Advantages of early weaning in pigs.

i) There are fewer runts since bullying during suckling is reduced

ii) Pigs access creep feeds and gain weight very fast.

iii) It encourages the sow to come on heat earlier

iv) It enables a sow to maintain its weight due to reduced nutrient loss

v) It reduces chances of parasites and diseases transmission from the sow to the piglets

vi) It reduces chances of mortality in piglets since they are not exposed to being crashed by the mother sow

Disadvantages of early weaning:

i) Its expensive to purchase creep feeds

ii) The high level of management is needed to avoid piglet mortality.

iii) There is increased labour requirement on the farm to take care of the piglets.

Signs of poor health in pigs:

- Dull eyes
- Loss of appetite
- Blood stained diarrhoea
- Drooping ears pointing downwards
- It separates itself from the rest
- Change in skin colour of the skin especially in the white pigs.
- Rapid breathing which indicates a fever.
- Increase in body temperature
- Loss of body weight.

Revision question:

Qn a) Explain management practices carried out on piglets during their first week of life (14mks)

b) Outline reasons for the popularity of pig rearing in Uganda. (06mks)

NUTRITION IN FARM ANIMALS:

- ✓ **Nutrition:** This is the process by which an animal can obtain food materials it requires for body nourishment from the environment.
- ✓ **Food:** It's any substance that provides the required nutrients for the body.
- ✓ **Nutrient:** It is any compound that is essential to the body and can support life of an organism.

NB: In order for the animal to obtain nutrients it requires, it should be fed on the right type and quantity of food.

Reasons for feeding animals:

- For energy production e.g. carbohydrates.
- For growth and development especially in young animals e.g. proteins.
- For reproduction in order to multiply their number.
- For production of the right quantity of animal products in terms of milk, eggs, meat, hides and skins.
- For heat generation and insulation of the body temperature e.g. lipids
- To build body resistance/immunity against diseases e.g. vitamins and minerals.
- For repair of worn out body cells and tissues e.g. proteins.
- For life maintenance of body processes like respiration, blood circulation, heartbeat, etc e.g vitamins and minerals.

Terms used in livestock nutrition

1. **Ration:** This is the day's or 24hour feed allowance given to the animal or it's the amount of food eaten by an animal in a day.
2. **Production ration:** It is the amount of feed eaten by the animal to meet its production requirements of meat, milk and eggs.
3. **Maintenance ration**: This is the amount of feed required by the animal to keep it alive without gaining or losing weight.
4. **Balanced ration**: It is the feed which contains the correct proportion and quality of various nutrients, water and dietary fibre required to maintain health.

N.B: The ideal balanced ration varies from one animal to the other depending on certain factors like age, sex, body size, productivity and health condition.

5. **Starch equivalent (S.E):** This is the amount of pure starch which has the same energy as 100kg of a feed.
6. **Palatability:** This is the relative attractiveness of the feed and its pleasantness to the taste of an animal i.e. a palatable feed is one that is liked by an animal and can be eaten in large quantities.
7. **Basal feeds:** These are feeds which have a higher content of carbohydrates that can provide energy e.g. maize bran, rice bran, etc.
8. **Bulk feed:** These are feeds that contain a limited amount of nutrients per given weight and are usually have a high fibre content e.g. roughages/forages or pasture plants.
   They are mainly used to satisfy the animal's appetite since they contain a high dry matter content.
9. **Crude protein (CP):** This is the amount of protein contained in the feed stuff i.e.
   CP = Nitrogen content of the feed × 6.25
10. **Feed conversion ratio**: it is the ease at which the feed is converted into a utilizable product or value e.g. meat, eggs, milk, etc.
11. **Digestible crude protein (DCP):** This is the proportion of the proteins in the feed stuff that can be digested.
12. **Total digestible nutrient (TDN):** This is the sum of all the nutrients in the feed that can be digested.
13. **Protein supplement:** These are feeds with a high protein content of over 30% e.g. fish meal, Cotton seed cake, etc.
14. **Heat increment:** It is the heat produced as a result of fermentation and nutrient metabolism. It is produced in the liver and the kidneys and can be used for body temperature regulation or wasted as heat.
15. **Biological efficiency:** This is the measure of the amount of output per feed eaten by an animal. In lactating animals, it can be the amount of milk given per kg of dairy meal consumed.
16. **Economic efficiency:** It is the measure of the cost of animal product to the cost of inputs like feeds i.e. $E.E = \frac{Output \times Price}{Feeds\ eaten \times Price}$

17. **Gross energy efficiency:** It is the ratio of energy output of an animal to its energy intake.

$$GEE = \frac{\text{Energy output in products}}{\text{Energy intake in feeds}}$$

18. **Digestibility of a protein:** It is the measure of proportion of a protein digested and absorbed in the body of an animal.

19. **Biological value (B.E):** It is the proportion of protein that is absorbed and retained in the body of an animal.

20. **DIGESTIBILITY OF FEEDS:**

This is the proportion of food absorbed and retained by the body when the rest has been lost through urine, gases and faeces.
OR: It is the oral-faecal difference of the feed.

Determining feed digestibility:
In practice, digestibility is determined for dry matter, proteins, fats and crude fibre.

Therefore; ***Percentage digestibility*** $= \left(\frac{\text{Nutrient intake (NI)} - \text{Nutrient in faeces (NF)}}{\text{Nutrient intake (NI)}} \times 100\ \%\right)$

Worked Example:

1. An animal was given 500g dry matter of a feed and later passed out 200g. Calculate;

i) Digestibility of the feed
Digestibility = (NI – NF)
= (500-200) g
= 300g

ii) Percentage digestibility
$$\text{Percentage digestibility} = \frac{(NI-NF)}{NI} \times 100\%$$
$$= \left(\frac{300}{500} \times 100\right)\%$$
= 60%

2. In an experiment to analyse a feed sample, it was found to be 16% protein and 10% crude fibre. It's dry matter intake was 500g and faecal output was 250g. The faecal crude protein and crude fibre was 13% and 12% respectively.
Calculate the;

i) Percentage crude protein digestibility
$$\%\ \text{crude protein digestibility} = \left(\frac{\text{Intake - Faecal}}{\text{Intake}} \times 100\%\right)$$

- *But CP intake = (0.16 × 500) g*
= 80g

- *CP faecal = (0.13 x 250) g*
  *= **32.5g***

- *% CP digestibility = $\frac{(I - F}{I} \times 100)$ %*
  = $\frac{(80-32.5}{80} \times 100)$ %
  *= **59.38%***

ii) Percentage crude fibre digestibility
Percentage crude fibre digestibility $= \frac{(I - F}{I} \times 100)$

