

Provide free schooling and bursaries to children of farm worker

❑ IMPROVING WORKING CONDITION

- It can be improved by:

Provide protective clothing to farm workers

Provide transport between home and work

Adequate leave

❑ IMPROVING LIVING CONDITION

- It can be improved by:

Adequate shelter safe and secure

Adequate water and food

Provide recreational facilities

❑ ADDRESSING HIV and AIDS

- It can be limited by:

Education (awareness campaign)

Provide access to condoms

Provide access to treatment

Encourage good values such as not having multiple sexual partners

LABOUR LEGISLATION

It is placed to protect employees and employers as both parties will know what their rights and responsibilities are. It prevents unfair labour practices on farms.

□ **Basic Condition Of Employment Act of 1997**

It ensures that fair labour practice exist

It regulates the following:

Working hours

Overtime (working on Sunday and public holidays)

Minimum wage

Method of payment

Condition for termination of employment (a 30-day notice should be placed prior to the termination)

Leave (including sick leave , maternity leave and annual leave)

Meal interval

□ **Labour relation act of 1995**

It regulate relationship between the employer and employee

It address the following:

Labour dispute

It ensure social justice

Gives workers a right to strike

Provide procedure to resolution of labour dispute

Right to join trade union

Involvement of workers in decision making process

□ **Occupational Health and Safety Act of 1993**

It deals with health safety in a workplace

It ensures the following:

Workers are trained to operate machinery and handling dangerous chemicals

Supply protective clothing

Working environment is safe

□ **Compensation of Occupational Injuries and Disease Act 1993**

It applies to employers and employees who are injured, disable or contract a disease due to workplace accident

It ensures that:

Compensation due to injuries, disease and disability is granted

□ **Skill Development Act of 1998**

It enforces enrichment of farm workers with skills

All employers are entitled to pay skill development levy (1% of worker's pay)

It ensure the following:

Provision of training to workers

Developed workforce skill

□ **Labour Equity Act of 1995**

It ensure that there is no work place discrimination based on:

Gender

Age

Race

Religion

Sexuality

Disability

LABOUR CONTRACT

Is the legal written agreement between the employer and the employee.

- ☐ Employer and employee details
- ☐ Employment details
- ☐ Payment details
- ☐ Hours of work
- ☐ Leave details (indicate annual leave, maternity leave and family responsibility leave)
- ☐ Conditions for termination (valid and fair reason for termination)
- ☐ Wages (agreed amount to be paid per hour or per day)
- ☐ Other benefits (if workers will receive uniform or accommodation)
- ☐ Signatures of both parties

3. CAPITAL

This money or equipment that are used in production process

☐ It includes all the goods and assets such as **building, equipment and vehicles** that are used in production process.

☐ **Asset** – item of economic value that you own

TYPES OF CAPITAL

☐ **Fixed capital**

➤ Capital invested on fixed assets

e.g. **building, land borehole and dam**

☐ **movable capital**

➤ Capital invested on medium-term assets

e.g. **livestock , vehicle ,machinery , and equipment**

☐ **working /floating capital**

- Capital invested on short-term assets and used to pay short term operational expenses

e.g. feed, fertilizers, chemicals, seeds ,fuel, wages & telephone bill

TYPES OF ASSETS

☐ **Fixed assets**

Assets that are purchased and used for long term

Its value appreciate overtime

e.g. land , building dam and borehole

☐ **Movable assets**

Assets that are purchased and used for medium term

Its value appreciate overtime

e.g. machinery , equipment and livestock

☐ **Current assets**

Assets that are used for short-term

e.g. money in the bank , seeds and wages etc

GENERATION/CREATION OF CAPITAL

☐ **Production**

☐ **Savings (inheritance)**

☐ **Credit, loans and grants**

Credit – All loans and advances given to borrowers that need to be repaid back with interest

Grant- Some of money provided by a government that does not need to be repaid back

Interest- amount of money that a financial institution charge for lending money

SOURCE OF FINANCE

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- ☐ Commercial bank
- ☐ Land bank
- ☐ Agricultural cooperatives

When applying for a loan you need:

Prepare a business loan

Financial record

Collateral

CREDIT

TYPES OF CREDITS

☐ **Long-term credit**

Credit given and repaid over long period

- Used to expand fixed assets (such as **building, land and dam and borehole**)

Repayment period: **over 10 years**

☐ **Medium-term credit**

Credit given and repaid over medium term period

- Used to improve movable assets (such as **machine and equipment**)

Repayment period: **1-5 years**

☐ **Short-term credit**

Credit given and repaid over short period of time

- Used to cover operational expenses (current assets) e.g. **wages, seeds, fuel and fertilisers**

Repayment period: **less than 1 year**

PROBLEM ASSOCIATED WITH CAPITAL

- ☐ **Scarcity of capital** – some capital items cannot be produced in a country and must be imported
- ☐ **Cost** – capital goods are expensive and cost to borrow money to buy them
- ☐ **Depreciation-** most capital item have limited lifespan and can lose value overtime (**subjected to wear and tear**)
- ☐ **High interest rate**
- ☐ **Undercapitalisation-** having less capital than required
- ☐ **Overcapitalisation-** having too much capital than required
- ☐ **Subject to risk**
- ☐ **Subject to law of diminishing**

FINANCIAL MANAGEMENT SYSTEM

Is the process of keeping records of all business transaction (**accounting**)

Reason for keeping financial record

- ☐ To plan for the future of business
- ☐ For loan application
- ☐ To draw up a budget
- ☐ To analyse previous and current performance of the business
- ☐ To provide information for tax purpose

Financial management system allow the farmer to do the following:

- ☐ **Keep inventory of assets**

Inventory – record of all assets

- ☐ **Cash analysis book** – used to record receipts and payments

□ **BALANCE SHEET**- summary of all assets and liabilities

➤ It projects **net worth** of the business

□ **Net worth**- assets minus liability

□ **Liability**- money that you owe(financial debt)

□ **Asset** – item of economic value that you owns

Example of balance sheet

ASSETS	RAND	LIABILITIES	RAND
Machinery	R 850 000,00	Bond	R1000 000,00
Value of the farm	R4 500 000,00	Overdraft	R 850 000,00
Breeding livestock	R350 000,00	Loan repayment	R980 000,00
Building	R750 000,00		
Vehicles	R900 000,00		
Interest from savings	R75 000,00		
Positive bank balance	R1 200 000,00		
Total assets	R8 625000,00	Total liabilities	R2 830000,00
Net worth = Total assets – total liability = R8 625000,00 – R2 83000,00 = R3 692 500,00			

□ **INCOME STATEMENT**- summary of income and expenditure

➤ It projects net profit

□ **Net profit** – income minus expenses

Example of income statement of period

FARM INCOME	RANDS	FARM EXPENDITURE	RANDS
Beef sales	R85 000,00	Electricity and water	R35 000,00
Maize sales	R 105 000,00	Bank charges	R 8 500,00
Soya beans sales	R 73 000,00	Feeds	R 27 000,00
TOTAL INCOME	R263 000,00	Rent	R 23 000,00
Profit= income – expenditure = R263 000 – R 357 500 = - 94500 (loss)		Telephone bill	R10 000,00
		Marketing cost	R52 000,00
		Pesticides	R 37 000,00
		Fuel	R 45 000,00
		Wages and salaries	R 120 000,00
		TOTAL EXPENDITURE	R357 500,00