- *But CF intake = (0.1× 500) g*
  = 50g
- *CF Faecal = (0.12 x 250) g*
  *= **30 g***
- *% CF digestibility = $\frac{(I-F}{I} \times 100)$ %*
  = $\frac{(50-30}{50} \times 100)$ %
  = 40%

Factors influencing digestibility of feeds:

i) **Type of animal:** Ruminants have a higher digestibility of fibre than non-ruminants.

ii) **Amount of feed eaten:** High level of feed intake reduces digestibility of feeds.

iii) **Processing:** Grinding of grains improves digestibility by the animal.

iv) **Time taken for digestion:** Adequate time given for the process of digestion to take place increases the degree of digestibility of a feed when eaten by animals.

v) **Nutrient content of feeds:** Feeds which have a high protein content like legumes and concentrates have a high digestibility.

vi) **Percentage of crude fibre:** High fibre percentage reduces digestibility of the feed.

vii) **Age of animal:** Young ruminants cannot digest grass due to undeveloped digestive system as compared to mature animals.

viii) **Health of animal:** Sick animals may not effectively digest feeds as compared to healthy ones.

ix) **Moisture content of the feed:** Feeds with high moisture content e.g succulents are easier to digest than dry ones e.g mash or roughages.

x) **Presence of anti-metabolites in some feeds:** Digestive inhibitors like anti-trypsin factors (Trypsin inhibitors) in soya beans interfere with protein digestion and reduce digestibility of feeds.

xi) **Exercise:** Light exercise increase digestibility of feed while heavy exercise depresses it.

xii) **Associated effects of other feeds:** Increased intake of protein feeds will increase digestibility of fibre.

Ways of increasing digestibility of feeds:

- Providing feeds with a high nutrients values to the animals.
- Providing plenty of fresh water to animals adlib.
- Adding molasses to feeds increase palatability.
- Chopping pastures and crushing feeds to increase surface area for enzyme reaction.
- Avoid excess exposure of feeds and water to sunshine inorder to maintain their quality by reducing their rancidity.

METHODS OF DETERMINING THE DIGESTIBILITY OF A FEED:

1. **Convectional total collection:**

   This involves giving an animal a constant daily feed intake and recording the amount taken and faecal output.

2. **Indicator method**:

   It involves mixing of an inert substance with feeds to be used as an indicator in determining the digestibility of a particular feed.

   Characteristics of a good indicator:

   i) It should be harmless to the animal

   ii) It shouldn't be digested by the animal.

   iii) It should be able to pass through the alimentary canal uniformly.

   iv) It should be harmless to the rumen microbes.

   v) It should be readily mixed with feeds.

NB: The indicators are of two types namely:

i) External indicators: These are not part of the feed e.g **Chromic oxide.**

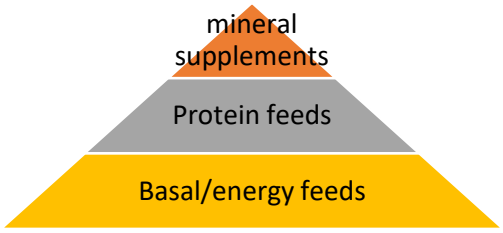
ii) Internal indicators: These are parts of the feed e.g **Ash, Chromogens,** etc.

FEED MIXING / RATION FORMULATION:

On commercial scale, a mechanical feed mixture is used to mix the feeds well. However, a small scale farmer can mix the feeds manually on a concrete floor using a spade.

✓ **The feeds are put on a conical shape/heap as follows;**

- **Basal/energy feeds** occurring in large amounts are put at the bottom.
- **Protein feeds** are added in the middle of the cone.
- **Mineral supplements** are put at the corn so that they can spread over as seen below.



Factors considered when formulating or mixing feed rations:

Before mixing the feed rations, the following must be put into consideration.

i) **Nutrient required by the animal:** Feeds that are well balanced with nutrients should be given to the animals.

ii) **Age of the animal:** Young animals require more proteins than the old animals.

iii) **Health of the animal:** Sick animals require a high amount of vitamins for body immunity than normal ones.

iv) **Physiological status of the animal:** Pregnant animals may require more energy, minerals and protein intake.

v) **Cost of feeds:** Cheaper feed that can meet the animal's nutrient requirements should be considered for mixing.

vi) **Productivity of the animal:** High milking animals require a lot of minerals e.g. Calcium, Phosphorus and Potassium than low milking ones.

vii) **Type of animal:** Ruminants can digest coarse roughages due to the microorganisms in rumen than non-ruminants thus a ration for non-ruminants shouldn't contain large roughage content.

viii) **Availability of feeds:** Feeds that are easily available in the nearby locality should be considered for animals.

ix) **Palatability:** The feed mixture should be liked to be eaten by the animal due to its taste, scent, etc.

x) **Digestibility:** Feeds that are easily digested and absorbed in the body of the animal should be considered.

xi) **Familiarity of the feed**: animals tend to reject or refuse new feed stuffs at the first time and thus gradual introduction of new feeds should be done**.**

xii) **Physical nature of the final mixture**: the texture of the final mixture i.e. whether mash(powdery) or grain, pelleted (solid) should be considered.

xiii) **Wholesomeness of the feed:** The feeds chosen should not cause any harm to the animal or spoil animal products i.e. it should not be poisonous to the animal.

xiv) **Binding property of the feeds:** Feeds with a low binding ability e.g chicken mash should be considered than groundnut seed cake.

METHODS USED IN FEED FORMULATION:

i) **Pearson square method:** This is the commonest method used and it involves the use of a square to calculate the amount of feeds mixed and it can only handle two items.

ii) **Trial and error method:** This involves the first mixing of feeds with very many mistakes until when correct quantity is mixed that is required or liked by animals.

iii) **Graphical method:** This involves the use of a graph to calculate the required amount of nutrients to be mixed for the animals.

iv) **Linear programming method**: This is also used now days but it requires the use of computers and it can handle more than two feedstuffs simultaneously.

PEARSON SQUARE METHOD:

This is the method of determining how much protein supplement is needed to balance the feed ration for the animals.

Procedure:

i) Draw the square and put the percentage of the proteins in the ratio at the Centre of a square.

ii) Put the percentage of proteins of each feed ingredient to be mixed at the left hand corner of the square.

iii) Subtract diagonally or across regardless of the sign i.e negative or positive.

iv) The figures got at the right hand corner give the parts of the ingredients to be mixed in the ration.

v) Add to get the total parts of the ingredients to be mixed.

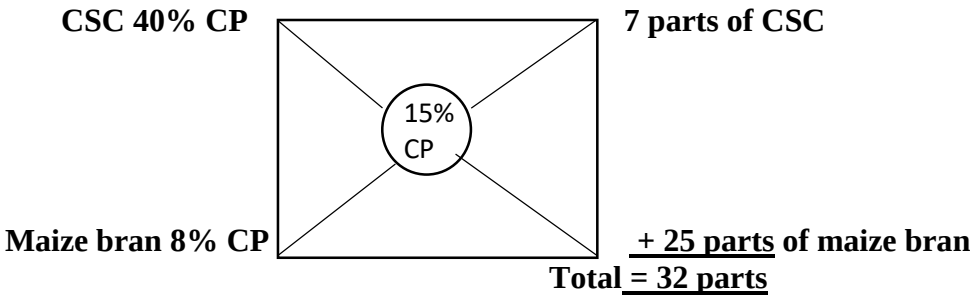
vi) Work out the percentage of each ingredient.

Worked examples:

1. A farmer would like to mix the feed ration of 15%CP using cotton seed cake containing 40% CP and maize bran containing 8% CP.

a) Work out the percentage of each ingredient using Pearson square method.

Using Pearson square;



The proportion of each ingredient in the ration is as follows:

- Cotton seed cake = $(\frac{7}{32} \times 100)$ % = **21%**
- Maize bran =$(\frac{25}{32} \times 100)$ % = **79%**
- Proof = (21+79) = **100%**

b) In what proportion would he mix the feed ingredients to obtain a 200kg bag of feeds?

- **From 21% of CSC, the proportion would be;**
  = $(\frac{21}{100} \times 200)$ kg = **42 kg**.
- **From 79% of Maize bran, the proportion would be;**
  = $(\frac{79}{100} \times 200)$ kg = **158 kg**.
- Proof: = (42 + 158) kg = 200 kg.

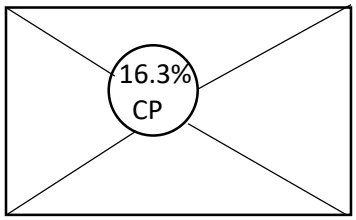
2. Mr. Kasumali wants to mix a ration of 16% CP using maize bran which is 8% protein and cotton seed cake which is 38% CP. The mineral supplement e.g. Maclick block should be added to supply the required minerals at 2% level.

Solution:

- Therefore, maize bran and C.S.C would constitute 98% and 2% for minerals.
- The level of protein in the 98% of the ration would have to be higher than 16%.
- It would be $(\frac{100}{}$ x16) = **16.3%**

Using Pearson square method

CSC 38% CP **8.3 parts of maize bran**



Maize bran 8% CP **+ 21.7 parts of CSC**

Total = 30.0 parts

The proportion of each ingredient is as follows;

- Maize bran = $(\frac{21.7}{30.0} \times 98)$ = **71%**
- CSC = $(\frac{8.3}{30} \times 98)$ = **27%**
- Mineral supplement = + 02**%**

  100%

3. A farmer would like to make a ration of 16% protein with the following feed stuffs. Sorghum bran 9%CP, Maize bran 15% CP, Cotton Seed Cake 40% CP and Fish meal 60% CP. In what proportion would he mix the food stuffs to make a ration if sorghum bran and maize bran are to be mixed in the ratio of 2:1 and Cotton Seed Cake and Fish meal in the ratio of 2:1 respectively?

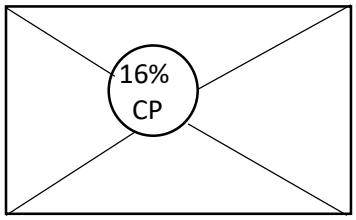
Solution:

The feed stuffs are of two groups namely:

i) Basal/Energy feeds	**Part**	**% CP**	**Average**
Sorghum bran	2	9	$\frac{24}{3}$
Maize bran	1	15	
Total	**3**	**24**	**= 8%**

ii) Protein feeds	**Part**	**% CP**	**Average**
Cotton seed cake	2	40	$\frac{100}{3}$
Fish meal	1	60	
Total	**3**	**100**	**= 33%**

Using Pearson square method

Basal feeds 8% CP  **17 parts of Basal feeds**

Protein feeds 33% CP **+ 8 parts of Protein feeds**

Total = 25 parts

The proportion of each major feed ingredient is as follows;

- Basal feeds = $(\frac{17}{25} \times 100)$ = **68 %**
- Protein feeds = $(\frac{8}{25} \times 100)$ = **32%**

The proportion of sorghum bran to maize bran in the ratio of 2:1, is as follows;

- Sorghum bran = $(\frac{2}{3} \times 68)$ = **45 %** | **-** Protein feeds = $(\frac{1}{3} \times 68)$ = 2**3%**

The proportion of cotton seed cake to fish meal in the ratio of 2:1, is as follows;

- Cotton seed cake = $(\frac{2}{3} \times 32)$ = **21%** | **- Fish meal =** $(\frac{1}{3} \times 32)$ = 11**%**

Therefore, the ration consists of the following as follows:

- Sorghum bran = 45 %
- Maize bran = 23 %
- Cotton seed cake = 21%
- Fish meal = 11 %

  Total **= 100 %**

NUTRIENTS REQUIRED BY FARM ANIMALS:

There are mainly six major nutrients namely:

i) Minerals
ii) Proteins
iii) Carbohydrates
iv) Lipids
v) Vitamins
vi) Water

1. MINERALS;

These are inorganic substances which are useful to animals and are required in small quantities.

Importance of minerals in animal nutrition:

- They help in fomentation of strong bones and teeth e.g. Calcium and Phosphorus.
- They are responsible for blood clotting e.g. calcium
- They are components of animal products e.g. calcium in milk and eggs
- They are components of enzymes e.g. manganese and molybdenum
- Some are important components of blood and other body fluids e.g Iron and Copper.
- They are important components of hormones e.g. thyroxine produced by the thyroid gland e.g. iodine.
- They are required for the proper functioning of muscles e.g. Potassium and Sodium.
- They are useful in responsible e.g. iron is present in Haemoglobin to distribute oxygen into body tissues as **Oxy-haemoglobin (Hb_20).**

Source of minerals:

- Bone meal
- Oyster /snail shells
- Fish meal
- Limestone
- Ordinary salt /table salt
- Legumes/mineral lick / mineral block (mac- lick block) or Dairy cube.

2. CARBOHYDRATES:

These are organic compounds containing C, H and O. They are the cheap source of energy in farm animals.