The above business **cannot** be recommended since the expenditure exceeds income hence it lead to business loss

□ **CASH FLOW STATEMENT**- is the movement of cash in a business

- It includes receipts and payments

□ **COMPONENTS OF CASH FLOW STATEMENT**

Opening balance

Income

Expenditure

Profit /loss

Closing balance

Cash items

Example of a cash flow budget statement

CASH FLOW SUMMARY	JAN	FEB	MARCH	APRIL
Opening balance	R25 000,00	R22 000,00	R 19 000,00	R-6 000,00
Total Income	R3 000,00	R5 000,00	R15 000,00	R 65 000,00
Total expenses	R 6 000,00	R 8 000,00	R 40 000,00	R 6000,00
Profit/loss(income-expenses)	R -3 000,00	R -3 000,00	R-25 000,00	R 64 000,00
Closing balance(opening balance+ profit/loss)	R 22 000,00	R 19 000,00	R-6 000,00	R58 000,00
Total Profit for Jan – April	PROFIT = INCOME - EXPENSES =R58 000 – R25 000 =R33 000,00			

□ **BUDGET**- is the written document that shows the estimation how much you think you will spend and earn over a period of time

TYPES OF BUDGETS

Whole farm budget

- Budget that combines all the enterprises within the farm

Enterprise budget

- Budget for one single enterprise within the farm

Partial budget

- Budget used to test the effect on profit

Example of enterprise budget showing estimate for 2020/21 financial year

ESTIMATEED COST		ESTIMATED RETURNS	
ITEM	AMOUNT	ITEM	AMOUNT
Water	R 8 500 ,00	Roses (floral shop)	R 130 000,00
Manure	R 29 000,00	Roses (nursery)	R 200 000,00
Electricity	R 15 000,00	Compost	R 6 500,00
Potting soil	R 11 000,00		
Vegetative material	R 8 000,00		
Chemicals	R 20 000,00		
Total cost	R 91 000,00	Total return	R 336 500,00

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MANAGEMENT

□ Is the combination and co-ordination of human, physical and financial resources to achieve a certain goal

PRINCIPLES/ COMPONENTS OF MANAGEMENT

□ PLANNING

It involve developing long-term and short-term plan

It involves what to do, when to it, how to do it and who is going to do it

➤ Documents linked to planning are;

Business plan & Budget

IMPLEMENTATION

It involve setting the plan in motion

□ CONTROL

It involves measuring and verifying the results

STRATEGIC MANAGEMENT COMPONENTS

It allow the business to anticipate and adapt to changes and future challenges

Main components of strategic management

□ Develop a vision

This is what you hope the business would be in future

□ Develop a mission

It outline the purpose of the business (what you do, for who and the purpose of the business)

□ Set a goal

It gives overall direction

MANAGEMENT SKILLS NEEDED TO MANAGE FARMING BUSINESS

NB: THE OWNER OF THE FARM CAN BE THE MANAGER OR MIGHT HIRE A PERSON AND THE PERSON MUST SHOW WIDE RANGE OF SKILLS.

□ GENERAL MANAGEMENT SKILLS

Analytical skill

Able to analyse information (market information)

Conceptual skill

Allow manager to reflect to changes in the industry and develop strategies (like change in market price and completion)

Planning skill

Important for day-to-day planning and long term planning.

Problem-solving skill

Able to deal with problems rather than avoiding them.

Ability to adapt

Able to adapt to changed (know when to adapt to new technologies)

□ FINANCIAL MANAGMENT SKILL

The manager must be well vested on financial matters regarding borrowing, investing and full understanding regarding taxation so as to regard against financial losses.

He/she must able to negotiate prices

Able to keep financial records

□ COMMUNICATION AND INTERPERSONAL SKILL

Able to interact effectively with different people (negotiate deals and contracts)

Able to make other people understand you and be able to understand what others are trying to say to you

☐ **PRODUCTION AND OPERATIONAL SKILL**

Manager must have a thorough knowledge of the farm operation. They should know the requirements of the enterprise.

For an example: In beef enterprise;

The manager must have adequate knowledge of veld management to know how many animals should graze in a certain camp, and when to move them to a new camp

☐ **RISK MANAGEMENT SKILL**

Manager must identify potential risk and come up with a strategy to reduce, control and eliminate the risk.

SOURCE OF RISK IN FARMING BUSINESS

☐ **TECHNICAL RISK (PRODUCTION RISK)**

Unpredictable weather conditions

Drought and flooding

Disease outbreaks

Pest

Machine breakdown or outdated

Labour-related(strike)

☐ **MARKETING RISK**

Change in customers' needs and wants result in;

Reduced demand

Reduced price

☐ When other producers enter the market results in;

More competition

☐ **FINANCIAL RISK**

Inability to pay debts on time

Unpredictable interest rates

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Production fails

☐ **LEGAL RISK**

When the manager is taken to court for having ignored some regulatory standard that lead to an injury or death.

☐ **HUMAN or PEOPLES RISK**

It takes place when the skill is lost due to death, disability, divorce, illness etc.

RISK MANAGEMENT STRATEGIES

It involves managing the spread of risk in a farming business

☐ It includes;

INSURANCE

It is good to insure the property, machinery against things like storms, hail damage, injury of the visitor etc.

RISK SHARING

Allow farmer to share risk with other parties

DIVERSIFICATION

Having number of different enterprise on the farm

Example of diversification;

Planting of different crops (i.e. mixed farming)

A farmer can spread his/her investment over several enterprises (pig farming, poultry farming cattle farming etc.)

Geographical diversification (have different land types wherein there are different soil types and different climatic conditions)

PROCESSING or VALUE ADDING

Changing raw form of goods into a form that can easily be used by customers

Example of processing;

Processing milk into cheese, yogurt and chocolate

SPECIALISATION

Specialising with one enterprise that is product suited

☐ **HEDGING**

Entering in future contract with supermarkets

FACTORS AFFECTING FARMING BUSINESS

☐ **INTERNAL FORCES**

These are forces that originate on the farm itself

The employer can have control over such forces

For an example;

- ☐ Skill of worker
- ☐ Available resource
- ☐ Demand of wages by workers

☐ **EXTERNAL FORCES**

These are forces that the employer cannot have control over

For an example;

- ☐ New laws (legislation)
- ☐ Change in taxation
- ☐ Wars
- ☐ Natural disasters

Notes

AGRICULTURAL MARKETING

MARKETING

Is the process involving the movement of a product from the farm to the consumer

It can also be a place where buyers and sellers meet

DIFFERENCES BETWEEN MARKETING AND SELLING

Marketing	Selling
It is Profit- oriented	It is Product oriented
Focuses on long-term plans	Short-term objective is selling of product
Focus on satisfying the wants of customers	Customer's needs and satisfaction are neglected
Focus mainly on the product	Focus on sales volume

MARKETING FUNCTIONS

FOUR MAIN FUNCTIONS OF AGRICULTURAL MARKETING

1. TRANSPORT FUNCTION

It involves moving products from the farm to processing facilities, and then to the consumer using different mode of transport

ADVANTAGES OF TRANSPORT FUNCTION

- ☐ Bridges the gap between producer and consumer.
- ☐ Cost effective
- ☐ Fast delivery
- ☐ Quick movement of perishables to the market
- ☐ Creates job opportunity

- ☐ Bulky goods can be moved

Example: Transporting fruits from farm to processing plant

2. STORAGE

It includes holding raw products until they needed.