Importance of carbohydrates in animal nutrition:

- They provide energy to the animal's body
- They are used in the synthesis of products e.g. meat. Milk etc
- Excess of it can easily be converted into fats and oils hence stored under the muscles to be used to provide energy during time of starvation.
- They help in absorption of minerals e.g. Calcium and Phosphorus.
- They are found in body structures like cartilage and connective tissues.
- They also prevent accumulation of toxins or poisons called Ketone bodies.

Sources of carbohydrates:

- Fresh pastures i.e. grasses and legumes
- Root tubers of crops like cassava and their peelings
- Molasses i.e. by products of sugar in sugar manufacturing industry
- Grains i.e. seeds of cereals and their products like maize bran, rice bran etc.

3. PROTEINS:

These are complex chemical/organic compounds containing C, H, O and Nitrogen and some contain Sulphur, Phosphorus and Iron.

Importance of proteins in animal nutrition:

- They are useful for growth of new tissues hence early maturity in animals
- They are required by the body for body building, repair of worn out /old and damaged cells and tissues.
- They are used in the production of hormones in the body.
- They are useful for the synthesis of digestive enzymes in the body.
- They used in production of animal products like meat, milk and eggs
- Some act as carriers for transporting substances in the body e.g Haemoglobin for oxygen transportation.
- They are used in production of antibodies for body immunity
- They are used in production of membranes in the body
- They are broken down to produce energy during times of starvation

Sources of proteins;

- Legume pastures
- Fish and bone meal
- Young grass
- Seed cakes e.g Cotton Seed Cake, Groundnut seed cake, etc
- Meat meal.

Examples of proteins:

They are found both in animals and plant tissues for example:

- **Myosin** - from beef /meat.

- **Albumin** -from eggs.
- **Gluten** - from cereals e.g. wheat
- **Legumene** - from legumes e.g. beans, groundnuts, etc.
- **Casein** - from milk.

4. LIPIDS:

These are organic compounds containing C, H and O more than the carbohydrates.

- **Fats** are solids at room temperature while **Oils** are liquids at room temperature becau**se** they contain plenty of **unsaturated fatty acids.**
- **Lipids** consist of **fats, oils** and their building units called **fatty acids** and **glycerol.**

NB: Unsaturated means that the fatty acids can hold and contain more hydrogen in their molecules.

- When animals are fed on a lot of them especially feeds like cakes of seeds, its fat deposits will be soft and of poor quality.

Functions of lipids:

i) They increase the animal's appetite.

ii) They provide energy (more) than the carbohydrates.

iii) They act as insulators especially under the skin against heat loss.

iv) They reduce pain during defaecation hence helping to reduce constipation.

v) They are carriers of fat soluble vitamins i.e. A.D.E.K.

vi) They have a structural role in the cell membrane and sheaths of nerve fibers.

Rancidity in lipids:

- The Fat becomes rancid when it undergoes **autoxidation / self-oxidation.** It occurs when it is exposed to **moist air, heat** and **light**.
- It develops **bad flavours** and **odours** that makes animal refuse eating the food in their feeds.
- There is also **loss of fat soluble vitamins A** and **E** which are anti-oxidants that get used up in the process.

NB: Butyrated Hydroxyl Toulen (BHT) and Butyrated Hydroxyl Anisole (BHA) are **synthetic anti-oxidants.**

5. VITAMINS:

These are organic compounds required in small amounts for body maintenance and defence against diseases.

Functions of vitamins in animal nutrition:

- Protect the animal against diseases
- Improve the fertility of the animal e.g. vitamin E
- Promote healthy growth of the animal
- Are components of enzymes
- Assist in blood clotting e.g. vitamin K
- Some are useful for the functioning of muscle in the body
- Regulate chemical reactions in the body**.**

Classification of vitamins

There are **15** essential vitamins that are recognized and are classified into two;

i. Fat soluble vitamins
ii. Water soluble vitamins

- **Fat soluble vitamins:** They dissolve in fats e.g. **A.D.E.K.**
- **Water soluble vitamins:** These dissolve in water e.g. **C** and **B-** complex group i.e. Thiamin (B_1), Riboflavin ($B_{2)}$, Pyridoxine (B_6) and Cyanocobalamin (B_{12}).

NB: There are compounds which probably vitamins e.g. Para amino benzoic acid (PABA) and Lipoic acid

- Vitamins are not synthesized in the body except **B** and **C**. Man and Monkeys (primates) in general can't synthesize vitamin C thus must be supplied in their diet.

Source of vitamins

- Yellow maize/ popcorn
- Green pastures
- Succulent feeds
- Unpolished cereals

6. WATER:

It's necessary in order to enable animals utilize the food they eat.

Sources of water in the body:

- **Exogenic sources:** It involves getting water from outside the body of the animal e.g. through direct drinking and from feeds obtained by the animal during feeding.
- **Endogenic sources:** It involves getting water from inside the body of the animal e.g.
  i) Metabolic water resulting from metabolism i.e. respiration and oxidation of food.
  ii) From chemical reactions in the body e.g formation of **Glucosidic bond**.

NB: Animals lose water from their bodies through the following:

- Micturition i.e. passing out of urine.
- Through the skin as sweat
- Through milk production
- Through vomiting
- Through watery diarthoea/stool
- Lacrination i.e. shedding of tears by crying through the eyes.

Functions of water in the animal's body:

- It helps to dissolve the food eaten since it's a solvent.
- It controls the body temperature of animal due to its cooling effect.
- It maintains the cell shape (turgidity) of living cells in an organism
- It helps in excretion i.e. removal of waste products from the body e.g. sweat.
- Its component of many body fluids e.g. saliva, tears, synovial fluid and semen or sperms.
- It provides a medium through which enzyme activities can take place /occur.
- Helps to activate chemical reactions in the body since it easily combines with other components.

Factors that affect the amount of water intake by the animal:

1. **Age:** The young animals e.g. calves take in less water that old cows.
2. **Health of the animal:** Sick animals tend to take in more water all the time because they feel thirsty all the time than healthy ones**.**
3. **Breed of the animal:** Exotic breeds of cattle take in more water e.g. Friesians than local breeds e.g. Zebu.

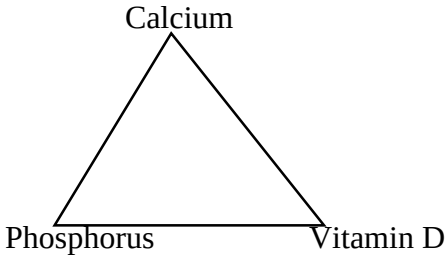
4. **Climatic conditions:** Animals take in more water when its hot due to increased rate of sweating than in cold days.
5. **Level of production:** The High yielding cows require more water that the low producers or dry cows.
6. **Physical exercise of the animal:** Working animals like oxen take in more water than those kept in zero grazing units with no movement.
7. **Physiological status of the animal:** Pregnant animal and those on heat take in more water because of the increased metabolic activities than those that are not.
8. **Accessibility / water availability:** Animals that are given water without restriction (adlib) take in more water than those that are given a form of measure.
9. **Salinity of water (taste):** When water is too saline, more of it will be taken in than when it's not salty.
10. **Species of the animal:** Under the same environmental conditions, cattle need more water than the camels since the camel's physiological makeup (hump) enables it to resist drought than cattle.
11. **Type of feeds eaten:** Animals drink more water when they eat dry or roughage feeds than when they eat succulent feeds that contain some water.

Sample question:

1. a) Outline the importance of water in the body of an animal. (10 mks)
   b) Explain the factors that determine the amount of water taken in by an animal (10mks)

GENERAL DEFICIENCY DISEASES ASSOCIATED WITH NUTRIENTS

1. **Grass tetany (grass staggers):** This is lack of **Magnesium** that causes staggerly movement in animals.
2. **Pica:** This is due to excessive appetite of the animal that makes it eat or gnaw soil, bones, sticks, clothes, mud, etc due to lack of **Phosphorus**.
3. **Rickets;** This is the poor formation of bones in animal caused by lack of **Calcium**, **Phosphorus** and **Vitamin D** as seen in the **anti-rickets triangle** below:

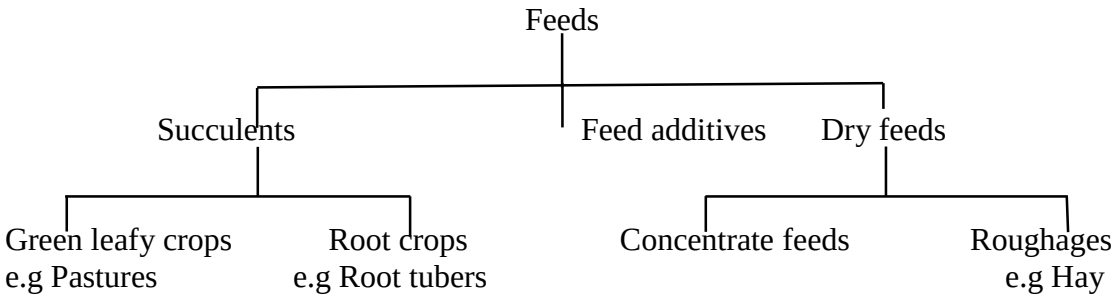


4. **Osteoporosis:** This s the softening of bones in poultry and laying of soft-shelled or shell-less eggs and also lower hatchability of eggs due to lack of **Calcium, Phosphorus** and **Vitamin D**.
5. **Milk fever (Osteomalacia):** This is the softening of bones and general body weakness in milking or dairy animals due to lack of **Calcium**.
6. **Night blindness:** It is the reduced vision in animal due to lack of **vitamin A**.
7. **Goitre:** This is the swelling of the neck region of the animal due to lack of **Iodine.**
8. **Sterility:** This is the permanent inability of the animal to reproduce due to lack of **Vitamin E**.
9. **Scurvy:** It is the bleeding of gums of teeth and reduced resistance to diseases due to lack of **Vitamin** C.
10. **Poor hair growth/ fur/ feathers/wool:** This is common in poultry, sheep and pigs due to lack of **Sulphur.**
11. **Piglet anemia:** It is lack of **Iron** in the ration of pigs and also the piglets may be born without hair. It can be treated by feeding pigs / smearing the teats of the sow with red anthill soil or injection of iron vaccine.
12. **Slip tendon:** This is a condition that cause the chicks to die with their necks stretched and facing upwards due to lack of **Manganese**. It's also referred to as **star grazing**.

FEEDS AND FEEDING:

A feed stuff is any material of natural origin or artificially prepared which has a nutritional value when included in the ration or diet of animals.

Classification of feeds:



The livestock feeds are classified basing on the **nutrients** they contain and their **bulkiness.**

They are put under the following categories;

- Roughages. - Concentrates.
- Succulents. - Feed additives.

1. ROUGHAGE FEEDS:

These are fibrous and bulky feeds of plant origin which are coarse and hard with a high fibre content.

Functions of roughages:

- Essential for proper functioning of the digestive system.
- They stimulate peristalsis during digestion of food.
- They give bulk i.e. dry matter to the material hence satisfying the animal.
- They help to prevent constipation and other intestinal disorders.

Characteristics of roughages:

- They have a high fibre content i.e. contain high lignin and cellulose.
- They have low energy and protein content.
- They have low palatability / acceptability by animals.
- They are bulky with low digestibility.
- Their feeding value is variable i.e. changes according to the stage of growth.
- They are got from green fodder, hay, dry grass, silage, cereal straw/stalks etc.

2. SUCCULENT FEEDS:

These are feeds that contain a high water content but with low dry matter content and they include;

- Green pastures
- Fresh root tubers
- Peelings of tubers and bananas
- Fresh forage crops.

Characteristics of succulents:

- They have a high water content of about 80%.
- They have a high digestibility.
- They have low dry matter/ fibre content.
- They have a high vitamin K content.
- They increase the animal's appetite when fed on them.
- They are cheaper that concentrate feeds.

3. CONCENTRATES:

These are feeds manufactured in the industry/factory for commercial purposes i.e. for sale.

- They are either rich in carbohydrates or protein and are either of plant or animal origin.
- They have a limitation in their utilization because they are expensive to buy.

They are divided into the following;

a) Protein concentrates: These are rich in proteins needed for body building and they are either of plant or animal origin.

i) Plant origin protein concentrates: These are mainly by-products of oil and soap manufacture from oil crops e.g. sunflower seed cake, Cotton seed cake, Groundnut seed cake, simsim seed cake, etc.

ii) Animal origin protein concentrates: These are by-products of fish or meat industry or poor quality / condemned meat / fish e.g fish meal, bone meal, blood meal and ruminal contents.

b) Carbohydrate concentrates (Basal feeds):

These are very rich in carbohydrates /energy and they are called **Basal feeds**.

- They are mainly of plant origin and are made from cereal grains and their by- products e.g. maize bran, sorghum bran / grains, rice bran, etc.

Characteristics of concentrate feeds:

- They have high energy and protein content.
- They have a high palatability by animals.
- They have a low moisture content.
- They have a high digestibility.
- Their feed value is fairly constant.
- They are a source of supplement feeds to non-ruminant animal e.g. pigs.
- They increase the animal's appetite i.e. feed intake and utilization

4. FEED ADDITIVES:

These are special substances added to the feeds to perform some specific purposes i.e. either to supplement / improve on the mineral content.