Food is kept for later use to guarantee food security

ADVANTAGES OF STORAGE

- ☐ Ensure fresh products
- ☐ Maintain products' quality
- ☐ Ensure continuous supply of agricultural product
- ☐ Prevent spoilage of products
- ☐ Prevent over supply

3. PACKAGING

The science of enclosing products for distribution and distribution

ADVANTAGES OF PACKAGING

- ☐ Make product handling easier
- ☐ It protect the product

Packaging should protect the product against:

- (i) Mechanical damage
- (ii) Poor environmental conditions during handling
- ☐ **For identification of product**

Packaging must: provide useful information about the product such as:

- (i) Name of product
- (ii) Size of product
- (iii) Grade of product
- (iv) Net weight
- (v) Country of origin

4. PROCESSING/ VALUE ADDING

Involves changing a raw form of a product into a form that can easily be used by consumers

ADVANTAGES OF PROCESSING/VALUE ADDING

- ☐ Minimise oversupply
- ☐ Prolong shelf life
- ☐ Add value of product
- ☐ Create job opportunity
- ☐ Allow easier handling of product

Example: Drying up meat

: Blending

: Canning

: Fermenting

FACILITATING FUNCTION

It does not involve direct handling of the product

It includes:

(i) Standardization

It is about setting standards or specification for a product

(ii) Grading

Is the process of sorting agricultural products according to set standards

MARKETING POLICY INSTRUMENT (4ps)

1. PRODUCT DESIGN

Producer needs to be aware of what the consumer wants

2. PRICE

Producer determines how much the consumer will pay for the product

3. PLACEMENT

Producer should know where the consumer wants to buy product

4. PROMOTION

Producer needs to communicate information about the produce

Ways to implement promotion;

- IN-STORE PROMOTION
- EXHIBITIONS
- DIRECT MAILING

PRICE DETERMINATION**FACTORS CONSIDERED WHEN DETERMINING A PRICE OF A PRODUCT**

- ☐ Cost
- ☐ Demand
- ☐ Competition
- ☐ Supply

DEMAND AND SUPPLY**DIFFERENCES BETWEEN DEMAND AND SUPPLY**☐ **Demand**

Amount of goods that the **consumer** are willing to **buy** at a given price

☐ **Supply**

Amount of goods that the **producer** is willing to **sell** at given price

1. DEMAND

LAW OF DEMAND

Shows a negative relationship between price and quantity demanded:

- The **HIGHER** the price the **LOWER** the demand

Meaning: If the **price** of a product **increases** less customers will buy the product
: If the product is **cheap** customers will buy **more** of the product

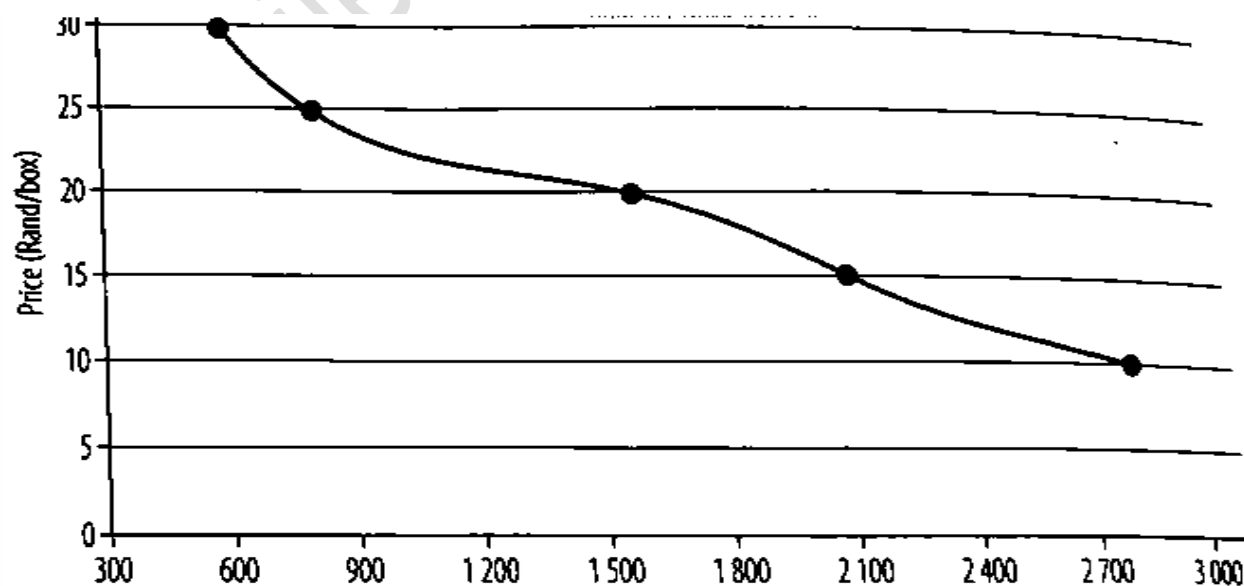
DEMAND SCHEDULE

Is the table that shows relationship between price of goods and quantity demanded

Price (R/Box)	Quantity (Box/week)
2800	10
2100	15
1600	30
800	35
600	40

DEMAND CURVE

Is the graph showing the relationship between price of goods and quantity demanded



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FACTORS DETERMINING DEMAND

- ☐ Price of the product
- ☐ Quality of the product
- ☐ Consumer taste and preferences
- ☐ Fashion
- ☐ Festive season
- ☐ Number of consumers
- ☐ Culture and religion

2. SUPPLY

LAW OF SUPPLY

Shows a positive relationship between price and quantity supplied

- ☐ The **higher** the price the **higher** the supply

Meaning: If the **price** of a product **increases** the producer will supply more products (taking advantage of the price to affect profit)

When the price of a product increases the producer supply more products to gain more money from the products