Types of feed additives:

i) **Nutrients feed at additives:** These supply some nutrients to the animal e.g.
   - Mineral lick/ block
   - Soda ash
   - Oyster/snail shells

NB: The main nutrient supplied include **Calcium** and **Phosphorus.**

ii) **Non- nutrient feed additives:** These do not supply any nutrient to the animal but only aim at preventing some conditions and diseases in animals.

Examples of feed additives:

i) **Growth promoters**/hormones e.g. meat and egg boosters.
ii) **Drugs e**.g. coccidiostat drugs to control coccidiosis
iii) **Antibiotics** to kill bacteria in feeds
iv) **Anti-stress** substances.
v) **Flavourings** which are used to increase the taste of feeds e.g. food colour
vi) **Hormones** e.g. **Stilboestrol** used in beef animal to increase meat production and **caponisation** in poultry, oxytocin that increase milk production.

Functions of food additives:

- They prevent disease causing germs in animals e.g. drugs.
- They promote growth in animals e.g. growth promoters.
- They increase production in animals e.g. Oxytocin in animal for milk production.
- They increase on feeding efficiency of animals since they increase their appetite e.g. Flavourings, food colour.

Differences between concentrates and roughages:

Roughages (highly fibrous)	**Concentrates (manufactured)**
i) Low Nutrients content.	i) High nutrient content.
ii) Low digestibility.	ii) High digestibility.
iii) Low palatability	iii) High palatability.
iv) Nutrient content is variable	iv) Nutrient content is constant.
v) Low energy and protein content.	v) High energy and protein content.
vi) Forms greatest portion of ruminant feed supply.	vi) Forms the greatest portion of non-ruminant feed supply.
vii) Made up of whole/all parts of the plants.	vii) Made from grains, seeds, and animals products.
viii) Coarse with high fibre content	viii) Finely ground material with low fibre content (mash)

FACTOR THAT AFFECT UTILIZATION OF FEED RATIONS BY ANIMALS;

1. **Age of the animals:** The actively growing animals have a higher efficiency in utilization of feed because they have got higher nutrient demands that finishers.
2. **Type of animals:** Ruminants are more efficient in the utilization of coarse fodder (roughages) while non ruminants e.g. pigs have a very high feed conversion ratio of quality feed that are low in fibre e.g. concentrates.
3. **Health of the animal:** Healthy animals have a higher FCR than sick ones because their physiological functions are at optimum.
4. **Climate:** Animals that are in less stressful environments will have a higher FCR than those in stressful environments.
5. **Digestibility of the feed:** The feeds that have a higher digestibility can be utilized better than those with or low digestibility.
6. **Nutrient content of the feed:** The feeds that are balanced have a higher FCR since utilization is better if all the nutrients are available in balanced proportions.
7. **Processing:** This eases digestion and utilization and may also help to remove some toxins e.g. boiling/heating soya beans removes trypsin inhibitors in it.
8. **Amount of feeds given to the animal per day:** If the animals are given more feeds than they require, the utilization will be less than when they are given just enough.
9. **Physiological status of the animal:** Actively functioning animals e.g. high milkers have better utilization of minerals and vitamins as reverse is true.

10. Additives added to the feed: The hormones and antibiotics that are added to the feeds, increase their utilization as compared to those that are not mixed with them.

METABOLIC NUTRITIONAL DISORDERS IN THE ANIMALS BODY

1. **Bloat (Tympanites):** This is the disorder of ruminants that causes the distention of the rumen due to excessive accumulation of gases e.g. Carbon dioxide and methane from the fermentation of cellulose.

NB: During digestion of food in the rumen, the animal is supposed to expel or get rid of these toxic gases by the **reflex action** of **belching** and **gassing** but when this reflex fails, the gases accumulate and the animal bloats.

Types of bloat:

i) **Frothy bloat:** This occurs due to the eating of succulent feeds e.g young grass, juicy berries/fruits, legumes, green crops, etc. It causes foaming in the rumen and the gas is trapped in the tiny bubbles which cannot escape from the rumen.

ii) **Feed lot boat**: This is due to eating of excess concentrate feeds e.g protein concentrates like cotton seed cake, groundnut seed cake, etc.

iii) **Gassy/obstruction float**: This is due to physical obstruction/ blockage of the oesophagus e.g a lump of food or rumen liquids or foreign objects e.g swallowing of the whole fruit and seed etc. These prevents gases from escaping from the rumen thru regurgitation or belching

iv) **Enterotoxaemia bloat:** This is due to milk fever

Factors that predispose animals to bloat/causes of bloat.

i) **Excessive feeding of animals on large amounts of legume** and lush forage e.g cabbage leaves and lush grass. This causes rapid fermentation producing a lot of gas in the rumen faster than the gas can escape through the oesophagus.

ii) **Blockage of oesophagus** by big objects e.g large lumps of food, potatoes, carrots, etc

iii) **Excessive feeding** of animals on high protein succulent feeds

iv) **Injury to the nerve supply** of the rumen causes paralysis of the rumen

v) **High moisture content** in the feeds e.g peelings of crops

vi) **Abrupt change in the feeds given** to the animal i.e. from very dry feeds to very succulent feeds since the rumen is not used to the new feed, indigestion occurs.

vii) **Grazing animal**s during extreme cold weather with very low temperatures (extreme coldness) in the mornings.

viii) **Rapid eating** of the animal with reduced chewing of food

ix) **Grazing/feeding animals** on young pastures (fodder)

x) **Lack of roughages** (fibre) in the feed ration

xi) **Eating of leaves** and non stemy plant parts

xii) **Toxic components** in the feed ration

Symptoms of bloats

- Swelling of the left hand side of the abdomen behind the ribs due to the swollen rumen
- Difficulty in breathing due to the pressure exerted on the diaphragm, lungs and heart by swollen rumen.
- Loss of appetite.
- Animal becomes staggery and goes down and also fails to rise up.
- Animal stands with legs wide open apart and stops eating.
- Sudden death of the animals with legs wide open.
- Grunting and kicking at the belly.
- Profuse salivation.

Prevention of bloat:

- Wilting the pastures before feeding animals.
- Feeding animals on grass- legume pastures in the ratio of 1:1.
- Supplementary feeding of the animals on roughages or hay or silage.
- Exercise the animals by walking it around to induce churning or mixing of rumen contents and inorder to cause belching to allow escape of gases.
- Avoid feeding animals on succulent feeds e.g lush or young grasses.
- Regulation of feeding intervals of animals by the farmers.