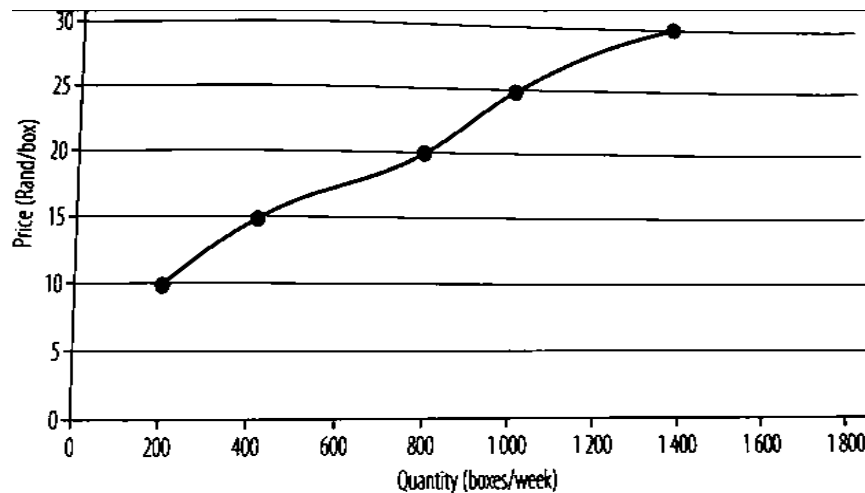
SUPPLY SCHEDULE

- ☐ is a table showing the relationship between price and quantity supply of product

Price (R/box)	Quantity (box/week)
200	10
400	15
800	20
1000	25
1400	30

SUPPLY CURVE

Is the graph showing the relationship between price and quantity supplied



FACTORS DETERMINING SUPPLY

- ☐ Price of the product
- ☐ Production costs
- ☐ Change in technology
- ☐ Environmental conditions / Nature
- ☐ Government subsidy and taxation
- ☐ Demand for the product
- ☐ Political instability
- ☐ Seasonality fluctuation
- ☐ Competitive products

PROBLEMS ASSOCIATED WITH SUPPLY

- ☐ **Oversupply**

Supplying more than required

- ☐ **Undersupply**

Supplying less than required

WAYS TO AVOID OVERSUPPLY

1. Reduce production
2. Product dumping
3. Processing
4. Diverfication
5. Hedging
6. Improve promotion and advertising

PRICE ELASTICITY OF DEMAND AND SUPPLY

PRICE ELASTICITY

Is the relationship between the change in price and demand and supply

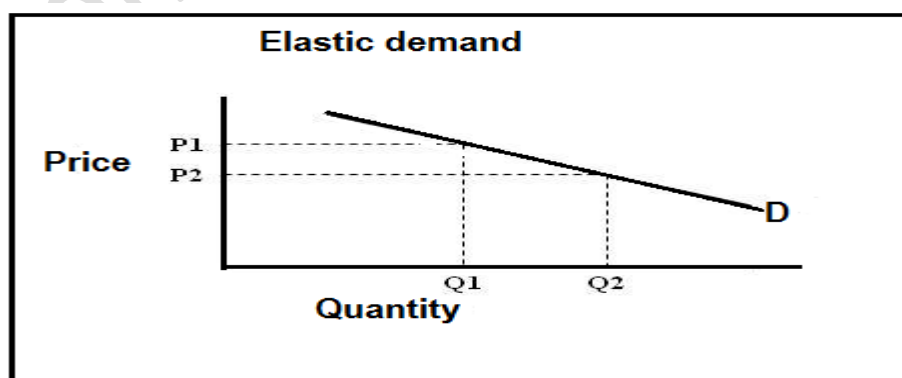
PRICE ELASTICITY OF DEMAND

Is the relationship between the change in price and a change in demand of a product

Example of elasticity of demand

□ If a **price of chocolate bar increase by 12%**, many people will **stop buying** it and go for other **cheaper chocolate** and hence demand changes in response to change in price

Graph illustrating price elasticity of demand



INTERPRETING THE GRAPH:

A **slight change in price** results in a **substantial change** in quantity demanded

It is a common knowledge that when price increases less of that product will be bought

FACTORS DETERMINING ELASTICITY OF DEMAND

Nature of the product

Luxury items show more elasticity than basic items

Availability of substitute products

The more substitute goods for the product the more elastic the demand

Time/period

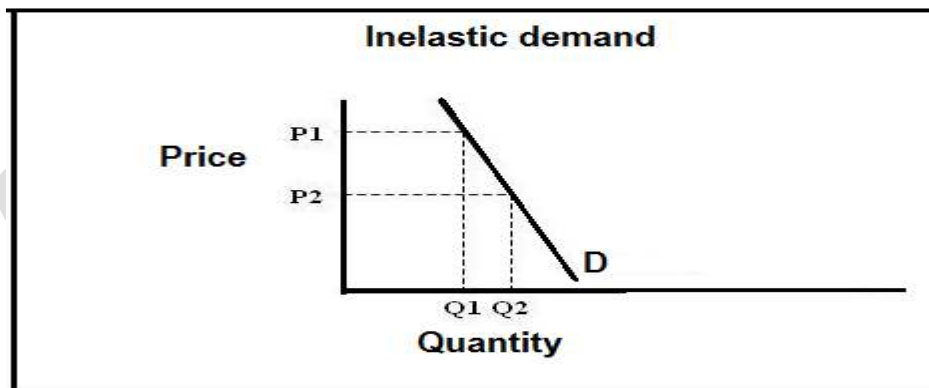
The more time passes, the more elastic is the demand

PRICE INELASTICITY OF DEMAND

Example of inelasticity of demand

If the price of petrol **increase by 20%**, most people will have no choice but to buy the petrol

Graph illustrating inelasticity of demand



INTERPRETING THE GRAPH

An increased **change in price** results only a **slight change in quantity** demanded. **Increase in price** has **less effect on the demand** of the product

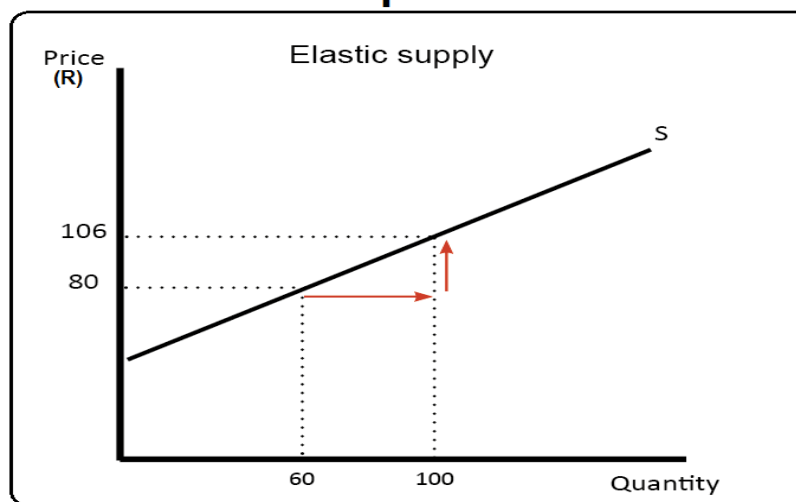
PRICE ELASTICITY OF SUPPLY

Is the relationship between the change in price and the change in supply.

Example of elasticity of supply

If the **price of certain products increases** this will cause the **quantity supplied to increase**. The producer always take advantage of increased price when supplying his products

GRAPH ILLUSTRATING ELASTICITY OF SUPPLY



INTERPRETING THE GRAPH

An increase change in price results in increased change in quantity supplied

It is common knowledge that if price increases the producer will take advantage of the price and supply more to affect his profit

FACTORS DETERMINING ELASTICITY OF SUPPLY

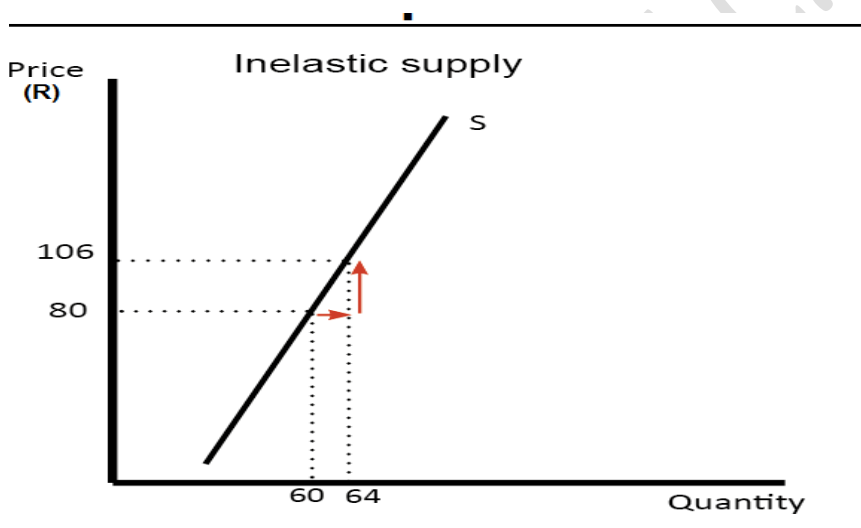
- ☐ Price of product
- ☐ Season
- ☐ Nature of product
- ☐ Marketing cost

PRICE INELASTICITY OF SUPPLY

Example of inelasticity of supply

If Products can be stored and be marketed all year round, quantity supplied will not change

Graph illustrating inelasticity of supply



INTERPRETING THE GRAPH

An increased change in price result in small change in quantity supplied.
Change in price has less effect on supply

MARKET EQUILIBRIUM

Is the point where **demand** and **supply** is **equal**

Example of market equilibrium

As the **price of the product increases**, **demand for the product decreases**. But the **producer is willing to supply more**. Where supply and demand is equal is called the **market equilibrium**

DEMAND AND SUPPLY SCHEDULE

Price (R/box)	Quantity demanded (box/week)	Quantity supplied(box/week)
5	2000	12000
4	4000	1000
3	7000	7000
2	11000	4000
1	16000	1000

Graph illustrating market equilibrium

FLOOR PRICE

Is a situation where price charged for a product is higher than equilibrium price.

It is imposed by the government to prevent prices from falling below certain levels

CEILING PRICE

Is a situation where price charged is below the equilibrium price.

It is imposed by the government to prevent prices from rising above certain levels and this lead to shortage of product

OVERSUPPLY AND SHORTAGE IN THE MARKET EQUILIBRIUM

Over supply (surplus)

When price of a product is above the equilibrium price the following occur;

1. **Demand** of the product **decrease**
2. **Supply** of the product **increase**
- **Supply exceeds the demand** this result in more product supplied than required

Shortage (deficit)

When price of a product is below the equilibrium price the following occur;

1. Demand of the product increase
2. Supply of the product decrease
- **Demand exceeds the supply** this results in more product demanded and less is supplied

SHIFT DEMAND AND SUPPLY

SHIFT DEMAND

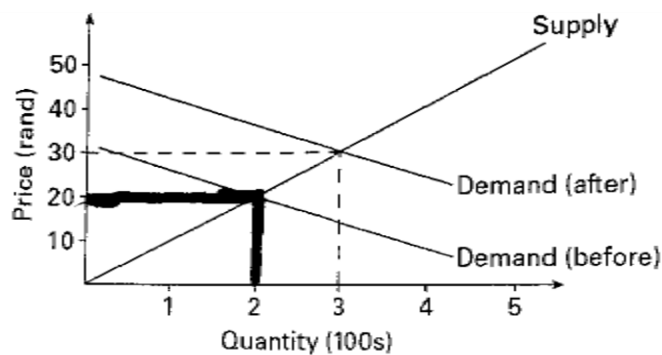
Is the factor that influence changes of demand (other than price)

The **equilibrium price changes** if the demand for a product changes.

Example of shift

During Christmas there is an **increase** in demand of **CHOICE ASSORTED BISCUTS**. As the demand **increases** the biscuits become **scarce**(less supply). The market will then sets a **new price** that is **above** the equilibrium price, meaning the producer will **charge more** for the CHOICE ASSORTED BISCUTS.

Shift demand graph



Increased in demand tend to increase equilibrium price while decrease in demand tend to decrease equilibrium price

FACTORS CAUSING SHIFT DEMAND

- ☐ Consumers income
- ☐ Consumers preference
- ☐ Change in price
- ☐ Population size

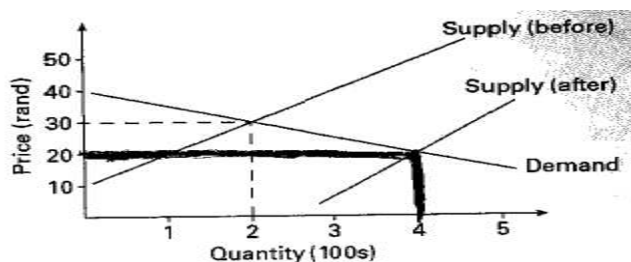
SHIFT SUPPLY

Is one factor that influence changes of supply (other than price). The equilibrium price change if the supply for a product change

Example of shift supply

As summer arrives the fruits such as **mangoes come to season** (increased supply). The market will set a **new equilibrium price** that is **lower than** the old equilibrium price. Meaning the sellers will shift their **prices down**.

SHIFT SUPPLY GRAPH



Increase in supply tends to decrease equilibrium price. While decrease in supply tend to increase equilibrium price

FACTORS CAUSING SHIFT SUPPLY

- ☐ Changes in production
- ☐ Improved technology
- ☐ Industry growth

MARKET DEVELOPMENT

Is a strategic step taken by producer to develop existing market rather than looking for new market

DEVELOPING A MARKET YOU MUST;

1. Conduct market research

- Study the market you would like to sell your product to

Market research includes:

Collecting information about customers

Collecting information competition

2. Developing marketing strategy

It includes conducting the 4ps:

- (i) **PRODUCT** (what product to make and sell)

Factors to consider when designing the product

- ☐ Packaging
- ☐ Size
- ☐ Quality
- ☐ Design
- ☐ Brand name

- (ii) **PRICE**(how much your product is going to cost)

Factors to consider when determining price

- ☐ Production cost
- ☐ Demand
- ☐ Competition

- (iii) **Placement**(where to sell the product)

Factors to consider when determining placement of product

☐ Location

☐ Logistics

(iv) **Promotion**(how are you going to convince people to buy your product)

Ways to implement promotion

☐ In-store sales

☐ Exhibition

☐ Direct mail

MARKETING APPROACH

☐ **NICHE MARKETING**

Focuses on selling to a small segment of a market

Focuses on a specific group of consumers in a market place.