Treatment of bloat:

- Drenching the animals with anti-frothing agents e.g vegetable oil to break down the froth in the rumen.

- Use of anti-bloat drugs e.g. liquid paraffin can be sprayed on pastures or added in feed concentrates to stop any risk of bloat.
- Use of a trocar cannula to puncture/pierce the rumen to release the gases.
- Use of bloat capsules to treat animals.
- Broom stick method i.e. the stick is inserted across the mouth to keep the mouth open to allow the escape of gases.

2. MILK FEVER:

This is a metabolic disorder that develops in lactating cows due to low Calcium levels i.e **Hypocalcemia/Hypophosphatemia/Hypomagnesemia.**

Causes of milk fever:

- Inadequate dietary calcium
- Poor Calcium: Phosphorus ratio or Phosphorus: Magnesium ratio.

Symptoms of milk fever:

- Unco-ordinated movement i.e. staggering movement.
- Muscular twitching that causes the animal to tremble.
- Breathing becomes slow and weak.
- The animal feels cold to touch at extreme cases.
- Dullness and starring of the eyes with dilated pupils.
- General paralysis i.e the animal's body functions like urination, defaecation and milk secretion stops and this is followed by death.

Prevention milk fever:

- Feeding on high calcium in the ration of the animal during gestation.
- Delayed or incomplete milking.
- Injection of calcium salts
- Feeding on calcium and phosphorus in the ratio of 1:1.
- Feeding massive doses of Vitamin D.
- Giving of adequate mineral supplements to animals.
- Raising the blood calcium level by intravenous injection.

3. **KETOSIS (ACETONE) OR PREGNANCY TOXAEMIA**:

This is a disease of ruminants occurring most commonly in high milking cows during the first 2 months of lactation when the milk production of the animal exceeds their feeding capacity.

It is characterized by low blood glucose levels (**Hypoglycemia)** and increased keto acids/Ketone bodies e.g Acetone, Aceto, Acetate, etc.

Causes of Ketosis

- Low blood glucose in the body
- Inadequate feed intake to meet the milk yield requirement
- Increased keto acids
- Unstable feeds
- Malfunctioning liver i.e. the liver may not be working or functioning in order to regulate insulin hormone level.

Symptoms of Ketosis:

- Drop in milk yield and the cow fails to return to full lactation.
- Rapid loss of body weight.
- Nervousness of the animal
- The cow becomes staggery
- Blindness of the animal
- Walking in circles by the animal.

Prevention of Ketosis:

- Adequate and balanced feed ration
- Exercise of the animal
- Adequate feeding of animals on roughages
- Seek veterinary assistance
- Feeding on given feeds.

4. NITRATE POISONONG:

It occurs as a result of toxic levels of nitrogen or nitrates in silage or pastures or hay and it leads to the interference with vitamin A utilization.

Symptoms of nitrate poisoning:

- Violet respiration
- Breathing rate of the animal doubles.
- Weakness of the body
- Diarrhoea
- Colourless urine
- Convulsions.
- Death.

Prevention of nitrate poisoning:

i) Less use of nitrogen fertilizers on pastures

ii) Use of grass-legume mixed pastures.

FEED INTAKE:

This is the act of taking in of solid feeds through the mouth.

FACTORS INFLUENCING FEED INTAKE IN ANIMALS:

1. **Environmental temperature:** High temperatures reduce feed intake while low temperatures stimulate a high feed intake.
2. **Palatability of a feed**: Highly palatable feeds are consumed in large amounts as compared to the unpalatable feeds.
3. **Health of the animal:** A healthy animal takes in more feeds than a sick one**.**
4. **Amount of water in a feed/moisture content of a feed:** Succulent feeds are taken in at a much faster rate than dry feeds.
5. **Regularity of feeds**: regular and familiar feeds to the animal have a high feed intake and vice versa.
6. **Level of production:** Animals that produce a lot of milk will eat more feeds to compensate the loss in the milk.
7. **Amount of feeds provided**: Animals will always strive to eat all what is provided thus giving a lot of feeds to the animal increases the intake.
8. **Shift in the hormonal imbalance**: During pregnancy, foetal displacement of the rumen and reticulum and the changes in the hormones will affect feed intake.
9. **Lignin content of feeds**: High Lignin in feeds will suppress feed intake since it has a low digestibility.
10. **Blood components:** A high quantity of glucose and VFA in blood of ruminants will suppress the feed intake.

TOXICITY OF FEEDS:

This refers to the harmful effects of nutrients in the feed in the animal's body when it is supplied above sufficient or optimum levels required in the body.

- Some substances if absent in the feeds prevent certain body reactions e.g detoxification and thus cause toxic effects by their absence.
- Some forages/pastures at certain periods or stages of maturity contain harmful substances and also there are minerals which can be harmful to animals.

Examples of minerals that may become toxic to farm animals.

i) **Molybdenum:** Pastures raised on soils high in Molybdenum may interfere with the animals' use of Copper in the body.

ii) **Selenium:** It has toxic effects in the body of animals hence dangerous when eaten.

iii) **Fluorine:** It may interfere with the supply of Phosphorus e.g rock phosphate, so it must be **Deflorinated** before feeding on by animals.

Some harmful substances contained in some forage and feed by-products:

i) **Trypsin inhibitor:** This is found in soya beans may inhibit the digestion of proteins by the Trypsin enzyme in non-ruminants so, the soya beans should be heat treated or boiled before feeding to the animals.

ii) **Aflatoxin:** This is a chemical produced by a fungus in groundnut seed cake that has gone mouldy. They interfere with protein synthesis in poultry especially in ducks and turkeys and liver cancer in humans.

iii) **Lactic acid:** This is found in brewers' grains produced by yeast and can cause lactic acidosis and also interferes with intestinal metabolism.

iv) **Mimosine:** This is found in Leucaena shrub and it interferes with the synthesis of Thyroxine hormone.

v) **Alkaloids:** E.g Morphine and Nicotine are found in Phytolacca and they interfere with oxygen intake.

vi) **Gossypol:** This is found in cotton seed cake and is toxic to animals. It is heat stable and more dangerous in non-ruminants.

However, the process of oil extraction and heating changes the Gossypol to the less dangerous form.

vii) Glycosides: E.g Hydrocyanic acid found in fresh peelings of cassava.

viii) Prussic acid: this is found in sorghum and it interferes with respiration especially in ruminants. However, the problem can be reduced by the use of mature grains and fermentation of sorghum grains before use.