It is not served by mainstream suppliers

☐ **MASS MARKETING**

Take in as large market as possible

Promotes same product in different ways to different group of people

Attempts to reach every consumer rather than targeting a particular market segment.

It targets the whole market with a single offer.

Traditionally, Mass marketing is done through radio. Television and newspaper

□ MULTIPLE SEGMENT

It allows you to select few segments and develop a marketing strategy that fit well.

This is typically done by offering different **levels of quality to different levels of income**.

Example multi-segment

Offering **Class 1 fruits** to consumers with **high income** and **Class 3 fruit** to consumers with **low income**.

SUSTAINABLE MARKETING

Involves the application of an environmental friendly marketing approach

WAYS OF MARKETING PRODUCTS IN A SUSTAINABLE WAY

- Developing a product that is naturally healthy (organic product), instead of genetically modified crops
- **Eco-labelling**
The practice of putting labels on products to promote them as environmental friendly
- Biodegrading/ recyclability

MARKETING SYSTEM

Is the mechanism through which goods reach different places

Marketing systems are divided into: Free marketing, co-operative marketing & controlled marketing

TYPES OF MARKETING SYSTEM

1. FREE-MARKETING

System where goods and services are exchanged freely without restriction and control



Advantages of free marketing system

- ☐ Farmers do not transport their products
- ☐ Payment is usually cash
- ☐ Cash is received on spot
- ☐ Middlemen are eliminated
- ☐ Produce goods of high quality (they create good reputation)
- ☐ Producers show initiative and drive (they work very hard to earn profit)

Disadvantages of free marketing system

- ☐ Producers are exposed to competition

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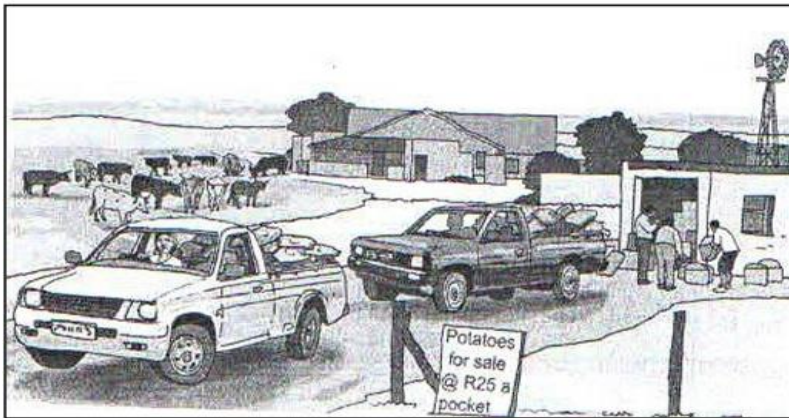
- ☐ There is fluctuation of prices
- ☐ They lack marketing skills
- ☐ Less bargain power
- ☐ High marketing cost (since products are sold at small-scale)
- ☐ High risk of perishability

FREE MARKETING CHANNEL

☐ **FARM-GATE MARKETING**

Selling directly from the farm

Price notice is placed on the farm gate



Advantages of farm-gate marketing

- ☐ Farmer do not have to transport their product
- ☐ Cost of marketing is reduced
- ☐ Products are sold at a low price

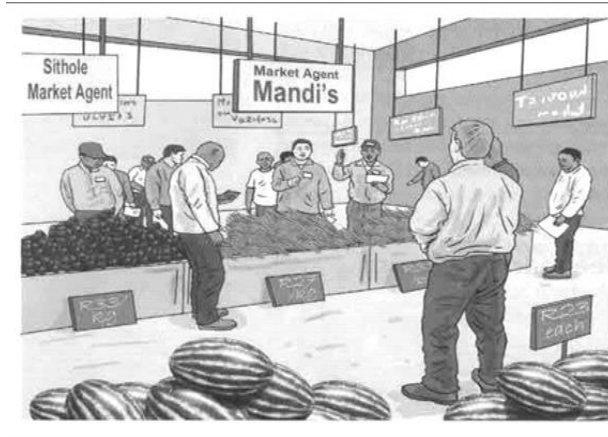
Disadvantages of farm-gate marketing

- ☐ Buyers have to come to the farm which require good accessibility
- ☐ Farmers have to accept local prices

❑ FRESH PRODUCE MARKET

Goods are delivered to agents at municipal market.

Goods delivered, graded and sold at set purchased

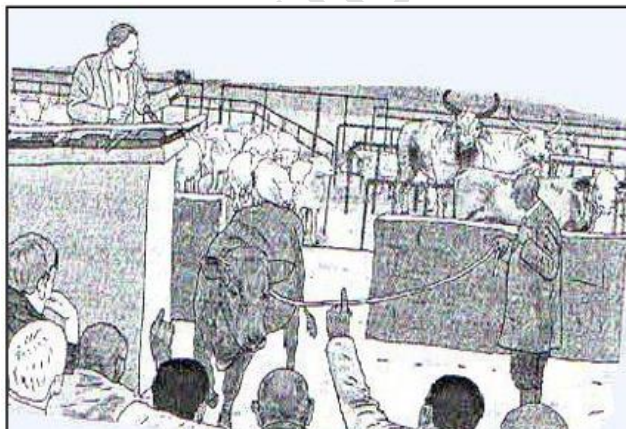


Advantages of fresh produce market

- ❑ Large volume can be sold
- ❑ Agents market products on behalf of the producer
- ❑ Agents market products on behalf of the producer
- ❑ Farmers can take advantages of higher price

❑ STOCK AUCTION

Livestock are sold on auction to the highest bidder



Advantages of stock auction

- ☐ The auctioneer advertise the event
- ☐ Payment is guaranteed
- ☐ The market is larger than local market

Disadvantages of stock auction

- ☐ Seller may not be offered the price expected.
- ☐ Prices may be lower than market price

☐ **CONTRACT MARKETING**

Producer sell directly to retailer(it is done under contract arrangement)

Advantages contract market

- ☐ Volume and price is guaranteed
- ☐ Middleman is eliminated

Disadvantage of contract market

- ☐ Producer must always have sufficient products available to meet the needs of customers
- ☐ Quality and quantity of product must be consistent (If the farmer cannot meet the needs of the retailer, he will have to buy in products to make up quantities required by the retailer)

☐ **INTERNET MARKETING**

Products are advertised and sold online via a computer

Advantage of internet marketing

- ☐ Large market can be reached cheaply
- ☐ Money can be transferred before goods are delivered.
- ☐ It reach global audience

Disadvantages of internet marketing

- ☐ It is relevant to customers with internet access
- ☐ Online marketing is not free.
- ☐ The possibility of fraud is a risk.
- ☐ Many visitors will not want to use their credit card

2. AGRICULTURAL COOPARATIVES

Is the marketing system where two or more independent farms or group of people work together to meet their common needs

PRINCIPLES OF AGRICULTURAL COOPRATIVES

Democratic member control

Voluntary and open membership

Concern about community

Members contribute equally

ADVANTAGES OF COOPARATIVES

- ☐ **There is consistent supply** (work together to supply large volumes)
- ☐ **Middleman is eliminated**
- ☐ **Better infrastructure** (get facilities that and individual farmer cannot afford)
- ☐ **Bargain power** (greater chance of negotiating good price their product)
- ☐ **Bulk purchasing** (able to negotiate good price for their inputs)
- ☐ **Access to funding** (government make funding available for cooperative)
- ☐ **Branding** (can develop a brand for their product)

TYPES OF COOPERATIVES

PRODUCTION COOPARATIVE-produce collectively

SERVICE COOPARATIVE-provide service to members

MARKETING COOPERATIVE-negotiate with markets on behalf of members

PURCHASING COOPERATIVE-purchase inputs on behalf of members

CONSUMER COOPRATIVE-buy products in bulk and sell to their members at a discount

3. CONTROLLED MARKETING

Is the marketing system in which buying and selling is manipulated or controlled by the government (government may decide on the price of a product)

ADVANTAGES OF CONTROLLED MARKETING

- ☐ Orderly marketing
- ☐ Producer focus on their farming activities rather than spending time on marketing the products
- ☐ Stable prices
- ☐ Secure market outlets

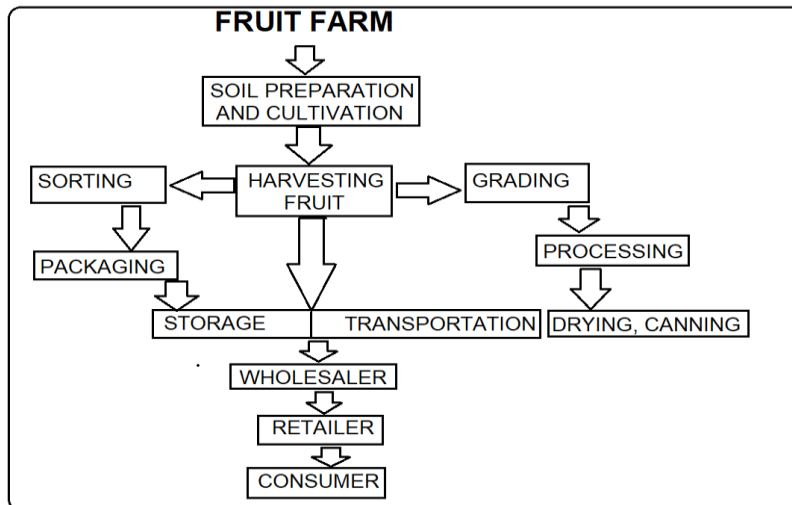
DISADVANTAGES OF CONTROLLED MARKETING

- ☐ It does not encourage entrepreneurship
- ☐ Producers cannot negotiate prices with potential buyers
- ☐ The establishment of centralized facilities such as abattoirs or grain storage facilities can be inefficient and increase transport costs.

MARKETING CHAIN / SUPPLY CHAIN / AGRIBUSINESS CHAIN

Steps or path involved in the movement of product from farm to the consumer.

Each activity in the chain involves a cost



COST INVOLVED IN MARKETING CHAIN

1. PRODUCTION COST
2. PACKAGING COST
3. PRODUCT PREPARATION
4. TRANSPORT COST
5. STORAGE COST
6. PROCESSING COST
7. TAX
8. PRODUCT LOSS COST

FACTORS HAMPERING MARKETING OF AGRICULTURAL PRODUCTS

1. POOR INFRASTRUCTURE

Include poor roads and lack of storage facilities

2. PERISHABILITY OF PRODUCT

Many products deteriorate when not stored, handled and transported properly

3. LOW VALUE IN RELATION TO VOLUME

Some product have low value to their size this increase transport cost

4. SEASONAL FLUCTUATION

Many products are produced during one season and yet there's year-round demand which means proper storage is needed