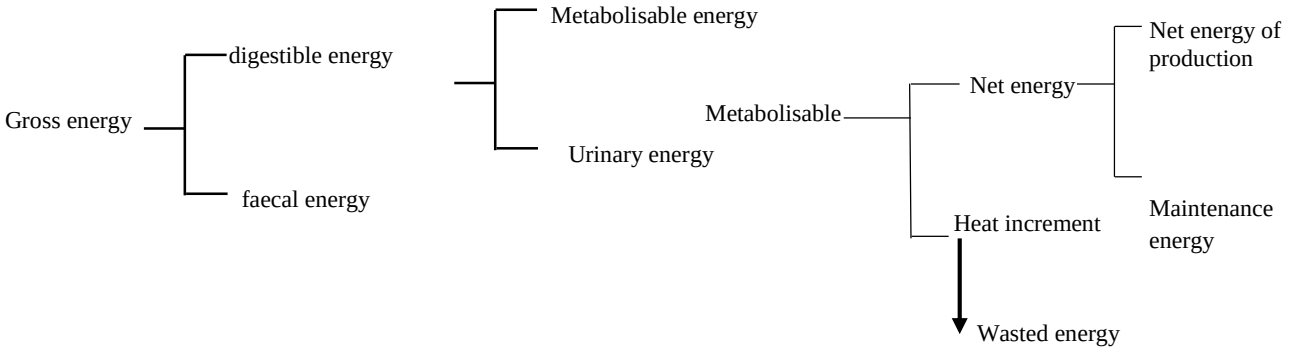
ix) Molasses toxicity: this causes drunkardness when the animal consumes a lot of molasses but it can be overcome by feeding animals on more roughages.

NB: Molasses contain high Potassium which can antagonize Magnesium uptake.

MEASURING THE ENERGY VALUE OF FEEDS:

The energy content of feeds maybe measured in a variety of ways as seen in the flow diagram below:

Partition of feed energy:



i) Gross energy: This is the total energy content of a feed and it may be calculated from the feed composition tables.

- Each of the nutrients is a potential source of energy e.g fats yield 38 KJ/g, carbohydrates 17KJ/g and proteins 17 KJ/g.

ii) Digestible energy: This is the measure of the gross energy of a feed minus that part of the feed energy which is lost in faeces.

iii) Metabolisable energy: This is the digestible energy less the energy lost in urine and methane in ruminants and thus, it gives the energy used by the animal in metabolism.

- **M.E** is the basis for calculating the livestock ration composition>

iv) **Net energy:** This is the energy from the absorbed nutrients available for the various metabolic processes in animals.

Advantages of mixing animal feeds on the farm instead of buying:

i) It prevents the introduction of diseases in feeds brought from other farms.
ii) It's cheaper than buying already made/mixed feeds from suppliers.
iii) It ensures proper utilization of materials on a farm e.g use of old maize in store.
iv) Feeds can be mixed according to the animal's nutritional requirements.
v) Many feeds from suppliers are usually adulterated with non-feed materials and such problems are solved by mixing own feeds on the farm.
vi) Excess feeds mixed on the farm can be sold to generate income to the farmer.

Limitations of mixing own feeds on the farm:

i) Not all the ingredients required in the feed can easily be obtained on the farm
ii) Limited skills in feed formulation among many farmers.
iii) Some feed stuffs need first to be processed before they can be used in feed formulation.
iv) Lack of proper storage facilities for the feeds on the farm.
v) Lack of proper equipments used in feed formulation.

Sample questions:

1. a) What is meant by the following as applied in animal nutrition?

i) **Safety factor:** This is the extra amount of a feed used to cater for spillage during feeding, weighing errors, improper mixing of ingredients, deterioration of nutrients during storage and also to cater for the animal's requirements above the herd average.

ii) **Feeding standards:** This refers to the table or list showing the nutrient requirement of a feed by livestock.

b) Explain why the allowance is given for extra ingredients during feed formulation.

- To cater for the animals whose requirements are above or over the minimum given in the feeding table.
- To cater for the inadequate mixing of feeds where some nutrients are not equally mixed.
- To cater for lack of deficiency of some minerals in the feed.

- To cater for the nutrient variation in some feeds due to differences in the agronomic practices and soil fertility.
- To cater for loss of unstable nutrients.

2. **a) Explain the measures that a farmer can take to ensure availability of livestock feeds throughout the year.**
   - Good grazing practices e.g paddock, rotational, strip and differed grazing.
   - Irrigation to ensure continued pasture growth.
   - Weed control to avoid competition.
   - Herbage conservation as hay or silage to cater for the periods of scarcity.
   - Fertilizer application to ensure vigorous pasture growth.
   - Feeding animals, the right amount of feeds to reduce wastage.
   - Supplementary feeding on concentrates to reduce dependence on only the pastures.
   - Fencing pasturelands to keep out other intruder animals.
   - Correct stocking rate to avoid over grazing.
   - Controlled burning to encourage re-growth of pastures especially in the dry season.
   - Planting drought resistant pasture species to ensure availability of pastures.
   - Spraying with recommended chemicals to control pests and diseases.
   - Over - sowing with legumes to encourage nitrogen fixation into the soil.
   - Proper distribution of the watering points to avoid destruction/trampling of pastures.
   - Topping/slashing of pasture to encourage tillering or fresh re-growth of pastures.
   - Application of lime to encourage decomposition of trash and also to reduce the acidity.
   - Re-seeding or spot sowing to fill up the gaps inorder to increase its biomass.

b) Describe ways of ensuring that feeds are efficiently utilized by animals on the farm

- Giving the right type of feeds to animals.
- Giving the right amount of feeds to the animals.
- Feeding animals regularly or at the right time
- Provision of enough water together with the feeds
- Presenting the feeds to the animals in the right form e.g cakes, mash, pellets, etc.
- Controlling diseases and parasites to keep animals healthy.
- Presenting the feeds to the animals in a palatable form

- Providing feeds to the animals at the right stage of growth.
- Providing feeds to animals in clean containers.
- Providing the right combination of feeds to animals.
- Providing feeds free from anti-metabolites to animals.

c) Explain ways of guarding against the following nutritional disorders:

i) Bloat.

- Wilting of fodder before eating
- Providing roughages to the animals
- Avoid feeding too much young succulent grass
- Giving anti-bloat drugs to animals
- Feeding on good grass - legume mixture.

ii) Common calf scours (it's a disease that causes diarrhoea in calves).

- Use clean feeding utensils e.g buckets
- Feeding milk at the right body temperature
- Feeding the calf with clean fresh milk.
- Feeding the calf with the right amount of milk.
- Follow the feeding routine.
- Keep the calves in clean pens.

3. a) Explain the causes of bloat as a digestive disorder in cattle (10mks)

b) Give the symptoms and preventive measures of bloat in animals (10mks)

END