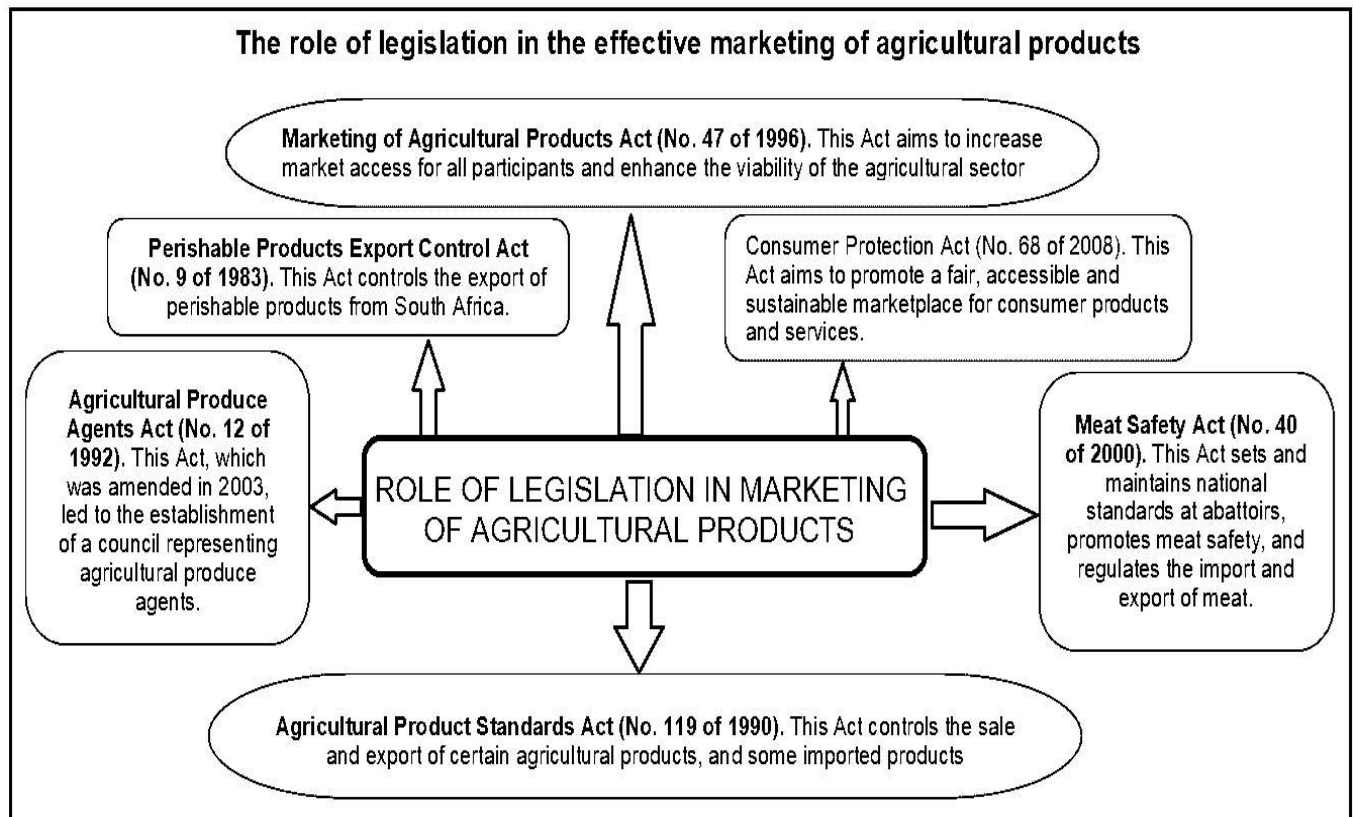
5. ACCIDENT AND THEFT

It increase marketing cost

WAYS TO STREAMLINE AND IMPROVE MARKETING CHAIN

- ☐ **IMPROVING INFRASTRUCTURE** (build adequate roads)
- ☐ **IMPROVE ACCESS TO MARKET INFORMATION** (provide cell phones and internet as a marketing strategy)
- ☐ **PROVIDE STORAGE** (to prevent product spoilage)
- ☐ **PROCESS PRODUCTS CLOSE TO WHERE THEY ARE PRODUCED** (reduce less value to value)

MARKETING LEGISLATION



Notes

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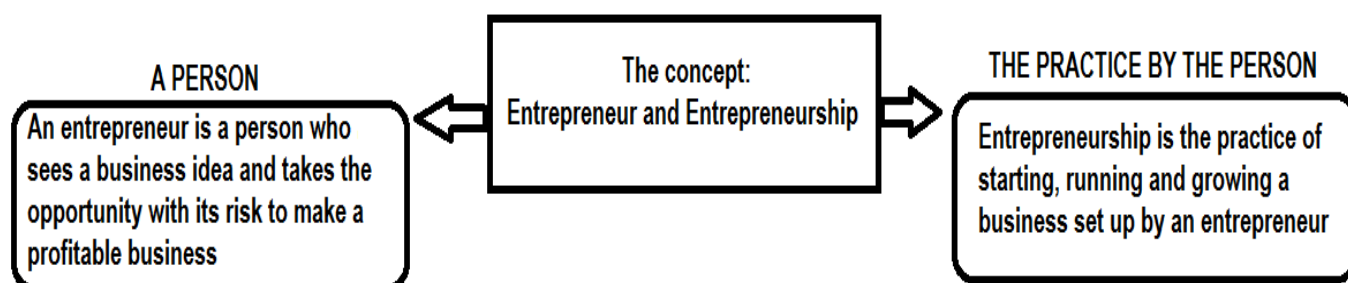
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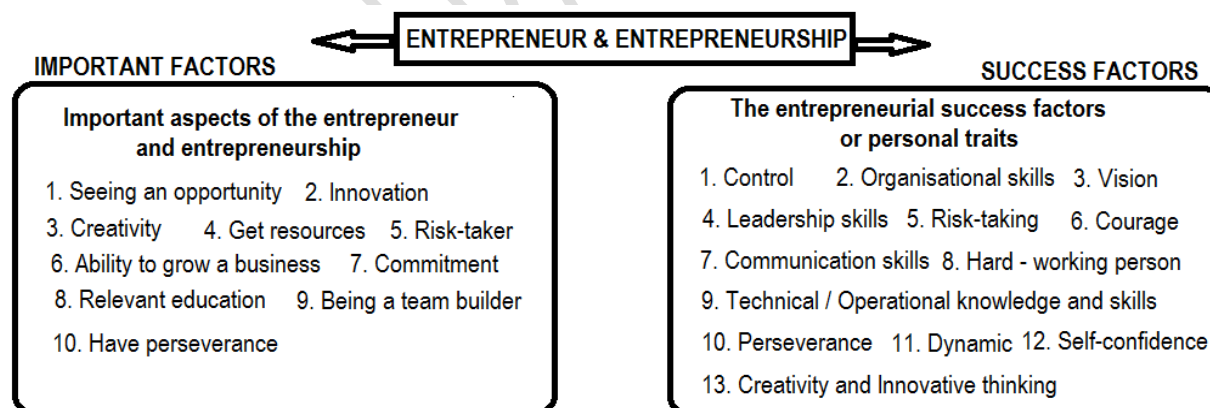
Paper 2

AGRICULTURAL ENTREPRENEUSHIP AND BUSINESS PLANNING

Difference between entrepreneurship and entrepreneur



ENTREPRENEUR IMPORTANT FACTORS AND SUCCESS FACTORS



PHASES OF ENTREPRENEURSHIP

1. Identify an opportunity
2. Evaluate opportunity

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3. Determine resources required
4. Develop a business plan
5. Start and manage the business

BUSINESS PLAN

Is a document that describes how a business will operate. It also states the business goals, the reasons they can be achieved and the plan for how to achieve them

REASON FOR DRAWING UP A BUSINESS PLAN

- ☐ To secure funding
- ☐ To test feasibility of business idea
- ☐ To effectively manage business
- ☐ To foresee problems and minimise risk
- ☐ To determine your financial needs
- ☐ to state vision and mission of the business

TESTING FEASIBILITY OF BUSINESS IDEA

☐ **There are 3 questions you got to ask yourself to decide if your business idea will succeed:**

Is there a market for my product or service i want to offer?

Do i have skills to start and run the business?

Do i have resources to start the business or can i acquire them?

PROBLEMS WHEN DRWING UP A BUSINESS PLAN

- ☐ Insufficient research
- ☐ Leaving gaps or providing too much information
- ☐ Hiding weakness and risks
- ☐ Using incorrect format

- ☐ Not highlighting your competition

SOLUTION WHEN DRAWING UP A BUSINESS PLAN

- ☐ Using electronic resources as a tool for drawing up a business plan

SWOT ANALYSIS

Is a strategic planning tool that helps you to evaluate your business

It is an acronym for: S- **STRENGTH** W- **WEAKNESS** O- **OPPORTUNITY**

T- THREATS

1. STRENGTH

- ☐ Factors contributing to the business success
- ☐ It gives the business an advantage
- ☐ It is an internal factor that the business can control

For an example:

Good reputation

Skills and labour experience

Latest equipment or latest technology (out-dated machinery)

Good infrastructure

Good management skill

2. WEAKNESS

- ☐ Factors within the business preventing your success
- ☐ It is an internal factor which can be improved to strength for the benefit of the business

For an example:

Lack of latest equipment or latest technology (out-dated machinery)

poor location of the business

lack of skills
undercapitalisation
bad reputation
having large debts
poor management skill

3. OPPORTUNITY

- ☐ External motivating factors that are needed for a farming business to be successful
- ☐ It help to improve performance of business

For an example:

Changes in tax laws

Market growth

New trends

Lifestyle changes

A competitor went bankrupt

4. THREATS

- ☐ The external factors that can put your farming business at risk.

For an example:

Increased interest rates

Products become unfashionable

Increased competition

